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Predicting Binge Drinking

Personality dimensions and parent-adolescent
relationship as determinants of adolescent
alcohol use

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Abstract

Binge drinking is a common phenomenon among Dutch adolescents. Frequent binge drinkers are likely to experience negative social and health consequences. The aim of the present study was to test for the potential moderation effects of parent-adolescent variables on the relation between personality risk factors (i.e. impulsivity, sensation seeking, hopelessness and anxiety sensitivity) and binge drinking. Additionally, it was investigated if cannabis could be explained by determinants of binge drinking and if cannabis use itself could account for binge drinking behavior.

Data were obtained from an online survey that was completed by 201 adolescents between 16 and 20 years of age. Respondents were asked to fill in the Substance Use Risk Profile Scale measuring personality risk factors for substance use. The questionnaire further consisted of four different scales measuring parental respect, alcohol-specific rules and control and the quality of alcohol-related communication as parent-adolescent variables and measures of binge drinking and cannabis use.

Moderated multiple regression analyses indicated that adolescents whose parents exerted low levels of control on their offspring's alcohol consumption were more likely to engage in frequent binge drinking when they were low in anxiety sensitivity. Results concerning the role of cannabis use in the context of binge drinking were inconsistent. It was suggested that future research should examine shared risk factors that make cannabis users and binge drinkers part of the same subculture and simultaneously search for factors that distinguish cannabis users from binge drinkers.

Samenvatting

Binge drinking is een veel voorkomend fenomeen in Nederland. Jongeren die vaak veel alcohol consumeren zijn meer geneigd om negatieve gevolgen in hun sociale leven en voor hun gezondheid op te lopen. Doel van deze studie was om het veronderstelde moderatie effect van de relatie tussen jongeren en hun ouders op het verband tussen persoonlijkheidskenmerken (m.n. impulsiviteit, sensatie zoeken, hopeloosheid en angst sensitiviteit) en binge drinking te onderzoeken. Verder werd gekeken of cannabis door determinanten van binge drinking verklaard kan worden en of cannabisgebruik een verklaring voor binge drinking levert.

De data werd verzameld door 201 jongeren tussen de 16 en 20 jaar een online vragenlijst te laten invullen. Respondenten werden gevraagd om de Substance Use Risk Profile Scale in te vullen om persoonlijkheidsfactoren te meten die met alcohol en drugsgebruik samenhangen. De vragenlijst bevatte verder vier schalen die de variabelen m.b.t. de relatie tussen jongeren en hun ouders meten, m.n. ouderlijk respect, alcohol-gerelateerde regels en toezicht en de kwaliteit van alcohol-gerelateerde communicatie.

Gemodereerde meervoudige regressie analyses toonden aan dat jongeren diens ouders een geringe mate aan toezicht over het alcoholgebruik van hun kinderen hielden een groter risico hadden om binge drinkers te zijn als ze laag op de angst sensitiviteit dimensie scoorden. De resultaten die betrekking hadden op de rol van cannabisgebruik in verband met binge drinking waren niet eenduidig. Een voorstel werd gemaakt om het oogmerk van toekomstig onderzoek op gemeenschappelijke risicofactoren voor cannabisgebruikers en binge drinkers als leden van één subcultuur te richten en tegelijk naar factoren te zoeken die beide van elkaar onderscheiden.

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1. Introduction

In a large part of contemporary research adolescence is seen as a period in which young people are happy to try out new things. During this period, experimenting with alcohol, cigarettes and cannabis is very common among adolescents (Kaminer, 1999; Wagner, Brown, Monti, Myers, & Waldron, 1999). For instance, at the age of 14 years 87% of Dutch adolescents drank alcohol for at least one time in their lives and at the age of 17-18 years nearly all adolescents (94%) have tried it once. Among Dutch adolescents of 17 and 18 years, about half of male teenagers and a third of female teenagers have at least once been in contact with cannabis (Monshouwer, Van Dorsselaer, Gorter, Verdurnen & Vollebergh, 2003). Other results indicate that this happens on a regular basis. The aforementioned study also found that more than half of the adolescents (58%) between age 12 and 17-18 drank alcohol during a one-month period prior to the study. The monthly prevalence of cannabis use was 25% and 10% for male and female adolescents, respectively. Research has shown that lifelong drinking patterns arise during this stage (Beal, Ausiello & Perrin, 2001; Guo, Collins, Hill & Hawkins, 2000; Griffin, Botvin, Epstein, Doyal & Diaz, 2000).

Monshouwer, K., Verdurnen, J., van Dorsselaer, S., Smit, E., Gorter, A., & Vollebergh, W

The present study especially focused on binge drinking as a wide spread phenomenon among adolescents. The term “binge drinking” typically refers to drinking a large amount of alcohol on one occasion or deliberately consuming alcohol for the sake of getting drunk. Researchers are still busy to find an agreed-upon definition of binge drinking (see Ham & Hope, 2003). In the present paper, binge drinking is defined as exceeding a number of six standard glasses of alcohol on one evening/occasion (Monshouwer, Verdurnen, van Dorsselaer, Smit, Gorter & Vollebergh, 2008). In a series of studies, binge drinking has been associated with a number of adverse outcomes. A study of Wechsler, Davenport, Dowdall, Moeykens and Castillo (1994) indicated that the risk of engagement in unplanned or unprotected sex, having problems with the police or getting injured is 7-20 times higher among frequent binge drinkers. Other negative outcomes that have been linked to binge drinking are alcohol-impaired driving, the consumption of illegal drugs, and sexual aggression (Schuldenburg, O’Malley, Bachman, Wadsworth & Johnston, 1995; Wechsler, Kuo, Lee & Dowdall, 2000; Wechsler, Dowdall, Davenport & Castillo, 1995). As longitudinal research indicated, social issues that are affected by adolescent alcohol use included academic problems, delinquent behavior and persistence of behavioral problems into young adulthood (Ellickson e.a., 2003). Negative health outcomes were also related to binge drinking. The diagnosis of alcohol dependence or alcohol misuse is

more likely among individuals who excessively consume alcohol on a regular basis (Stolle, Sack & Thomasius, 2009). Adolescent alcohol use had a negative impact on neuro-cognitive abilities, including memory performance and tests requiring attention skills (Brown & Tapert, 2000). In their study, Goudriaan, Grekin and Sher (2009) showed that decision-making is negatively affected by binge drinking behavior in young adults. Adolescent alcohol use is thus a serious public health problem.

Cannabis is another physical and mental health issue to be investigated in the present study. Cannabis has been shown to be addictive and its use was associated with diminished cognitive functions, such as memory, attention and executive functions, and diminished motor functions, although the nature of this relationship could not definitely be shown (Rigter & Van Laar, 2000; Vandereycken, Hoogduin & Emmelkamp, 2008; Solowij, Stephens, Roffman, Kadden, Miller, Christiansen, et al., 2002). Cannabis use has also been identified as a trigger for the onset or relapse of schizophrenia and it has been associated with acute anxiety, panic, and depression (van Os, Bak, Hanssen, Bijl, de Graaf, Verdoux, 2002; Hambrecht & Hafner, 1996; Hambrecht & Hafner, 2000; Thomas, 1996; Chen, Wagner & Anthony, 2002). Showing that cannabis has adverse effects on issues as well, it has been linked to lower educational achievement, injuries, motor accidents, and assaults (Macleod et al, 2004; Brookoff, Cook, Williams, & Mann, 1994; Maio, Portnoy, Blow, & Hill, 1994).

Alcohol and cannabis use were consistently found to be connected in various studies. The correlations between alcohol and cannabis consumption are typically found in the region of .30 and .35 (Donovan & Jessor, 1985; DuRant, Rickert, Ashworth, Newman, & Slavens, 1993; Farrell, Danish, & Howard, 1992; Gillmore, Hawkins, Catalano, Day, Moore & Abbott, 1991; Grube & Morgan, 1990; McGee & Newcomb, 1992). There are several constellations in which alcohol and cannabis use could possibly influence each other: (a) one behavior may impose an increased risk for engaging in the other behavior; (b) both behaviors may share common underlying risk factors; (c) the risk factors for the behaviors themselves may not be the same for both behaviors but may be correlated and it could be this correlation that causes alcohol and cannabis use to occur together; (d) the comorbidity between alcohol and cannabis use could be manifestations of the same vulnerability or condition. Corresponding to (a), the stage or gateway theory suggests that the consumption of one substance encourages the use of another substance and states that there is a causal link between different substance use behaviors (Kandel & Faust, 1975; Kandel, Yamaguchi & Chen, 1992). In contrast to this view, other studies have pointed out that the comorbidity between the consumption of

different substances stems from common risk factors (cf. b) and life pathways (cf. c) that facilitate substance use. Analogous to constellation (b), a study by Lynskey, Fergusson and Horwood (1998) has identified the influence of substance using peers, novelty seeking, and parental illicit drug use as common underlying factors of alcohol, tobacco and cannabis use.

