Alcohol Availability at Home and Adolescent Alcohol Use: Impulsivity and Drinking Motives as Moderators

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Master Thesis Youth Studies

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Abstract

Adolescent alcohol use is associated with negative consequences on brain development. This study examined the predicting effects of alcohol availability at home, impulsivity, and drinking motives on adolescent alcohol use, and specifically, the interactions of impulsivity and drinking motives with alcohol availability at home in predicting adolescent alcohol use. Longitudinal data were obtained through questionnaires, filled in by 383 adolescents (88% boys, mean age = 13.56, *SD* = 0.86) in special education schools in the Netherlands. Multinomial logistic regression analyses were performed. Cross-sectional findings at T1 showed that alcohol availability at home, and social and enhancement motives were positively related to adolescent alcohol use. Longitudinally, T1 alcohol use and social motives were the strongest predictors of alcohol use at T2. Alcohol availability at home did not add significance to that model. No significant interactions were found. Thus, alcohol use over time can be best predicted by social motives and previous alcohol use. These results emphasize the importance of the social aspects of drinking and prevention, in order to decrease alcohol use over time. Additionally, increasing parental awareness of the positive relation between the availability of alcohol at home and the alcohol use of their adolescents could be of value.

Keywords: adolescents, alcohol use, alcohol availability at home, drinking motives, impulsivity

Samenvatting

Alcoholgebruik bij adolescenten kan negatieve gevolgen hebben voor de hersenontwikkeling. De huidige studie onderzoekt de voorspellende effecten van alcoholaanwezigheid thuis, impulsiviteit en drinkmotieven op alcoholgebruik bij adolescenten. Ook kijkt deze studie specifiek naar de interacties tussen impulsiviteit en drinkmotieven enerzijds en alcoholgebruik anderzijds. Longitudinale data zijn verkregen door vragenlijsten, afgenomen bij 383 adolescenten (88% jongen, gemiddelde leeftijd = 13.56, *SD* = 0.86) op speciaal onderwijs in Nederland. Multinomiale logistische regressie analyses zijn uitgevoerd. Cross-sectionele resultaten op T1 lieten zien dat alcoholaanwezigheid thuis, sociale en versterkende drinkmotieven positief gerelateerd waren aan alcoholgebruik bij adolescenten. Longitudinaal gezien waren alcoholgebruik en sociale motieven op T1 de sterkste voorspellers voor alcoholgebruik op T2. Alcoholaanwezigheid thuis verhoogde de verklaarde variantie niet significant. Dus, alcoholgebruik kan het beste worden voorspeld door eerder gebruik en sociale drinkmotieven. Deze resultaten benadrukken het belang van preventie en de sociale aspecten van drinken in het terugdringen van alcoholgebruik bij adolescenten. Daarnaast kan het vergroten van ouderlijk bewustzijn betreffende de positieve relatie tussen de aanwezigheid van alcohol thuis en het drankgebruik van hun adolescenten van toegevoegde waarde zijn.

Kernbegrippen: adolescenten, alcoholgebruik, alcoholaanwezigheid thuis, drinkmotieven, impulsiviteit

Alcohol Availability at Home and Adolescent Alcohol Use: Impulsivity and Drinking Motives as Moderators

Adolescent drinking in the Netherlands has drastically declined over the last five years (Van Dorsselaer et al., 2016). However, in the last two years, the prevalence of alcohol intoxicated adolescents has increased (Van Der Lely, Schreurs, Van Hoof, & Van Dalen, 2016). This contradiction provides a reason for further research on possible predictors of adolescent alcohol use, since heavy alcohol use in adolescence is associated with negative consequences on neurological and cognitive development (Squeglia, Spadoni, Infante, Myers, & Tapert, 2009; for a review, see Clark, Thatcher, & Tapert, 2008). For example, selective loss of prefrontal white matter is reported (De Bellis et al., 2005), which is associated with poorer cognitive performance (Schulte, Müller-Oehring, Salo, Pfefferbaum, & Sullivan, 2006). Since the legal drinking age in the Netherlands has raised up to eighteen years, it can be harder for younger adolescents to obtain alcohol. In 2015, 26% of adolescents younger than 16 years obtain alcohol from their parents' home, and 80% drink alcohol at home or at their friends home (Van Dorsselaer et al., 2016). These numbers have increased over the last five years (Van Dorsselaer et al., 2016; Verdurmen et al., 2012). Alcohol availability at home can predict adolescent alcohol use (Van Den Eijnden, Van De Mheen, Vet, & Vermulst, 2011). Surprisingly, few studies have looked specifically at alcohol availability at home as a potential predictor of adolescent alcohol use, and the available results are inconsistent. Additionally, it may be a person's specific motivation to drink that plays a pivotal role in the decision to start drinking (Cox & Klinger, 1988) and can influence the development of heavy drinking (Cooper, 1994). Since each motive is accompanied with unique drinking patterns (Cooper, 1994), these motives may also moderate the effects of alcohol availability at home. Finally, impulsivity can predict alcohol use (Jentsch et al., 2014). Moreover, the effects of alcohol availability may be stronger for impulsive adolescents (Papachristou, Nederkoorn, Corstjens, & Jansen, 2012). However, to our knowledge, there are no studies available which scrutinize impulsivity or drinking motives as moderators in the relation between alcohol availability at home and adolescent alcohol use. Therefore, the purpose of this study is to examine (1) the effects of alcohol availability at home, impulsivity and drinking motives on adolescent alcohol use and (2) the effects of impulsivity and drinking motives on the relation between alcohol availability at home and adolescent alcohol use. A demonstrated relation, including the interactions with impulsivity and motives, may be a guidance to preventive interventions. This study may reveal a vulnerable group of adolescents at risk for alcohol use.

Preventive policy may use the results of this study to design selective or indicative interventions, with different strategies based on adolescent respective proximal risk factors, in order to prevent adolescent alcohol use.

Alcohol Availability at Home and Adolescent Alcohol Use

Theoretical underpinnings for the potential positive relation between alcohol availability at home and adolescent drinking behaviour can be found in the ecological theory of human development (Bronfenbrenner, 1977). This theory suggests that the context in which we live consists of a system of different structures, from proximal to ultimate factors, which all mutually influence each other and eventually influence the human development. The most proximal factors, such as personality traits and the nearest environment (i.e., parents, family) are interacting with each other in the first system. Alcohol availability at home can influence the development of alcohol behaviour by determining a norm in which alcohol use is normal and alcohol is available everywhere. The social learning theory suggests that people learn by observing and modelling others, for example their parents (Bandura, 1977). Almost self-evidently, higher alcohol availability at home is associated with higher parental drinking (Van Zundert, Van Der Vorst, Vermulst, & Engels, 2006) and may thereby stimulate adolescent drinking (Van Den Eijnden et al., 2011).

Few studies have examined the role of alcohol availability at home in adolescent drinking behaviour. However, these studies showed inconsistent results. For example, some studies have found alcohol availability at home to be a predictive factor of adolescent drinking behaviour (Komro, Maldonado-Molina, Tobler, Bonds, & Muller, 2007; Peeters, Koning, Monshouwer, Vollebergh, & Wiers, 2016; Stoolmiller et al., 2012; Van Den Eijnden et al., 2011). The latter Dutch longitudinal study found that perceived alcohol availability at home was the strongest predictor of adolescent alcohol use and alcohol-related problems (Van Den Eijnden et al., 2011). Alcohol availability at home can also significantly increase alcohol use and intentions in adolescence (Komro et al., 2007). Another study revealed that alcohol availability at home predicted alcohol onset, but not the transition to binge drinking (Stoolmiller et al., 2012). Also, alcohol availability at home can strengthen the positive effects of implicit alcohol associations on alcohol frequency in adolescence (Peeters et al., 2016). However, other studies have not found direct effects of alcohol availability at home on adolescent drinking behaviour. A cross-sectional study in the United States found that alcohol availability at home was a predictor of intoxication frequency for girls, but not for boys (Mahalik, Lombardi, Sims, Coley, & Lynch, 2015). A Dutch cross-sectional study concluded that alcohol availability at home was related to parental alcohol use, but not to adolescent

alcohol use (Van Zundert et al., 2006). Finally, in a qualitative Italian study, the availability of alcohol at home turned out to be a protective factor in adolescents harmful drinking (Strunin et al., 2010). In sum, results from studies on alcohol availability at home and adolescent alcohol use are inconsistent. However, most of these studies found alcohol availability at home to be a predictor of alcohol use, which is consistent with the ecological theory of human development and the social learning theory. Therefore, it can be concluded that alcohol availability at home is likely to predict alcohol use in adolescence.

Impulsivity and Alcohol Use

Along with availability at home, impulsivity can be linked to alcohol use (Bates & Labouvie, 1995). Impulsivity is a complex construct, consisting of multiple dimensions and traits (Mackinnon, Kehayes, Clark, Sherry, & Stewart, 2014). For example, impaired impulse control and reward-seeking behaviour can be linked to heightened possibility of drug use initiation, failure to resist drug use, and relapsing when trying to remain abstinent. As such, impulsivity probably contributes to the onset of substance use and the progression to addiction (Jentsch et al., 2014). Additionally, drug use can exacerbate impulsive behaviour, so that the drug user becomes more vulnerable to further use and addiction (Verdejo-García, Lawrence, & Clark, 2008). Impulsivity is often positively associated with alcohol use (Bates & Labouvie, 1995; Nees et al., 2012; Simons, Carey, & Gaher, 2004). However, other studies have not found a direct relation with alcohol use, but only with alcohol problems (Gunn, Finn, Endres, Gerst, & Spinola, 2013; Magid, MacLean, & Colder, 2007). Inconsistencies in results can be due to the operationalization of impulsivity. Different aspects of impulsivity can be measured, which can lead to various outcomes (Coskunpinar, Dir, & Cyders, 2013; Dick et al., 2010). Different forms of impulsivity may contribute in its own way to addiction-related behaviour (Jentsch et al., 2014).

In line with the ecological theory of human development (Bronfenbrenner, 1977), an interaction between environmental risk factors and impulsivity may enhance possible predictive effects (Bates & Labouvie, 1995). When alcohol is generally available, it could be more difficult for impulsive adolescents to control their impulse to drink. Cross-sectional research has shown that perceived alcohol availability has a significant effect on people with impaired response inhibition, resulting in more craving symptoms. This effect was not found for people with sufficient impulse control (Papachristou et al., 2012).