An investigation by Wechsler, Davenport, Dowdall, Moeykens and Castillo (1994) showed that most individuals who frequently engage in binge drinking did not seek treatment because they did not consider themselves as belonging to the group of problem drinkers. Gathering evidence-based information about such problem behaviors is extremely important to inform the development and evaluation of more effective preventive and therapeutic interventions. Some authors suggested a risk-centered approach to deal with adolescent alcohol and drug use. This implies the identification of underlying mechanisms concerning problematic substance use that put individuals at risk (e.g. Hawkins, Catalano & Miller, 1992). By specifying an at-risk population, it is possible to develop more effective selective intervention programs. An example can be found in interventions targeting already specified personality risk factors for substance use, such as an intervention program developed and evaluated by Conrod, Stewart, Comeau and Maclean (2007). This program focused on sensation seeking, anxiety sensitivity and hopelessness as risk factors of problematic alcohol use and associated drinking motives in adolescents. In a set of interventions, personality risk factors were individually addressed for those at risk which brought up an advantageous effect of the program and the program x personality interaction on alcohol use at four-month follow-up. Another useful approach to inform substance use interventions focuses on protective factors. Especially intervention programs targeting parent-adolescent relations are thought to benefit from this protection-centered approach (Cohen & Rice, 1995). A growing body of evidence suggests that there are several protective factors that mediate or moderate the effects of risk factors and thereby reduce the vulnerability to engage in problem behavior. As an example, a study by Nash, McQueen and Bray (2005) found that a positive family environment as protective factor moderated the potentially adverse effect of peers on adolescents' alcohol use. The authors suggested that certain positive aspects of the parent-adolescent relationship should play an important part in intervention programs targeting difficulties with alcohol consumption. This leads to the conclusion that it is important to investigate both protective and risk factors concerning adolescent alcohol and substance use.

In an attempt to integrate protective as well as risk determinants of binge drinking behavior, Pieterse, Boer and VanWersch (2010) proposed the Twente Model of Binge Drinking

(TMBD) which differentiates between ultimate, distal and proximal influences on binge drinking. As shown in Figure 1, the model is structured into two systems of information-processing. This is in line with recent developments of dual-system models that postulate reflective and impulsive pathways to explain social cognition and health behaviors (Deutsch & Strack, 2004). The reflective pathway of the TMBD can be described as conscious, deliberate and reasoned system and it incorporates the variables of the Theory of Planned Behavior (TPB, Ajzen, 1991). The impulsive pathway is postulated as an associative and automatic system that is comprised of the variables of the Prototype Willingness Model which are willingness, prototype favorability and prototype similarity (PWM, Gibbons & Gerrard, 1997; Gibbons, Gerrard & Lane, 2003, for reviews). The parent-adolescent relationship variables parental respect, alcohol-specific rules, alcohol-specific parental control and quality of alcohol-related communication are integrated as ultimate determinants. They are thought to affect binge drinking through the reflective and impulsive pathways and by moderating the relation between personality variables and binge drinking. Also postulated as ultimate determinants, certain personality risk-factors are hypothesized to influence binge drinking and to be mediated through the reflective or the impulsive pathway to affect this behavior. Past binge drinking as distal determinant of present behavior also plays an important role within the model. The role of the determinant cannabis use has not been investigated yet. Therefore, a construct named cannabis use is not included into the figure.

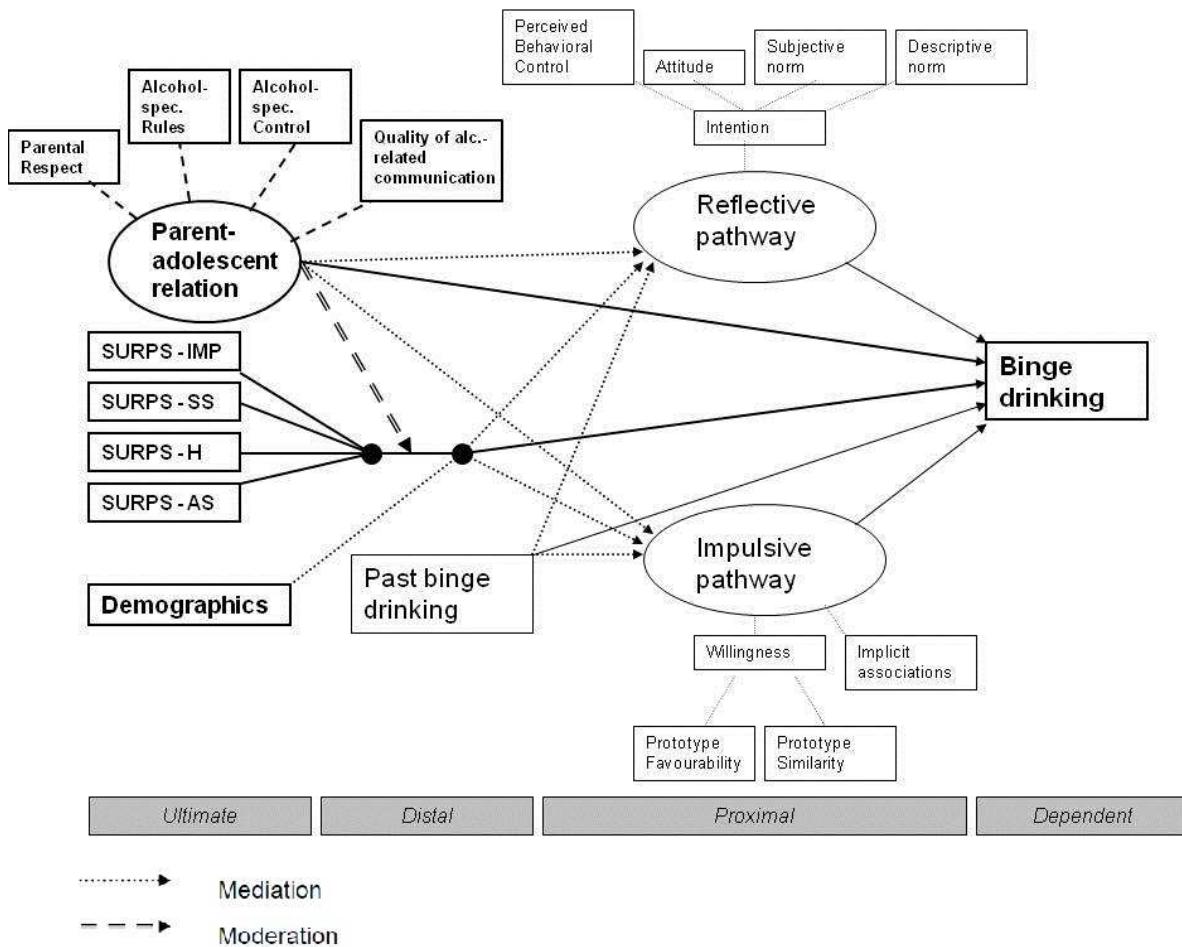


Fig. 1.

Twente Model of Binge Drinking. Ultimate (i.e. demographics, SURPS personality traits impulsiveness (IMP), sensation seeking (SS), hopelessness (H), anxiety sensitivity (AS) and parent-adolescent relationship variables parental respect, alcohol-specific rules, alcohol-specific control and quality of alcohol-related communication), distal (i.e. past binge drinking) proximal (i.e. reflective pathway including TPB variables and impulsive pathway including PWM variables) as determinants of the dependent variable (binge drinking). Variables under consideration in the present study are marked in bold.

The present study focused on personality risk factors and variables describing the parent-adolescent relation as determinants of binge drinking and investigated the role of cannabis use within the theoretical framework of the TMBD.

To increase our understanding of adolescent substance use, the influence of personality variables on such behavior is an important link to be investigated (Comeau, Stewart, & Loba, 2001). It has been found that personality is able to explain a large amount of variance in risk for addictive psychopathology, substance use motives and the sensitivity to the reinforcing effects of drugs and alcohol (Conrod, Stewart, Pihl, Côté, Fontaine & Dongier, 2000). The present study will take the personality dimensions of the Substance Use Risk Profile Scale

into account, which involve impulsivity, sensation seeking, hopelessness and anxiety sensitivity (SURPS; Woicik, Stewart, Pihl, Conrod, 2009). These personality traits have been associated with adolescent alcohol use, binge drinking and cannabis consumption.

Impulsivity (IMP) is a trait that typically refers to the tendency to engage in behavior that occurs without foresight and reflection and that lacks planning. Impulsivity is thought to consist of at least two factors: one component that is characterized by reward sensitivity and one component described as spontaneity and lack of reflectivity. A considerable body of evidence points out that impulsiveness is a robust predictor of alcohol and substance use (e.g. Grau & Ortet, 1999; Sher, Bartholow & Wood, 2000; Sher, Wood, Crews & Vandiver, 1995; Pidcock, Fischer, Forthun & West, 2000). Impulsivity was positively related to substance use (especially stimulant drugs) but showed no significant correlation with cannabis use (Baker & Yardley, 2002; Comeau et al., 2001).