Overall, most of these studies suggest that impulsivity can be directly related to adolescent alcohol use. Also, impulsivity may strengthen the effects of alcohol availability at home on alcohol use in adolescence.

Drinking Motives and Alcohol Use

In research on the reasons to drink alcohol, the motivation model of alcohol use suggest that people drink to attain desired outcomes (Cox & Klinger, 1988). Each motive can be founded internally or externally, and can act as a positive or negative reinforcement. This distinction distinguishes between four different motives: social (external, positive), enhancement (internal, positive), coping (internal, negative), and conformity (external, negative) motives. Each motive is accompanied by unique drinking patterns (Cooper, 1994), indicating the importance to know why an adolescent is drinking in order to decrease adolescent alcohol use.

Adolescent drinking motives appear to be relatively stable over time (Schelleman-Offermans, Kuntsche, & Knibbe, 2011). Social motives are the most common motives (Kuntsche et al., 2014; Kuntsche, Knibbe, Gmel, & Engels, 2005). Fewer adolescents pointed out enhancement motives and only a few reported coping motives as their reason to drink. However, literature on which motive relates to different levels of alcohol use is inconsistent. Most studies found social, enhancement and coping motives to be positively related to alcohol use (Cooper, 1994; Kuntsche et al., 2005; Kuntsche et al., 2014; Lammers, Kuntsche, Engels, Wiers, & Kleinjan, 2013; Schelleman-Offermans et al., 2011). In a Dutch longitudinal study, social motives appeared to be the strongest predictor of changes in alcohol behaviour (Schelleman-Offermans et al., 2011). Additionally, in early adolescence, social motives were more strongly associated with alcohol use than coping motives were (Kuntsche et al., 2014). On the contrary, another study concluded that enhancement, coping, and conformity motives were all related to alcohol use or problems, while social motives were not (Magid et al., 2007). Also, one American study found enhancement motives, instead of social motives, to be the strongest predictor of alcohol use (Cooper, 1994). Inconsistency also exists for conformity motives, which were negatively related to alcohol use in most studies (Cooper, 1994; Kuntsche et al., 2014), while in another study conformity motives were positively associated with alcohol use (Magid et al., 2007). In short, there exist inconsistencies in the literature about the relation between drinking motives and different forms of drinking behaviour. These various results could be due to culture differences and different drinking norms (Schelleman-Offermans et al., 2011), or to the heterogeneity in measuring drinking motives (Kuntsche et al., 2005).

Because each motive is accompanied by unique drinking patterns (Cooper, 1994), drinking motives may moderate the effects of alcohol availability at home in predicting alcohol use. Most Dutch adolescents report drinking because of social motives (Schelleman-

Offermans et al., 2011). In individualistic cultures as the Dutch, social motives are the most endorsed and socially accepted motives (Mackinnon et al., 2017). When alcohol is more readily available at home, it can be easier for adolescents to drink. This may particularly apply to adolescents with social motives, since they feel that it is accepted when they drink. Adolescents with endorsed social motives could therefore be more vulnerable to alcohol availability at home, than adolescents with less endorsed motives as enhancement, coping or conformity motives.

Overall, results suggest that drinking motives predict alcohol use in adolescence. Additionally, there are reasons to assume that social motives can moderate the relation between alcohol availability at home and alcohol use in adolescence. No evidence is found for other motives to moderate this relation.

Present study

The present longitudinal study has several aims. The first aim is to examine the effects of alcohol availability at home, impulsivity, and drinking motives on adolescent alcohol use. Secondly, this study investigates whether impulsivity and social motives interact with alcohol availability at home in predicting alcohol use in adolescence. The hypotheses of this study are presented in Figure 1. It is expected that alcohol availability at home and impulsivity positively predict alcohol use. Additionally, drinking motives are expected to predict alcohol use. Specifically, social, enhancement and coping motives are expected to positively predict alcohol use, while conformity motives are expected to negatively predict alcohol use. Fourth, the relation between alcohol availability at home and alcohol use in adolescence is expected to be stronger for impulsive adolescents and for adolescents with social drinking motives.