A definition of the sensation-seeking (SS) construct was given by Zuckerman (1994) as “the seeking of varied, novel, complex, and intense sensations and experiences and the willingness to take physical, social, legal, and financial risks for the sake of such experience” (p.10). This personality dimension is linked to careless and risky behavior among adolescents and the willingness to take risk for negative consequences of alcohol use (Arnett, 1994; Schall, Kemeny & Maltzman, 1992). As research indicates, sensation seeking is a robust predictor of alcohol consumption and alcohol use disorders (e.g. Sher, et al., 2000). Sensation seeking has been found to be strongly associated with cannabis and drug use (Arnett, 1994). Prior investigations found that between 12 and 29% of the variance in cannabis use could be explained by sensation seeking (Pedersen, Clausen & Lavik, 1989; Teichman, Barneo & Rahav, 1989).

The hopelessness-dimension (H) is characterized by negative expectancies and it has been identified as a risk factor for depression (e.g. Joiner, 2000; Young, Fogg, Scheftner, Fawcett, Akiska & Maser, 1996). Conrod, Pihl, Stewart and Dongier (2000) found that individuals primarily suffering from recurrent depression with a comorbid substance dependence disorder are more likely to be high in hopelessness than individuals with primary substance dependence and a comorbid depressive disorder. Additionally, hopelessness predicted the transition from reasonable to problematic alcohol consumption (Jackson & Sher, 2003). Recent research distinguished anxiety-motivated drinking from depression-motivated drinking (Grant, Stewart, O'Connor, Blackwell & Conrod, 2007). The depression-related drinking motive was uniquely linked to the hopelessness-dimension. This implies some sort of self-

medication of depressive symptoms in high H individuals by using alcohol or other substances (Woicik et al., 2009). Hopelessness did not correlate with cannabis use (Woicik et al., 2009).

Anxiety sensitivity (AS) has been described as the fear of bodily sensations that are related to anxiety. This fear is thought to be motivated by the belief that these sensations will bring about catastrophic outcomes (Reiss, Peterson, Gursky & McNally, 1986). Anxiety sensitivity has been found to be positively correlated with alcohol use (Stewart, Peterson, & Pihl, 1995). People high in AS are more likely to experience problem drinking symptoms (Conrod, Pihl, & Vassileva, 1998). AS was negatively associated with cannabis use which could be explained in terms of avoidance due to a fear of bodily sensations caused by cannabis use (Samoluk & MacDonald, 1999).

Prior research has identified two main sources of reinforcement for addictive behaviors: positive reinforcement is obtained from the positive and pleasant consequences of the consumption of particular substances. Negative reinforcement is connected to the relief of inconvenient, negative emotional states (Koob, 2004). Impulsivity and sensation seeking were found to be related to positive affect related (binge) drinking whereas hopelessness and anxiety sensitivity were linked to drinking as a means of coping with negative affect among young adults and adolescents (Stewart & Devine, 2000; Comeau et al., 2001; Cooper, Frone, Russell & Mudar, 1995).

Another important issue to be investigated in this study was the parent-adolescent relationship. Researchers have been pointing out the importance of peer influence, partly as the most prominent determinant of adolescent alcohol and drug use, for a long period of time (e.g. Flay, D'Avernas, Best, Kersell & Ryan, 1983; Glynn, 1981; Werner, 1991). However, the importance of other factors, such as the relation between parent and adolescent and the parental handling of the substance use topic, is also well established (Bauman & Ennett, 1996). Research has shown that parental influence does not end with the child's transition to adolescence. Actually, the way in which young people behave in peer relationships is influenced by their relationships to their parents (e.g. Parke & Ladd, 1992; Holmbeck & Hill, 1988; Buchanan, Eccles, Flanagan, Midgley, Feldlaufer & Harold, 1990). For instance, a study by Nash, McQueen and Bray (2005) found that peer influence was indeed a significant predictor of adolescent alcohol use but also pointed out that a positive family environment (as combined of parental monitoring, acceptance and good parent-child communication) reduced the adverse effects of peers on adolescent drinking behavior. Research has also shown that

adolescent behavior is influenced to some extent by the modeling behavior of their parents (Zhang, Welte & Wieczorek, 1999). In the present study, the parent-adolescent relationship will be investigated by means of the following variables: parental respect, alcohol-specific rules, alcohol-specific parental control and quality of alcohol-related communication.

In the present investigation, the parental respect measure incorporates an indication for the extent to which parents have an influence on what an adolescent decides and the extent to which adolescents respect the opinion of their parents, try to meet their parents' expectations and obey their authority (Chao, 2001). The parental respect scale was originally developed in connection to a parenting style named "training" and identified by Chao (2001). It is characterized by the importance of obeying parental authority, self-discipline and an emphasis on hard work and was formulated in connection to immigrant Chinese parents. Research on the relation between parental respect as measured by this scale and alcohol use (or cannabis use) has not been available, but there are investigations about similar constructs. For instance, in her study, Jackson (2002) showed that adolescents scoring low on the construct "perceived legitimacy of parental authority" were four times more likely to engage in alcohol consumption. Additionally, her results indicate that adolescents ascribe a certain extent of importance to parental values and rules regarding alcohol use.

The construct "alcohol-specific rules" that is used in the present study gives an index of parental rules about consuming alcohol and getting drunk in different situations (e.g. at home, in the presence of the parents, on weekends). It has also been found that alcohol-specific rules and harsh discipline were negatively associated with adolescent alcohol use (Wood, Read, Mitchell & Brand, 2004; Engels & Van der Vorst, 2005). Furthermore, it has been reported that youngsters' perceptions of having definite rules was a negatively linked to cannabis and illicit drug use (Barnes & Farrell, 1992).

Alcohol-specific parental control may be defined as the extent to which parents monitor their offspring's engagement in alcohol use (e.g. Guilamo-Ramos, Jaccard, Turrisi & Johansson, 2005). The construct indicates if parents track where and with whom their children consume alcohol, if adolescents have to get permission to drink alcohol and whether parents ask about the amount of alcohol that is consumed by their child. Cross-sectional and longitudinal research indicated that parental control was strongly negatively related to alcohol use (Slice & Barrera, 1995; Barnes et al., 1992; Wood, Read, Mitchell & Brand, 2004). Prior research identified parental monitoring as predictor for decreased levels of adolescent cannabis use (Ramirez, Crano, Quist, Burgoon, Alvaro & Grandpre, 2004; Dishion & Loeber, 1985).

The quality of alcohol-related communication is a construct that indicates parents' and adolescents' interest in each other's opinion about alcohol consumption, the ease, understanding and honesty of communication about alcohol and the extent to which the adolescent feels that he or she is taken serious during conversations about alcohol (van der Vorst, Engels, Meeus, Deković & van Leeuwe, 2005). Guilamo-Ramos et al. (2005) found that adolescents' satisfaction about the communication with their parents had a positive effect on the reduction of binge drinking behavior during high school. Findings by Kafka and Perry (1991) indicate that the more openly adolescents talk about substance use with their parents, the lesser the extent to which they consume marijuana.

The aim of the present study was to investigate if (1) a moderating effect of parent-adolescent relationship variables on the relation between personality dimensions and binge drinking can be found and (2) to clarify the role of cannabis use in the Twente Model of Binge Drinking. It is assumed that certain protective factors, such as a positive family environment, decrease the effect of certain risk factors on substance use.

The first research question was to examine whether the parent-adolescent relationship moderates the relation between personality dimensions of the Substance Use Risk Profile Scale (SURPS) and binge drinking. For instance, is a good quality of alcohol-related communication able to buffer the risky effect of high impulsivity on binge drinking behavior? It was hypothesized that a positive parent-adolescent relationship would influence the relation between personality dimensions and binge drinking. This was based on the assumption that high levels of parental respect, alcohol-specific rules and control and a good quality of communication would outweigh "risky" personality traits to some extent.

A second research question referred to the role of the cannabis use variable in the TMBD. A moderate correlation between alcohol and cannabis use was consistently found in various studies. A positive relation between the sensation seeking trait and cannabis use has also been reported and anxiety sensitivity was found to be negatively associated with cannabis consumption. Can cannabis use as a dependent variable in the TMBD be explained by certain personality dimensions, parent-adolescent variables and/or a moderating effect between the two? In other words, can the variables of the TMBD be applied to cannabis use? As an example, is a high SS adolescent who reports on high levels of parental respect less likely to be involved in cannabis consumption than a sensation seeker reporting low levels of respect for his parents? This question was based on the assumption that both risk behaviors shared certain underlying risk factors. It is further assumed that the alcohol-specific parent-

adolescent relation variables are indicators for how parents handle their offspring's potential cannabis use. This starts from the premise that parental rules and monitoring and the quality of communication about alcohol should at least have some similarity to the way in which they deal with the topic of cannabis use.

The third research question to be investigated was whether it was more appropriate to place the variable "cannabis use" into the TMBD as an independent variable that (in addition to parent-adolescent variables and personality dimensions) accounts for binge drinking behavior. If cannabis use would be found to have additional explanatory power in accounting for binge drinking behavior, this would indicate that cannabis use imposed an increased risk for engaging in binge drinking.

2. Methods

2.1 Participants and Procedure:

The sample consisted of 243 adolescents between 16 and 20 years of age (mean age = 17.9, SD = 1.3, 2 missing; 32.3% male, 67.7% female), 201 of which could be used in the analyses. Sixty-four adolescents filled in the paper version of the questionnaire. The others completed the survey online. An incentive of 10€ (as a gift coupon) was granted after a second completion of the survey (the data of which was not used in the present study). Within the sample, most adolescents were either VWO-students (highest variant of the secondary educational system of the Netherlands) or university students with 83 adolescents in each of both groups. Nineteen participants were educated at HAVO-level (provides access to universities of professional education, “hogescholen”). The remaining 16 participants were following some other education (basic education, VMBO, MBO/ROC, HBO). This sample thus represents a higher educated group of adolescents. A large part of the respondents reported living with their parents (68,2%), the remaining 31.8% reported living autonomously. Sampling was done by spreading information about the survey on the internet (e-mail distributor; social networks like hyves.nl), by spreading flyers in stores and on the street and by asking clubs and institutions, e.g. hockey clubs and schools, to forward the request to participate to the adolescents. At the beginning of the questionnaire participants were asked to give their informed consent and were told that they could withdraw from the survey at any time.

2.2 Questionnaire

Demographics

Demographic variables that were prompted included gender, age, housing situation (living with parents or autonomous), occupation and education. Alcohol consumption was measured in terms of standard glass units. Participants got information about standard glasses of alcohol which was given by means of pictures, explanations and a table with different examples. Alcohol consumption levels were obtained using quantity/frequency (QF) measures, item sets that gather information about the amount of alcohol that is consumed within a certain time frame. An advantage about these measures is that respondent burden tends to be low. Research has pointed out that QF measures of alcohol use are generally reliable, valid and useful (Grant, Harford, Dawson & Pickering, 1995; Hasin, Carpenter, McCloud, Smith & Grant, 1997; Dawson, 1998).

Objective and subjective binge drinking

Objective binge drinking was measured by asking respondents to indicate how many times they had consumed 6 or more standard glasses of alcohol in one occasion during the past four weeks (Monshouwer et al., 2008). Adolescents gave the frequency of binge drinking on a 10-point rating scale ranging from 0 to 9 with 0 = on no occasion in the past four weeks, 1 to 8 = 1 to 8 occasions in the past four weeks and with 9 = on 9 or more occasions in the past four weeks.

As comparative measure to the objective binge drinking variable, a subjective binge drinking measure was included into the survey. In a first question, respondents were asked to give the number of standard glasses that they can drink on one occasion or, in other words, to indicate their personal limit of alcohol units on one occasion (Monshouwer et al., 2008). A second question asked the adolescents to state the number of occasions in the past four weeks that they had exceeded their personal limit. This was measured on a 6-point rating scale with 0 = on no occasion, 1 = on 1 or 2 occasions, 2 = on 3 or 4 occasions, 3 = on 5 or 6 occasions, 4 = 7 or 8 occasions and 5 = on 9 or more occasions in the past four weeks. The scores of the second question were taken as an indicator for subjective binge drinking in the past month. Similar subjective measures (i.e. the frequency of feeling drunk) were shown to be good predictors of various outcome variables (Midanik, 1999).

Cannabis use

To measure cannabis consumption, respondents were asked to indicate the number of times they had consumed cannabis in their lives. This question was included to detect the life time prevalence and was taken from the Youth Risk Behavior Questionnaire from Brener et al. (1995). The answer was given on a 7-point rating scale where 0 = never, 1 = 1 to 2 times, 2 = 3 to 9 times, 3 = 10 to 19 times, 4 = 20 to 39 times, 5 = 40 to 99 times and 6 = 100 times or more. Month prevalence and daily consumption measures were also included into the questionnaire but were not taken into the analyses because too little respondents used cannabis regularly. Using the life time prevalence measure, it was possible to detect every adolescent who had tried cannabis before.

Substance Use Risk Profile Scale (SURPS)

As part of the survey, adolescents completed the Substance Use Risk Profile Scale (SURPS; Conrod & Woicik, 2002) which is a 23-item assessment tool measuring variations in four

personality risk factors for substance use. These include the aforementioned dimensions impulsivity, sensation seeking, hopelessness and anxiety sensitivity. All four dimensions are measured on a 4-point agree-disagree scale with high scores indicating high levels of the trait concerned.

The impulsivity-subscale of the SURPS includes 5 statements such as “I often don’t think things through before I speak” and “I often involve myself in situations that I later regret being involved in” (present sample: Cronbach’s $\alpha = .61$). An example for one of the 6 items measuring sensation seeking is “I enjoy new and exciting experiences even if they are unconventional”. In the present investigation, item 22 was deleted to increase the internal consistency of the scale (Cronbach’s $\alpha = .69$). The hopelessness-subscale consists of 7 mostly positively formulated statements such as “I am content” that require an inversion of the score (Cronbach’s $\alpha = .82$). Anxiety sensitivity is measured by means of 5 statements such as “It’s frightening to feel dizzy or faint” (Cronbach’s $\alpha = .64$). The authors of the SURPS report adequate two-month test-retest reliability (with quotients ranging from $r = .51$ to $.80$) and good internal consistency ($\alpha = .70, .75, .82$ and $.70$ for IMP, SS, H and AS respectively). The convergent validity of the four subscales is well-established. It has been reported that the IMP subscale and the SS subscale are related to the corresponding subscale of the Impulsivity and Venturesomeness Scale (Eysenck & Eysenck, 1978) and Arnett’s Inventory of Sensation Seeking (AISS; Arnett, 1994). The H subscale correlated with the Beck Hopelessness Scale (BHS; Beck, Weisman, Lester & Trexler, 1974) and the AS subscale was associated with the Anxiety Sensitive Index (ASI; Peterson & Reiss, 1992; Woicik et al., 2009). Additionally, the SURPS predicted future alcohol and drug use in adolescents beyond current substance use (Krank, Stewart, Wall, Woicik & Conrod, 2011).

Parental respect

A measure of parental respect was calculated from 6 items (Cronbach’s $\alpha = .80$). Respondents were asked to rate statements such as “It is important that my parents approve what I do” or “I respect my parents’ opinions about important topics in life” on a 5-point agree-disagree scale (with 1 = “totally disagree” to 5 = “totally agree”). High scores indicated greater levels of parental respect (Chao, 2001).

Alcohol-specific rules

As a measure of alcohol-specific rules that are laid down by their parents, adolescents rated 10 statements such as “I may drink a glass of alcohol at home when my mum or dad are

present” or “I may drink alcohol on weekends” (Cronbach’s $\alpha = .94$). Answers were coded on a 5-point Likert scale with 1 = “I surely may” to 5 = “I surely may not”, thus high scores meant that parents handled stricter rules (van der Vorst et al., 2005).

Alcohol-specific parental control

Alcohol-specific parental control was measured by answering 5 questions on a 5-point Likert-scale with 1 = “never” and 5 = “always”, e.g. “Before you go out on a Saturday evening, do your parents want to know with whom and/or where you drink?” and “Do you have to tell your parents how much you drank on the previous evening?” (Cronbach’s $\alpha = .71$). Higher scores on these items indicated higher levels of parental control (van der Vorst et al., 2005).

Quality of alcohol-related communication

An index of the quality of alcohol-related communication between parents and adolescent was derived from 6 items (Cronbach’s $\alpha = .84$). For instance, adolescents were asked to indicate whether they felt understood, whether they felt being taken serious or whether they could easily talk about their opinions about alcohol consumption with their parents. Statements were rated on a 5-point Likert-scale with 1 = “absolutely not true” to 5 = “absolutely true” and with high scores implicating high quality of alcohol-related communication (Ennett, Bauman, Foshee, Pemberton & Hicks, 2001)..

The items on parent-adolescent relationship variables were formulated for both parents. Respondents were advised to answer the questions regarding both parents. Only if they perceived a large difference between both parents they were asked to fill in the questions regarding the parent that is more important to them. The fact that open communication with at least one parental figure was linked to lower levels of different measures of adolescent substance use pleads for the way in which the parent-adolescent variables were operationalized in the present study (Kafka et al., 1991).

2.3 Data Analysis

To test for potential effects of the demographic variables, one way ANOVAs of gender, age, housing situation, occupation and education were done on all testing variables (impulsivity, sensation seeking, hopelessness, anxiety sensitivity, parental respect, alcohol-specific rules, alcohol-specific parental control, and quality of alcohol-related communication).

To examine the potential moderating effect of parent-adolescent variables on the relation between personality and binge drinking, all testing variables were z-scored and interaction

terms were computed by multiplying these z-scores (Aiken & West, 1991). Moderated multiple regression analyses were separately performed with objective B.D. and subjective B.D. as dependent measures.

As concerns the objective B.D. measure, the testing variables were entered hierarchically with gender constituting the first block to control for gender effects and with the personality dimensions (impulsivity, sensation seeking, hopelessness and anxiety sensitivity) in the second block.

For conducting the analysis with the subjective B.D. measure as dependent variable, gender was not entered into the model because it did not show an effect on subjective binge drinking. With the exception of this modification, the predictors were entered into the model in the same order as described for the analysis using objective B.D. as dependent measure.

To investigate whether the variable cannabis use could serve as a dependent measure in the TMBD, a moderated regression analysis was conducted. Cannabis use was regressed on the four blocks of testing variables in the following order: (1) gender, (2) personality dimensions, (3) parent-adolescent relationship variables, and (4) interaction terms. All variables except for gender were z-scored.