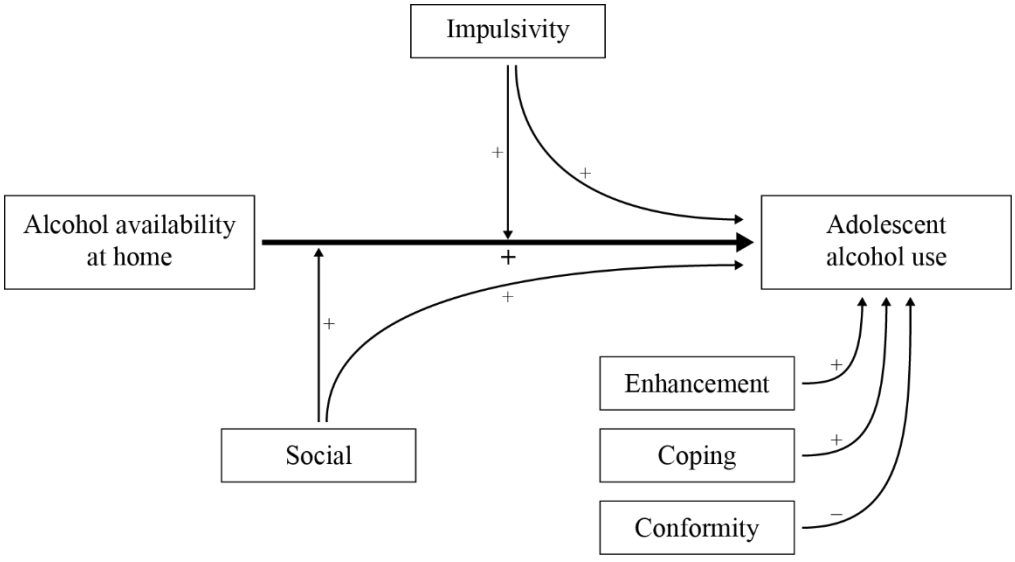

Figure 1. Research model.

Method

Research Design

Longitudinal data were obtained from the Implicit study (Peeters, 2014). Implicit consisted of four assessment waves in two years, with intervals of 6-8 months across the four waves. Unfortunately, there was a substantial amount of missing data in de third and fourth wave due to participant illness and absence. Therefore, in the present study, data from the first wave (T1) were used for alcohol availability at home, impulsivity, drinking motives, and the control variables. For alcohol use, data from T1 and the second wave (T2) were used.

Participants

Implicit was conducted among 383 at-risk adolescents (88% male, 12% female) from seventeen Dutch secondary special education schools. Due to externalising behaviour problems (e.g., attention problems, aggression or hyperactivity) students in these schools have problems attending regular education, although they are not necessary clinically diagnosed with a behavioural disorder. Boys are overrepresented in the sample, which is similar to what is typically found in in special education schools for students with externalising behaviour problems (Oswald, Best, Coutinho, & Nagle, 2003). Participants mean age was 13.56 years (*SD* = 0.86, age range: 12-16 years) at T1.

Procedure

Conforming to Dutch ethical standards, a letter of informed consent was send to all the parents, in which the study purpose, and the voluntary and anonymous nature of the study was explained. Parents were asked for passive parental permission. Fifteen parents and seven participants declined participation. Adolescents received 10 Euros for completing the first two waves and 20 Euros for completing all four waves. Schools received 150 Euros for their participation. Some schools did not allow a financial compensation for students, in which case the money was spent to improve the learning environment of the students. Students completed the questionnaires with pen and paper.

Measures

Alcohol use. The dependent variable alcohol use was assessed with measures of frequency and quantity of alcohol use. First, the number of drinking days during the week (Monday – Thursday) and during weekends (Friday – Sunday) were assessed (Engels, Knibbe, & Drop, 1999; Engels & Knibbe, 2000). Second, participants were asked to report the number of glasses they drink on a regular drinking weekday and weekend day. Response categories ranged from 0 glasses to 20 glasses or more (Sobell & Sobell, 1995). A continuous quantity x frequency variable (QF) was computed by multiplying the number of drinking

weekdays by the number of glasses on these weekdays, plus the number of drinking weekend days multiplied by the number of glasses on these weekend days (Koning et al., 2009). Higher scores on QF indicated more alcohol use in one week. Adolescent's self-report measures of alcohol frequency and quantity have proved to be a reliable measure of alcohol use (Koning, Harakeh, Engels, & Vollebergh, 2010).

Alcohol availability at home. Alcohol (wine, beer, mixed drinks, and distilled spirits) availability at home was assessed with a seven-item scale (e.g., "Do your parents have wine or beer at home?"; Van Zundert et al., 2006). The answer categories on a 5-point Likert scale ranged from never (1) to always (5). A continuous average score of the seven items was computed, where higher scores indicated greater availability of alcohol at home. The internal reliability of this scale in special education schools was good (Cronbach's Alpha = .88; Peeters, 2014).

Impulsivity. Impulsivity was assessed with the Substance Use Risk Profile Scale (SURPS, Woicik, Stewart, Pihl, & Conrod, 2009). In this study, a Dutch translation of the original scale was used (Malmberg et al., 2010). The total SURPS consists of 23 items, of which 5 items assessed impulsivity (e.g., "I often don't think things through before I speak; I usually act without stopping to think"). The four answer categories ranged from "strongly disagree" (1) to "strongly agree" (4), with higher scores indicating more impulsive behaviour. The internal reliability of the impulsivity part of the SURPS was acceptable (Cronbach's Alpha = .74; Peeters, 2014).

Drinking motives. The four drinking motives were assessed with the Drinking Motives Questionnaire-Revised (DMQ-R, Cooper, 1994), a 20-item self-report measure with five items per motive. Participants were asked to report how often they drunk because of different reasons (e.g., social: "Because it helps you enjoy a party", coping: "To forget your worries", enhancement: "Because you like the feeling", conformity: "To fit in a group you like"). Possible answer categories ranged from 1 (almost never/never) to 5 (almost always/always), with higher scores on a specific motive indicating more existence of that motive. Internal reliability was good for every subscale, with a Crohnbach's Alpha of .77 (social), .82 (enhancement), .78 (conformity), and .88 (coping; Schelleman-Offermans et al., 2011).