To answer the third research question whether cannabis use would add predictive value to the model of the first research question, another regression analysis was performed. The model consisted of the following variables: Cannabis use as a predictor of binge drinking was entered into the first block. Gender made up the second block. Impulsivity, hopelessness and anxiety sensitivity were entered as a third block. The fourth block consisted of the anxiety sensitivity x control interaction term and the parental control variable. The latter was taken into the analysis although it had not proven significant in the previous analysis in order to correct for potential main effects.

To investigate the nature of the AS x control interaction, binge drinking scores for individuals scoring low (-1SD) and high (+1SD) on the control measure who were low (-1SD) and high (+1SD) in anxiety sensitivity were estimated for both outcome measures (Aiken & West, 1991). Finally, to quantify the predictive effects of anxiety sensitivity on binge drinking at low (-1SD) and high (+1SD) levels of control, a simple slopes analysis was performed (Aiken & West, 1991).

3. Results

3.1 Descriptive statistics

A sample of 201 cases was used in the analyses. Table 1 shows means and standard deviations of the outcome measures objective binge drinking, subjective binge drinking and cannabis use. All measures show higher values for males than for females which is especially obvious in objective binge drinking and cannabis use. The averages of female objective binge drinking and male and female subjective binge drinking lay close together while the average number of times that males reported exceeding six alcohol units were considerably higher (3.4 times in the past four weeks). Means for the number of alcohol units as personal limit were 14 units for males ($SD=7.9$) and 7.4 units for females ($SD=6.2$). Female respondents have used cannabis 3.5 times in their lives on average while male respondents reported using it 12.3 times on average.

Table 1.

Means and Standard Deviations of the Measures Objective Binge Drinking, Subjective Binge Drinking and Cannabis Use.

	Objective B.D.		Subjective B.D.		Cannabis Use	
	male	female	male	female	male	female
N	65	136	65	136	65	136
Mean	3.4	1.1	1.0	.7	12.3	3.5
SD	2.93	1.7	1.5	1.1	26.3	11.3

3.2 Correlations

3.2.1 Correlations involving the SURPS personality dimensions

Correlations among the outcome measures and impulsivity, sensation seeking, hopelessness and anxiety sensitivity are shown in Table 2. Significant correlations between the objective and subjective B.D. measures were quite strong ($r=.51$). As expected, alcohol and cannabis use were associated while the subjective B.D. measure correlated more strongly with the cannabis measure. The correlation between cannabis and subjective B.D. (.37) is even higher than usually reported in the literature (between .30 and .35; e.g. Donovan et al., 1985). Impulsiveness and sensation seeking are positively related to the alcohol measures while hopelessness was negatively correlated and the correlation with anxiety sensitivity was not significant at all. The same tendency was found for the cannabis measure. A significant positive correlation with cannabis use was only found for sensation seeking. Impulsiveness and sensation seeking showed a moderate positive intercorrelation. Correlations among the other traits were insignificant which confirmed the view that the dimensions are largely independent.

Table 2.

Correlations among Objective and Subjective Binge Drinking, Cannabis Use and the SURPS Personality Dimensions (Impulsivity, Sensation Seeking, Hopelessness and Anxiety Sensitivity)

	Subj.	Cannabis	IMP	SS	H	AS
B.D.						
Obj.B.D.	.51**	.24**	.27**	.31**	-.19**	-.22
Subj.						
	-	.37**	.22**	.24**	-.03	-.05
B.D.						
Cannabis		-	.09	.31**	-.01	-.04
IMP			-	.33**	.07	.12
SS				-	-.07	-.13
H					-	.11

Note. ** = Correlations significant at 0.01 level (2-tailed)

* = Correlations significant at 0.05 level (2-tailed)

3.2.2 Correlations involving the parent-adolescent relationship variables

Correlations between alcohol and cannabis use and the parent-adolescent relationship variables are reported in Table 3. The overall picture shows that these variables did not correlate well with the outcome measures. The only measure being significantly correlated with a dependent measure was alcohol-specific rules. The association was moderate and negative. A moderate correlation was found between the quality of alcohol-related communication and parental respect.

Table 3.

Correlations among Objective and Subjective Binge Drinking, Cannabis Use and the Parent-Adolescent Relationship Variables (Parental Respect, Alcohol-specific Rules, Alcohol-specific Parental Control and Quality of Alcohol-related Communication)

	Subj. B.D.	Cannabis	Respect	Rules	Control	Communication
Obj.B.D.	.51**	.24**	-.13	-.23**	-.02	-.00
Subj.B.D.	-	.37**	.00	-.07	.00	-.07
Cannabis	-	-.12	.00	-.04	-.04	
Respect		-	-.11	.09	.36**	
Rules			-	.01	-.05	
Control				-	-.11	

Note. ** = Correlations significant at 0.01 level (2-tailed)

*=Correlations significant at 0.05 level (2-tailed)

The one way ANOVAS including the demographic variables yielded the following results: There were differences between age categories with regard to alcohol-specific rules that are laid down by their parents ($F(4,194)=9,38$, $p<.001$). The older adolescents get, the more relaxed their parents handle alcohol-specific rules. Differences between age categories regarding the quality of alcohol-related communication have been found ($F(4,194)=8.20$, $P<.001$). Sixteen-year-olds report about worse quality of communication than older adolescents. Gender had a significant effect on the objective binge drinking measure ($F(1,199)=46,87$, $p<.001$) and on cannabis use ($F(1,189)=4.04$, $p<.046$). In both cases, males reported about higher levels of consumption than females. This was not true for the subjective B.D. measure.

3.3 First research question: Interactive predictions of objective and subjective binge drinking

Moderated multiple regression analyses of the objective binge drinking measure yielded the following results: Gender was able to explain 19.5% of the variance in binge drinking behavior ($R^2=.19$, $F (1,198) = 47.9$, $p<.001$). All SURPS personality dimensions emerged as significant predictors and led to an increase of 13.3% of the variance explained in binge drinking ($\Delta R^2=13.3$, $\Delta F (4,194) = 9.59$, $p<.001$). The parent-adolescent relationship variables (parental respect, alcohol-specific rules, alcohol-specific parental control and quality of alcohol-related communication) made up the third block. None of these measures yielded a significant effect on binge drinking behavior. To examine the hypothesized moderating effect

of parent-adolescent variables and personality risk factors, the interaction terms were entered into the regression equation as a fourth block. The anxiety sensitivity x control interaction term was the only predictor to yield a significant result. It led to an increase of 3.7% in the amount of variance that was explained in binge drinking ($\Delta R^2=.037$, $\Delta F (1,189) = 11.23$, $p=.001$). All variables in the regression equation taken together, 37.4% of the variance in binge drinking could be accounted for ($R^2=.374$, $F(10,189)=11.27$, $p<.001$). The results of the analysis leaving out the other insignificant interaction terms are shown in Table 4.

Table 4.

Predicting Objective Binge Drinking: Main and Interaction Effects of Parent-Adolescent Relationship Variables and Personality Variables (Standardized Beta Coefficients).

Block/Predictor	Block 1	Block 2	Block 3	Block 4
1. Gender	-.442***	-.367***	-.341***	-.330***
2. Impulsivity		.248***	.246***	.280***
Sensation Seeking		.120*	.118*	.106
Hopelessness		-.171***	-.156**	-.145**
Anxiety Sensitivity		-.124**	-.122	-.164**
3. Respect			-.056	-.046
Rules			.066	.096
Control			.000	-.034
Communication			.062	.066
4. ASxControl				.204***
F (df)	47.99(1,198)	18.94(5,194)	10.69(9,190)	11.27(10,189)
P	.000	.000	.000	.000
R²	.195	.328	.336	.374
R² Change	.195	.133	.008	.037
F Change (df)	47.99(1,198)	9.59(4,194)	.593(4,190)	11.23(1,189)
P (F Change)	.000	.000	.668	.001

Note. N=200

* = Coefficients significant at 0.1 level (2-tailed)

** = Coefficients significant at 0.05 level (2-tailed)

*** = Coefficients significant at 0.01 level (2-tailed)

As Table 5 shows, 8.7% of the variance in subjective binge drinking could be explained by the SURPS-personality dimensions with impulsivity and sensation seeking having significant beta coefficients ($R^2=.087$, $F(4,195)=4.65$, $p=.001$) which is somewhat different from the results regarding objective binge drinking. As well as in the previous model, adding the parent-adolescent variables into the model did not yield any significant beta weights. Again, the anxiety sensitivity x control interaction was the only significant predictor among all interaction terms and increased the variance that was accounted for by 2.2% ($\Delta R^2=.022$, $\Delta F(1,190) = 4.68$, $p=.032$). The total amount of variance that was explained by the model was a proportion of 12.6% ($R^2=.126$, $F(9,190)=3.04$, $p=.002$).

Table 5.

Predicting Subjective Binge Drinking: Main and Interaction Effects of Parent-Adolescent Relationship Variables and Personality Variables (Standardized Beta Coefficients).

Block/Predictor	Block 1	Block 2	Block 3
1. Impulsivity	.176**	.181**	.207***
Sensation Seeking	.177**	.188**	.178**
Hopelessness	-.027	-.046	-.037
Anxiety Sensitivity	-.048	-.053	-.084
2. Respect		.066	.073
Rules		-.105	-.084
Control		-.029	-.055
Communication		-.072	-.069
3. ASxControl			.155**
F (df)	4.65 (4,195)	2.79(8,191)	3.04 (9,190)
P	.001	.006	.002
R²	.087	.104	.126
R² Change	.087	.017	.022
F Change (df)	4.659 (4,195)	.920 (4,191)	4.68 (1,190)
P (F Change)	.001	.453	.032

Note. N=200

*=*Coefficients significant at 0.1 level (2-tailed)*

**=*Coefficient significant at 0.05 level (2-tailed)*

***=*Coefficient significant at 0.01 level (2-tailed)*

A graphic representation of binge drinking scores for individuals low (-1SD) and high (+1SD) in anxiety sensitivity is shown in Fig. 1 with objective binge drinking as dependent measure in the top and subjective B.D. in the bottom panel. As we can infer from the pictures, a similar pattern emerges for objective as well as for subjective binge drinking regarding participants scoring low on the control dimension. Individuals reporting about low levels of parental control and scoring low on the AS dimension seem to engage in binge drinking more often than individuals also reporting about low levels of control but scoring high on anxiety sensitivity. This seems to be true for both outcome variables. Regarding individuals with high scores on the control scale, the relation between AS and binge drinking is not as distinct.

Simple slopes analyses of the effect of AS on binge drinking at low and high levels of control yielded the following results: The relation between objective binge drinking and anxiety sensitivity was significant at low levels of control ($t=-1.87$, $p<0.05$). The effect was found to be insignificant at high levels of control. As concerns the effect of anxiety sensitivity on subjective binge drinking, the analysis yielded no significant results at both low and high levels of control.

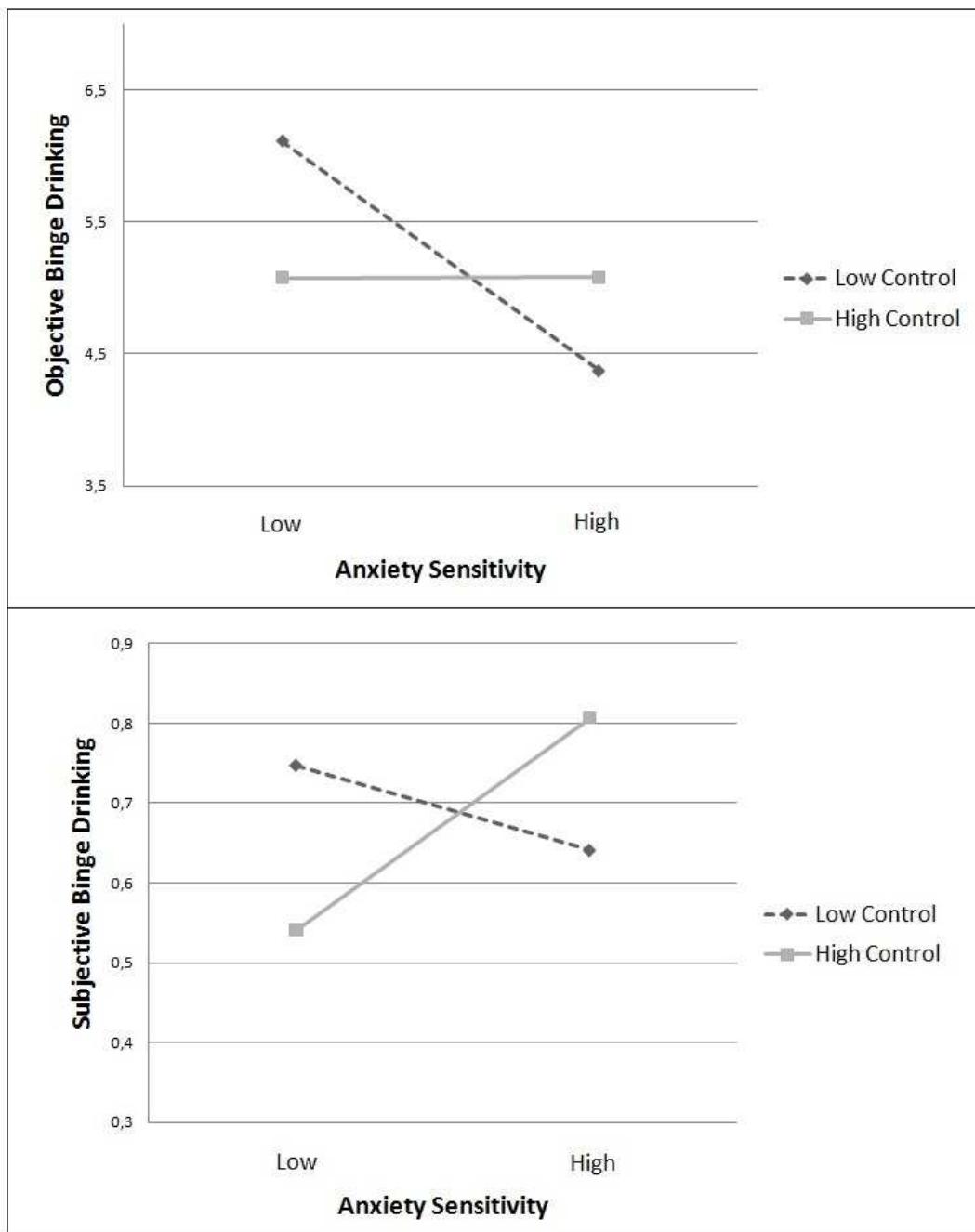


Fig. 1.

Objective binge drinking (top panel) and subjective binge drinking (bottom panel) as a function of the Anxiety Sensitivity x Control interaction.

3.4 Second research question: Interactive predictions of cannabis use

The analysis with cannabis use as dependent variable showed that gender was able to explain 6.7% of the variance in cannabis use ($R^2=.067$, $F(1,198) = 14.24$, $p<.001$). Among all other measures, sensation seeking was the only factor that added some proportion of variance in cannabis use that could be explained (standardized $\beta=.37$, $t=5.35$, $p<.001$). This result is comparable to the results obtained in the correlational analyses. Personality factors added a proportion of 17.8% to the variance that was explained by gender ($\Delta R^2=.178$, $\Delta F (4,194) = 11.43$, $p<.001$) with sensation seeking emerging as the only predictor. The beta weights of all other testing variables remained insignificant. It is worth mentioning that the regression coefficient of anxiety sensitivity tended to be negative ($\beta=-.11$, $t=-1.6$, $p>.1$) because this tendency is consistent with previous findings over the negative relation between AS and cannabis use.

3.5 Third research question: Predicting binge drinking

The results of the analysis concerning the objective measure are shown in Table 6. The overall pattern suggests that all variables (except for alcohol-specific control) can be seen as predictors of objective binge drinking. Interestingly, cannabis use had a significant effect on binge drinking when it was the only variable in the model. As shown in the first row of the table, the effect of cannabis use increasingly lost its significance with every additional block that was entered into the analysis. This observation implied a mediating effect of other testing variables on the relation between cannabis use and binge drinking (Baron & Kenny, 1986). Taken together, the variables under consideration were able to explain 35.8% of the variance in the objective measure of binge drinking behavior ($R^2=.358$, $F(7,192)=15.29$, $p<.001$).

Table 6.

Predicting Objective Binge Drinking: Main and Interaction Effects of Previously Significant Parent-Adolescent Relationship Variables and Personality Variables and Cannabis Use (Standardized Beta Coefficients).

Block/Predictor	Block 1	Block 2	Block 3	Block 4
1. Cannabis Use	.234***	.139**	.103*	.079
2. Gender		-.410***	-.366***	-.367***
3. Impulsivity			.281***	.311***
Hopelessness			-.176***	-.173***
Anxiety			-.137**	-.171***
Sensitivity				
4. Control				-.029
AS x Control				.187***
F (df)	11.43 (1,198)	26.74 (2,197)	18.8 (5,194)	15.29 (7,192)
P	.001	.000	.000	.000
R²	.055	.213	.326	.358
R² Change	.055	.159	.113	.032
F Change (df)	11.43 (1,198)	39.79 (1,197)	10.85 (3,194)	4.73 (2,192)
P (F Change)	.001	.000	.000	.010

Note. N=200

*=*Coefficients significant at 0.1 level (2-tailed)*

**=*Coefficient significant at 0.05 level (2-tailed)*

***=*Coefficient significant at 0.01 level (2-tailed)*

The results of the analysis with subjective binge drinking as dependent measure can be found in Table 7. Cannabis use was able to explain 14.1% of the variance in binge drinking ($R^2=.141$, $F(1,199)=23.6$, $p<0.001$). As opposed to the analysis with objective binge drinking as a dependent measure, the effect of cannabis use remained significant among other predictors in the model (block 3: $\beta = .32$, $p<.001$). The analysis suggested that impulsivity is a robust predictor of subjective binge drinking (block 2: $\beta = .17$, $p<.01$). Sensation seeking did not remain significant in block 3. Taken together, the SURPS personality factors accounted for an additional 4.3% of the variance that was explained in subjective binge drinking ($\Delta R^2=.043$, $\Delta F(3,196)=3.45$, $p=.018$). Among the other variables in the regression equation, the AS x control interaction did not yield a significant increment in the variance explained in subjective B.D.