Analysis

First, because of the zero inflated Poisson distribution of the dependent variable alcohol use, this variable was recoded into an ordinal variable with three categories: heavy, light, and no weekly drinking. Second, participants with incomplete data were excluded.

Third, descriptive statistics of demographics, alcohol availability at home, impulsivity, drinking motives (all measured at T1), and alcohol use (measured at T1 and T2) were provided. Fourth, a chi-square test and a Wilcoxon analysis were used to examine the difference in alcohol use between boys and girls, and between T1 and T2. Fifth, correlations between the models' predictors at T1 and outcomes at T1 and T2 were presented. Sixth, both cross-sectional and longitudinal hierarchical multinomial logistic regressions were used to examine the relation between alcohol availability, impulsivity, and alcohol use at T1 and T2. Additionally, interactions between alcohol availability at home and impulsivity were added. In an alternative analysis, main effects of drinking motives, and interactions between alcohol availability at home and drinking motives were added. In these analyses was controlled for age, gender and, in the longitudinal analyses, for alcohol use at T1. Finally, attrition analyses were performed.

Results

Sample Descriptives

First, because of its extremely skewed distribution (S = 3.834, z = 24.4), the QF measure was recoded into three categories, in which 0 = non-drinker, 1 = light weekly drinker (1 to 4 glasses of alcohol a week), and 2 = heavy weekly drinker (5 or more glasses of alcohol a week; cf. De Goeij et al., 2016). Because boys were overrepresented in this sample, no gender differences were made. For the cross-sectional analyses, 42 cases were excluded due to incomplete data, and the cross-sectional analyses were performed with 341 participants. For the longitudinal analyses, 142 cases were excluded due to incomplete data, resulting in a sample of 241 participants. Descriptive statistics of both samples are presented in Table 1 and Table 2. The descriptive statistics in Table 2 indicated that most participants, both boys and girls, reported no alcohol use at T1 and T2. For boys this was followed by light weekly drinking and thereafter heavy weekly drinking. Girls however reported more heavy weekly drinking than light weekly drinking. Gender differences in alcohol use were significant for both cross-sectional and longitudinal sample (χ^2 (2) = 13.65, p = .001; χ^2 (2) = 6.85, p = .033). Results of a non-parametric Wilcoxon signed-rank test indicated that differences in drinking behaviour between T1 and T2 were not significant (z = -.796, p = .426, r = -.05). Of the four motives, social motives were the most common motives in this sample, followed by enhancement motives, coping motives and conformity motives (Table 1).

Table 1.

Sample Descriptives at T1

	Cross-sectional sample	Longitudinal sample
	n (%)	*n* (%)
Total	341	241
Gender		
Boys	298 (87.4)	212 (88.0)
Girls	43 (12.6)	29 (12.0)
Ethnicity		
Dutch	314 (92.1)	221 (91.7)
Other	27 (07.9)	20 (08.3)
	Mean (*SD*)	Mean (*SD*)
Age	13.55 (0.87)	13.51 (0.85)
AAAH	2.18 (0.98)	2.31 (1.00)
Impulsivity	2.24 (0.73)	2.25 (0.73)
Motives		
Social	1.67 (1.07)	1.66 (1.05)
Enhancement	1.61 (0.90)	1.60 (0.92)
Coping	1.26 (0.64)	1.26 (0.67)
Conformity	1.09 (0.34)	1.11 (0.38)

Note. *n* = sample size after excluding participants due to incomplete data; AAAH = alcohol availability at home.

Table 2.

Alcohol use at T1 and T2 for the total cross-sectional and longitudinal sample, and for boys and girls separately

Cross-sectional sample	*n* (%)	*n* boys (%)	*n* girls (%)
Alcohol use (T1)			
Total	341 (100)	298 (87.4)	43 (12.6)
0	205 (60.1)	185 (62.1)	20 (46.5)
1-4	77 (22.6)	70 (23.5)	7 (16.3)
≥ 5	59 (17.3)	43 (14.4)	16 (37.2)
Longitudinal sample	*n* (%)	*n* boys (%)	*n* girls (%)
Alcohol use (T1)			
Total	241 (100)	212 (88.0)	29 (12.0)
0	143 (59.3)	130 (61.3)	13 (44.8)
1-4	58 (24.1)	53 (25.0)	5 (17.2)
≥ 5	40 (16.6)	29 (13.7)	11 (38.0)
Alcohol use (T2)			
0	137 (56.8)	123 (58.0)	14 (48.3)
1-4	62 (25.7)	57 (26.9)	5 (17.2)
≥ 5	42 (17.4)	32 (15.1)	10 (34.5)

Note. *n* = sample size after excluding participants due to incomplete data; Alcohol use (T1) = ordinal variable of alcohol use at T1; Alcohol use (T2) = ordinal variable of alcohol use at T2.