Table 7.

Predicting Subjective Binge Drinking: Main and Interaction Effects of Previously Significant Parent-Adolescent Relationship Variables and Personality Variables and Cannabis Use (Standardized Beta Coefficients).

Block/Predictor	Block 1	Block 2	Block 3
1. Cannabis Use	.375***	.331***	.316***
2. Impulsivity		.166***	.187***
Sensation Seeking		.082**	.077
Anxiety Sensitivity		-.048	-.072
3. Control			-.016
ASxControl			.123
F (df)	23.6 (1,199)	11.04 (4,196)	7.96 (6,194)
P	.000	.000	.000
R²	.141	.184	.198
R² Change	.141	.043	.014
F Change (df)	32.6 (1,199)	3.45 (3,196)	1.66 (2,194)
P (F Change)	.000	.018	.194

Note. N=200

*=Coefficients significant at 0.1 level (2-tailed)

**=Coefficient significant at 0.05 level (2-tailed)

***=Coefficient significant at 0.01 level (2-tailed)

4. Discussion

4.1 Review of findings

The present study was done to investigate the potential moderating effect of parent-adolescent variables on the relation between SURPS personality risk factors and binge drinking and to clarify the role of cannabis use in the TMBD. This was done by looking for main and moderating effects of parent-adolescent variables and personality dimensions on binge drinking and cannabis use and by regressing cannabis use along with the other variables on binge drinking.

Just as a positive relationship with the parents can buffer the potentially compelling effects of peers on adolescent binge drinking behavior (Nash, McQueen & Bray, 2005), it was hypothesized that certain parent-adolescent variables would protect adolescents scoring high on risky personality traits against engaging in binge drinking to a certain extent. For instance, it was assumed that an impulsive adolescent that was given clear rules by her parents would engage in binge drinking less frequently than an impulsive adolescent whose parents did not schedule alcohol-specific rules. Handling alcohol-specific rules would then serve as a safeguard against frequent binge drinking in impulsive adolescents which would have clear implications for practice.

The SURPS-personality traits were found to be predictive for binge drinking behavior with the objective measure explaining an additional 13.3% of the variance in binge drinking behavior when the effects of gender were controlled for. Impulsivity, hopelessness and anxiety sensitivity arose as significant predictors. Concerning the subjective binge drinking measure, personality factors accounted for an additional proportion of 10.4% of the variance of binge drinking. Here, impulsivity and sensation seeking were robust predictors. Hopelessness and anxiety sensitivity tended to be negatively associated with the subjective measure but the effect remained insignificant.

As the results show, the correlation between rules and objective binge drinking were the only constructs to be correlated among the parent-adolescent variables and the substance measures. Regarding the regression analyses, none of the parent-adolescent variables was linked to one of the binge drinking measures in the present sample.

In an attempt to test whether cannabis use was predicted by SURPS-personality factors and parent-adolescent variables in a similar manner, it was analyzed as dependent variable in the TMBD. After controlling for the effects of gender, personality factors were found to be

predictive of binge drinking behavior, adding a proportion of 17.8% of the variance that was accounted for in the model. Among them, sensation seeking was the only predictor to yield a significant result. The parent-adolescent variables and the interaction terms were not able to contribute any predictive value.

To answer the third research question, cannabis use was analyzed as independent variable among the other predictors to predict binge drinking as represented by the objective and the subjective measure. The results concerning the objective binge drinking measure suggested that other testing variables mediated the relationship between cannabis and alcohol use (Baron & Kenny, 1986).

4.2 First research question: Predicting binge drinking

Broadly consistent with previous research, impulsivity and sensation seeking were found to be predictors of both the objective and subjective binge drinking measure in the present sample (e.g. Sher et al., 2000).

The tendency of H and AS to be negatively correlated with alcohol use is in line with findings by Woicik et al. (2009). However, concerning the AS dimension and its relationship to alcohol use, research findings are inconsistent. The present findings contradicted the results of a study by Stewart et al. (1995) that showed that AS was positively associated with alcohol consumption levels in female university students. However, in a sample of male and female undergraduates, Wagner (2001) found that anxiety sensitivity was negatively associated with substance use. It could also be reasonable to speculate that another underlying factor moderates the relation between AS and substance use, such as differences between males and females or clinical and nonclinical samples. For instance, AS and alcohol use maybe show positive correlations in clinical samples due to negative affect coping. In nonclinical samples, AS and alcohol use could be negatively correlated because the fear of bodily changes holds individuals off excessive alcohol use. The nature of this relationship needs to be further investigated. In connection to this, it is possible that AS hinders the initiation of alcohol use in the first place. Once the fear of bodily changes due to alcohol consumption is overcome, AS could serve as intensifying factor when coping with negative emotions by consuming alcohol. Due to the tendentially negative correlation between AS and binge drinking, one can assume that high AS respondents the present sample are not initiated yet. More generally, both AS and H can be seen as substance use risk factor that are associated with drinking behavior through a negative reinforcement process and are thereby primarily associated with other

adverse factors of substance use, such as negative-affect related coping motives (Comeau et al., 2001) and alcohol abuse symptoms (Woicik et al., 2009).

The negative correlation between rules and alcohol use is consistent with the findings by Engels et al. (2005). The missing effect of parent-adolescent variables on binge drinking in the regression analyses could be explained as follows: As concerns the estimation of parental respect, the present analyses were rather explorative. However, prior research had shown that parental rules and control and the parent-child communication were predictors of underage alcohol use (Wood et al., 2004, Engels et al., 2005, Slice et al., 1995, Barnes et al., 1992). Referring to the parental respect measure, the lack of a considerable effect could stem from the fact that the parental respect scale was developed to inform research about other cultural backgrounds than those in the present study (Chao, 2001). There are three alternative explanations for the finding that the parent-related measures were not found to be predictors of binge drinking. One explanation is that a large part of the present sample can be viewed as being in the transition between adolescence and adulthood. More specifically, 31.8% of participants reported living autonomously and more than 50% were already studying at a university. The parent-adolescent variables could have failed to yield a considerable effect because parental influences did not have a large impact on those subjects anymore. In the questionnaire, participants were encouraged to imagine still living at their parents' home when answering the questions about their relation. In spite of that, the parent-adolescent relationship at that time could possibly not have enough weight to predict current binge drinking behavior. It would be interesting investigate the influence of these parent-related variables within a sample of younger adolescents who are bound to the influence of their parents to a greater extent. Another explanation for the missing effect is the educational level of the sample. The main part of the respondents (92.3%) was following a higher education (university, VWO, HAVO). It is thus probable that parental respect, rules and control and the quality of communication were quite high in the present sample. This could be the reason why the (potentially) adverse effects of missing respect, rules and control and a bad quality of communication on alcohol use did not have a considerable impact in the present sample. On the other hand, neither housing nor education was found to have an effect on the outcome measures in the present study. Still another explanation for parent-adolescent variables not having a direct impact is that their effect on binge drinking is mediated by some other variable. They could possibly be mediated by the reflective or the impulsive pathway in the Twente Model of Binge Drinking. For instance, strict parental rules could influence youngsters' subjective norm about alcohol use which in turn affects intention to engage in

binge drinking. At large, I conclude that the parent-adolescent variables used in the present study are not sufficient to predict binge drinking directly.

The main focus of the first research question lay on the potential moderating effect of parent-adolescent variables on the connection between personality and binge drinking behavior. A moderating effect of parental control on the relation between anxiety sensitivity and binge drinking was consistently found for both dependent measures. The findings suggest that it did not make a difference if an adolescent was low or high in anxiety sensitivity when parents monitored their offspring's alcohol consumption. However, adolescents whose parents did not monitor alcohol use had a higher risk for engaging in frequent binge drinking when they were low in anxiety sensitivity. Thus, with lack of parental control, low levels of anxiety sensitivity fueled the engagement in binge drinking in the present sample. As an implication for practice, parents with children who are not sensitive to the fear of anxiety-related bodily changes could be advised to monitor their offspring's alcohol consumption. This can be seen as a clear implication for interventions focusing on parents and their offspring's problematic drinking habits.

How can this finding be explained? Adolescents scoring low on the AS-dimension do not fear anxiety-related changes within their bodies (Stewart et al., 1995). Adolescents who are not afraid of strange body sensations will probably not be afraid of the effect of alcohol on their bodies. Parents' monitoring of their children's alcohol consumption maybe signalizes that using alcohol is coupled with some risks or that consuming alcohol is a behavior that should not occur without monitoring its effects. Adolescents low in AS and being monitored by their parents could learn to be sensitive for the effects of alcohol on their bodies. As the results show, these adolescents tend to refrain from frequent binge drinking. When the protective effect of parental control is missing, adolescents low in AS tend to engage in binge drinking frequently.