Correlations

The significant Pearson correlations between alcohol availability at home and the detailed original variable of alcohol use at T1 and T2 are presented in Table 3. As expected, adolescents with more alcohol available at home at T1, reported more alcohol use at T1 and T2 (r = .23, p < .001; r = .16, p = .007). Also alcohol use at T1 and T2 were significantly positively correlated (r = .35 p < .001). In Table 4, Spearman correlations between alcohol availability at home, the control variables, impulsivity, drinking motives at T1, and the ordinal variable of alcohol use at T1 and T2 are reported. Strongest correlations were found between alcohol use at T1 and drinking motives (social: r_s = .71, p < .001; enhancement: r_s = .71, p < .001; coping: r_s = .60, p < .001; conformity: r_s = .32, p < .001). Also alcohol use at T2 correlated strongly with drinking motives (social: r_s = .61, p < .001; enhancement: r_s = .52, p < .001; coping: r_s = .48, p < .001 ; conformity: r_s = .28, p < .001). Age correlated significantly and positively with drinking motives (social: r_s = .14, p = .017; enhancement: r_s = .15, p = .011; coping: r_s = .16, p = .007; conformity: r_s = .12, p = .029) and alcohol use at T1 and T2 (r_s = .16, p = .006; r_s = .18, p = .003), meaning that older adolescents reported more drinking motives and more alcohol use. Gender was significantly related to social (r_s = .15, p = .009), enhancement (r_s = .13, p = .025), and coping motives (r_s = .18, p = .003), meaning that girls were more likely to report these motives. Due to significant correlations, gender and age were included as control variables.

Table 3.

Pearson correlations between alcohol availability at home and alcohol use at T1 and T2

	1. AAAH	2. QF T1	3. QF T2
1. AAAH	-	.23**	.16**
2. QF T1		-	.35**
3. QF T2			-

Note. n = 241; AAAH = alcohol availability at home, QF T2 = original continuous Quantity by Frequency score.
** p < .01 (one-tailed).

Table 4.

Spearman correlations between demographic variables, alcohol availability at home, impulsivity, drinking motives and alcohol use at T1 and T2

	1	2	3	4	5	6	7	8	9	10	11
1. Age	-	.08	-.04	.08	-.02	.14*	.15*	.16**	.12*	.16**	.18**
2. Gender		-	.03	.08	.03	.15**	.13*	.18**	.06	.15**	.10
3. Ethnicity			-	-.08	.07	.07	.04	.04	.05	-.03	-.02
4. AAAH				-	.17**	.36**	.39**	.33**	.19**	.37**	.27**
5. IMP					-	.11*	.17**	.17**	.11*	.08	.13*
6. Social						-	.80**	.71**	.45**	.71**	.61**
7. Enhancement							-	.73**	.42**	.71**	.52**
8. Coping								-	.54**	.60**	.48**
9. Conformity									-	.32**	.28**
10. Use T1										-	.60**
11. Use T2											-

Note. n = 241; AAAH = alcohol availability at home, IMP = impulsivity, Use T1 = ordinal Quantity by Frequency score at T1, Use T2 = ordinal Quantity by Frequency score at T2. * $p < .05$, ** $p < .01$ (one-tailed), horizontal numbers represent variables in the first column.

Model Analyses

Because alcohol use at T1 and T2 did not differ significantly, it was expected that T1 alcohol use would strongly predict T2 alcohol use. To test the model predictors without the need to control for previous use, hierarchal multinomial logistic regression analyses were used both cross-sectionally and longitudinally (Figure 2). In cross-sectional model 0, the control variables age and gender at T1 were used to predict alcohol use. Model 1 added T1 alcohol availability at home, model 2 added the main effect of impulsivity and model 3 added the interaction effect of impulsivity. An alternative model 2 added the main effect of T1 drinking motives, followed by the interaction effect in model 3. For the longitudinal analyses, alcohol use at T1 was added in model 1, thereafter T1 alcohol availability at home in model 2, impulsivity in model 3 and the interaction effect in model 4. An alternative model 3 added the main effect of T1 drinking motives, followed by the interaction effect in model 4. Finally, attrition analyses were performed.

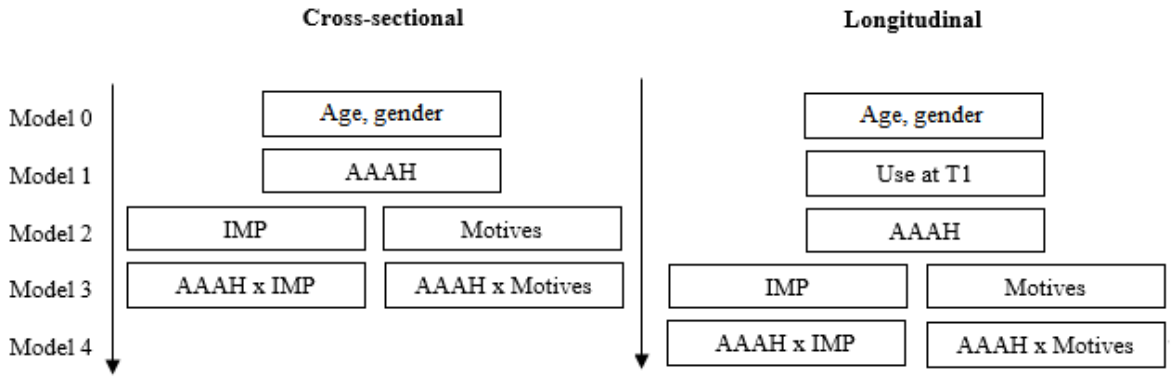

Figure 2. Models of cross-sectional and longitudinal hierarchal multinomial logistic regression analyses to predict adolescent alcohol use. Use at T1 = alcohol use at T1; AAAH = alcohol availability at home at T1; IMP = impulsivity at T1; Motives = Drinking motives at T1; cross-sectional model with alcohol use at T1 as dependent variable; longitudinal model with alcohol use at T2 as dependent variable.

Cross-sectional analyses. Results of model 0 are presented in Table 5, and indicated that gender and age were significantly associated with alcohol use at T1. Specifically, boys were less likely than girls to report heavy weekly drinking than no drinking or light weekly drinking (b = -1.11, Wald χ^2 (1) = 8.31, p = .004; b = -1.26, Wald χ^2 (1) = 6.44, p = .011). Older adolescents were more likely to report heavy weekly drinking than no drinking (b = .584, Wald χ^2 (1) = 10.41 p = .001). Model 1 significantly increased the explained variance (χ^2 (8) = 61.78, p < .001). Alcohol availability at home was positively related to reporting light or heavy weekly drinking week at T1 (b = 0.682, Wald χ^2 (1) = 21.10, p < .001; b = 0.837, Wald χ^2 (1) = 25.88, p < .001). Participant with higher scores on alcohol availability at home were not significant more likely to report heavy weekly drinking than light weekly drinking. Results of main effects of impulsivity, or interaction effects between alcohol availability at home and impulsivity, were both not significant. Of the four drinking motives, social and enhancement motives significantly increased the explained variance of the model (χ^2 (10) = 226.90, p < .001). Adolescents with enhancement motives were more likely to report light or heavy weekly drinking week at T1 than no drinking (b = 1.41, Wald χ^2 (1) = 18.26, p < .001; b = 2.28, Wald χ^2 (1) = 35.69, p < .001). In addition, adolescents with enhancement motives were significantly more likely to report heavy weekly drinking than light weekly drinking (b = 0.87, Wald χ^2 (1) = 10.27, p = .001). Also social motives were significantly associated with reporting light or heavy weekly drinking week at T1 (b = 0.98, Wald χ^2 (1) = 11.06, p = .001; b = 1.16, Wald χ^2 (1) = 12.76, p < .001). Adolescents with social motives were not significantly more likely to report heavy than light weekly drinking.

None of the four motives interacted significantly with alcohol availability at home in the relation with alcohol use at T1.

Table 5.

Significant models of cross-sectional hierarchal multinomial logistic regression with T1 control variables, T1 alcohol availability at home, and T1 drinking motives predicting T1 alcohol use

	Model 0 *B(SE)*	*OR*	Model 1 *B(SE)*	*OR*	Model 2 *B(SE)*	*OR*
1-4 glasses vs. 0 glasses						
Intercept	-5.12 (2.29)*		-6.68 (2.41)**		-7.92 (2.76)**	
Gender	-0.15 (0.46)	1.16	0.12 (0.48)	1.12	0.15 (0.53)	1.17
Age	-0.31 (0.16)	1.36	0.32 (0.17)	1.37	0.25 (0.19)	1.28
AAAH			0.68 (0.15)**	1.98	*ns*	
Social					0.98 (0.30)**	2.68
Enhancement					1.41 (0.33)**	4.12
≥ 5 glasses vs. 0 glasses						
Intercept	-8.46 (2.58)**		-10.59 (2.78)**		-13.86 (0.87)**	
Gender	-1.11 (0.39)**	0.33	-1.15 (0.41)**	0.32	-1.32 (0.58)*	0.27
Age	0.58 (0.18)**	1.79	0.61 (0.19)**	1.84	0.53 (0.26)*	1.70
AAAH			0.84 (0.16)**	2.31	*ns*	
Social					1.16 (0.33)**	3.20
Enhancement					2.23 (0.38)**	9.75
≥ 5 glasses vs. 1-4 glasses						
Intercept	-3.34 (2.95)		-3.91 (3.06)		-5.94 (3.58)	
Gender	-1.26 (0.50)*	0.28	-1.26 (0.50)*	0.28	-1.47 (0.55)**	0.23
Age	0.28 (0.21)	1.32	0.30 (0.21)	1.34	0.28 (0.25)	1.32
AAAH			0.16 (0.17)	1.17	*ns*	
Social					0.18 (0.20)	1.20
Enhancement					0.87 (0.27)**	2.37

Note. Table represents only significant models, $n = 341$; *OR* = odds ratio, gender: 1 = boys, 2 = girls, ethnicity: 1 = Dutch, 2 = other, AAAH = alcohol availability at home, *ns* = not significant, gender reference category: girls, ethnicity reference category: other than Dutch, * $p < .05$, ** $p < .01$, model 0: χ^2 (6) = 23.88, $p = .001$, model 1: χ^2 (8) = 61.78, $p < .001$, model 2: χ^2 (10) = 226.90, $p < .001$, model 3 did not significantly increased the explained variance and is therefore not presented in this table.