It is also possible to speculate that the AS trait is inversely linked to some other underlying factor that facilitates binge drinking behavior. Because of the search for new stimulation and physiological arousal, sensation seeking could be a candidate for this underlying factor. However, it can be excluded from these considerations because it was shown to be independent of anxiety sensitivity (Wagner, 2001).

The present research has shown that the effect of anxiety sensitivity on binge drinking was moderated by parental control. For a correct interpretation of this effect, it is even more important to clarify the nature of the relation between AS and alcohol consumption.

4.3 Second and third research question: The role of cannabis use within the Twente Model of Binge Drinking

As stated by previous research, sensation seeking is a robust predictor of cannabis use (Arnett, 1994). Impulsivity has been found to be related to substance use in general (e.g. Grau et al., 1999; Sher et al., 2000; Sher et al., 1995; Pidcock et al., 2000), but studies linking impulsivity and cannabis use were not available. Hopelessness has not been found to be related to cannabis use (Woicik et al., 2009). Thus far, the results of the present study meet the expected outcome. Samoluk and MacDonald (1999) reported on a negative association between anxiety sensitivity and cannabis use. The association between AS and cannabis use in the present sample tended to be negative as well, although the results remained insignificant.

Referring to the parental respect measure, the lack of a considerable effect on cannabis use could also be explained by the cultural specificity that was assumed by Chao (2001). Concerning the other measures, prior research has identified cannabis use to be predicted by parental rules (Barnes et al., 1992) and parental control (Ramirez et al., 2004). Results about the relation between cannabis use and the quality of parent-child communication were not available, but other findings suggest that the openness of parent-child communication was a predictor of cannabis use (Kafka et al., 1991). Except for parental respect, the parent-adolescent measures were alcohol-specific which means that the items of the scales were formulated in relation to alcohol use. The alcohol-specific parent variables had been assumed to indicate how parents handle their children's cannabis use. It was assumed that the way in which parents dealt with alcohol-related topics should be linked to the way in which they dealt with potential contact with marijuana. Possibly, the parent-adolescent variables did not yield significant results in predicting cannabis use because they were measured in relation to drinking behavior. Yet, this is difficult to assess because the parent variables did not have a considerable effect on binge drinking, too. The potentially different effects of alcohol-specific parent-adolescent variables on binge drinking and cannabis use are thus difficult to examine in the present study. A lack of parental influence and the higher educational level of a large part of the respondents, as discussed in relation to the first research question, could also serve as an explanation of the present results. Presumably, a direct parental influence on cannabis use was missing as concerns the variables under consideration.

As the results suggest, none of the interaction terms can be seen as predictors of cannabis use. Among all predictors of the model, gender and sensation seeking were the only variables that could provide considerable predictive value for cannabis use. This suggests that cannabis use is not readily embedded into the Twente Model of Binge Drinking as a dependent variable.

The mediation of other testing variables in the effect of cannabis on objective binge drinking implied that the other testing variables explained why individuals consuming cannabis also engaged in binge drinking behavior. Cannabis users and binge drinkers could thus be seen as individuals who share common risk factors or who are part of the same subculture. Following from the results of the analysis, being male and scoring high/low on certain SURPS personality risk factors increased the likelihood of engaging in binge drinking and cannabis use. Other common psychosocial or cognitive factors that have been identified by previous research add to this probability. A longitudinal study by Lynskey et al. (1998), for instance, found that the association between tobacco, alcohol and cannabis use was explicable by a factor that stood for a general vulnerability for substance use which could be predicted by the influence of substance using peers, novelty seeking and the extent to which parents used illegal drugs. Fifty-four percent of the correlations among tobacco, alcohol and cannabis use could be explained by these risk factors and the remaining part could be ascribed to unobserved vulnerability factors. As mentioned before, the association between alcohol and cannabis use can be explained in terms of (a) one behavior causing another, (b) both behaviors sharing common risk factors, (c) different risk factors for alcohol and cannabis use being associated and thereby causing both behaviors to occur together or (d) both behaviors being manifestations of the same vulnerability or condition. The present results point in the direction of the three last-named explanations for the association between alcohol and cannabis use. For detailed conclusions, further research would be necessary. As concerns the objective binge drinking measure, the cannabis construct should not be embedded into the TMBD. It is neither well explained by the parent-adolescent and personality variables (see first research question) nor is it able to explain binge drinking as independent variable. Both behaviors could be seen standing next to each other or belonging to the same subculture.

Regarding the subjective binge drinking measure, cannabis use was found to remain a predictor of subjective binge drinking along with impulsivity, sensation seeking and the AS x control interaction term. The potential mediating effect could not clearly be replicated. A possible explanation for the absence of this effect is that some common risk factors of subjective binge drinking and cannabis use are still missing in the model. By adding some

other shared risk factors, the effect of cannabis use on subjective binge drinking could also be mediated. Another possible explanation for this finding is that cannabis use did have predictive value for binge drinking behavior after all. This would point in the direction of the view of the stage or gateway theory suggesting a causal link between different substance use behaviors (Kandel et al., 1975; Kandel et al., 1992). Following from the results concerning the subjective binge drinking measure, cannabis could be integrated into the TMBD as having additional explicatory value in predicting binge drinking. However, more research is necessary to clarify the (causal) relations between the consumption of different substances and underlying risk or vulnerability factors. It seems likely that this relation is not easily explained by a causal association between different substance use behaviors or by underlying risk factors alone. Future research should inform the development of a model that integrates different aspects of the relation between different drug use behaviors.

What do the present findings mean for the Twente Model of Binge Drinking as concerns the role of cannabis use within the model? As the analyses of the second research question showed, cannabis was not found to be suitable for the role as dependent variable in the TMBD. This provides evidence for the specificity of the TMBD for binge drinking behavior. Analyzing the cannabis measure as independent variable in the TMBD did not yield consistent results concerning a potentially mediating effect. Nonetheless, the results suggest that cannabis did have predictive value in explaining binge drinking for both the objective and the subjective measure which seemed to be partly mediated by other variables. In sum, it would be appropriate to ascribe a minor role to cannabis use as independent variable within the TMBD. Cannabis use could be seen as a behavior that is clearly associated with binge drinking and that shares underlying risk factors with it. Cannabis users and binge drinkers can be seen as partly belonging to the same subculture. Some adolescents tend to engage in both behaviors, others show a special tendency towards one of the substances. Future investigations should address common risk or vulnerability factors for the consumption of both substances and simultaneously search for risk factors that distinguish cannabis users from alcohol users. Multivariate models are needed to inform our approach to problematic health behaviors that are influenced by a great deal of factors.

4.4 Shortcomings of the present study

In the present investigation, the objective binge drinking measure was operationalized as consuming more than six standard glasses on one occasion within the last four weeks. As concerns the subjective measure, participants had to state their own alcohol consumption limit

and indicate how often they had exceeded it within the last four weeks (Monshouwer et al., 2008). The results suggest that gender had an effect on the objective binge drinking measure which was absent regarding the subjective measure. Measuring binge drinking with exceeding six units may be more sensitive for measuring male binge drinking because they generally have a higher tolerance for alcohol. Wechsler, Dowdall, Davenport and Rimm (1995) suggested a gender-specific measure of binge drinking. They found that women typically consuming four drinks on one occasion were roughly as likely to experience alcohol-related problems as men typically consuming five drinks on one occasion. Wechsler and colleagues (1995) concluded that dealing the same standards for male and female binge drinkers underestimates binge drinking rates and adverse health outcomes for women and propose a measure that is guided by the aforementioned number of drinks.

The operationalization of the subjective binge drinking measure could also be clarified further. Participants were asked to state their personal limit of drinks they can consume at one occasion. It is likely that participants did not handle the same definitions of their personal limit. Some might define their personal limit as starting to feel the effects of alcohol; others might define it as feeling dizzy, not being able to walk anymore or throwing up. It would be useful to clearly define *which* limit the participants had to state. The present study used a quantity/frequency measure for subjective binge drinking. It could also be sufficient to use the individual estimation of a specified limit as a measure for alcohol use. Relevant to binge drinking and its definition of exceeding a certain limit (e.g. six units or personal limit), only using the estimation of a personal limit would not be sufficient. In general, the objective measure yielded clearer results as concerns the first and the third research question. It can be concluded that the objective criterion is superior to the subjective measure in predicting the testing variables in the present study.

Another shortcoming of the present study is the composition of the sample. A large part of the participants were higher educated and did not live at home anymore which possibly had a negative effect on the impact of parent-adolescent variables. Furthermore, female participants were overrepresented (68% female respondents).

Still another shortage of the present investigation is that self-report measures were used. Self-reported amounts of alcohol or drug use may be exaggerated or inaccurate because of difficulties remembering alcohol use or expressing it in standard glasses. With respect to the parent-adolescent measures, it would have been interesting to gather data from both parents

and adolescents. This would provide a more detailed picture of the parent-adolescent relationship. An even more detailed approach to measure the parent-adolescent relationship could be obtained using a longitudinal design. An investigation of the effect of respect, rules, control and communication over time would display potential developments and long-term influences of these variables on adolescent health behaviors.

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