Longitudinal analyses. Results of longitudinal analyses are presented in Table 6. Results of model 0 indicated that older adolescents were more likely to report heavy weekly drinking than no drinking ($b = 0.567$, Wald χ^2 (1) = 6.67, $p = .010$). Boys were compared to girls, less likely to report heavy weekly drinking than no drinking ($b = -1.23$, Wald χ^2 (1) = 4.28, $p = .039$). Model 1 added alcohol use at T1, which added to the significance of the model (χ^2 (10) = 110.08, $p < .001$). Participants who reported no drinking at T1 were more likely to report no drinking at T2 than light or heavy weekly drinking, compared to participants who reported heavy weekly drinking at T1, ($b = -2.377$, Wald χ^2 (1) = 13.33, $p < .001$; $b = -4.577$, Wald χ^2

(1) = 46.08, $p < .001$). Participants who reported light weekly drinking at T1 were less likely to report heavy weekly drinking at T2 than no drinking, compared to participants who reported heavy weekly drinking at T1 (b = -2.811, Wald χ^2 (1) = 16.66, $p < .001$). Against the expectations, model 2 did not significantly increased the explained variance of the model. However, without controlling for use at T1, alcohol availability did add significance (χ^2 (8) = 28.36, $p < .001$). Adolescents with more alcohol available at home, were more likely to report light or heavy weekly drinking than no drinking at T2 (b = .44, Wald χ^2 (1) = 7.46, p = .006; b = 061, Wald χ^2 (1) = 10.87, p = .001). Adolescents with more alcohol available at home were not more likely to report heavy than light weekly drinking. Contrary to the expectations, model 3 did not increase the explained variance. In model 4, the interaction of alcohol availability at home and impulsivity did not significantly increased the explained variance of the model. In the alternative model 3, only social motives added significance to the explained variance (χ^2 (12) = 125.88, $p < .001$). Adolescents with a higher score on social motives at T1, were more likely at T2 to report light or heavy weekly drinking than no drinking (b = 0.62, Wald χ^2 (1) = 5.95, p = .015; b = 1.03, Wald χ^2 (1) = 13.33, $p < .001$). Adolescents with a higher score on social motives were not significantly more likely to report heavy than light weekly drinking. Against the hypotheses, the other motives did add significance. In the alternative model 4, interactions between drinking motives and alcohol availability did not add significance to the explained variance of the model.

Table 6.

Longitudinal hierarchal multinomial logistic regression with T1 control variables, T1 alcohol use, and T1 drinking motives predicting T2 alcohol use

	Model 0 *B(SE)*	*OR*	Model 1 *B(SE)*	*OR*	Model 3 *B(SE)*	*OR*
1-4 glasses vs. 0 glasses						
Intercept	-5.26 (2.61)*		-2.68 (2.93)		-4.40 (3.02)	
Gender	0.31 (0.55)	1.37	0.51 (0.61)	1.66	0.64 (0.62)	1.89
Age	0.31 (0.19)	1.36	0.23 (0.20)	1.26	0.23 (0.20)	1.26
T1 = 0 glasses			-2.34 (0.65)**	0.09	-1.69 (0.72)*	0.18
T1 = 1-4 glasses			-0.53 (0.67)	0.59	-0.28 (0.70)	0.76
Social					0.62 (0.26)*	1.87
≥ 5 glasses vs. 0 glasses						
Intercept	-8.26 (0.68)**		-3.88 (4.08)		-6.37 (4.27)	
Gender	-0.91 (0.47)	0.40	-0.10 (0.67)	0.91	-0.07 (0.68)	0.93
Age	0.57 (0.22)*	1.76	0.42 (0.29)	1.52	0.37 (0.30)	1.45
T1 = 0 glasses			-4.58 (0.67)**	0.01	-3.22 (0.76)**	0.04
T1 = 1-4 glasses			-2.81 (0.70)**	0.06	-2.30 (0.74)**	0.10
Social					1.03 (0.28)**	2.81

Table 6.

Longitudinal hierarchal multinomial logistic regression with T1 control variables, T1 alcohol use, and T1 drinking motives predicting T2 alcohol use (continued)

≥ 5 glasses vs. 1-4 glasses						
Intercept	-3.00 (3.43)		-1.20 (4.14)		-1.96 (4.23)	
Gender	-1.23 (0.59)*	0.29	-0.60 (0.68)	0.55	-0.71 (0.68)	0.49
Age	0.26 (0.24)	1.30	0.19 (0.29)	1.21	0.14 (0.29)	1.16
T1 = 0 glasses			-2.20 (0.59)**	0.11	-1.53 (0.69)*	0.22
T1 = 1-4 glasses			-2.28 (0.56)**	0.10	-2.01 (0.58)**	0.13
Social					0.41 (0.22)	1.51

Note. Table represents only significant models, n = 341; *OR* = odds ratio, AAAH = alcohol availability at home, *ns* = not significant, gender reference category: girls, ethnicity reference category: other than Dutch, T1 alcohol use reference category: heavy weekly drinking (≥ 5), * $p < .05$, ** $p < .01$, model 0: χ^2 (6) = 14.01, p = .030, model 1: χ^2 (10) = 110.08 , $p < .001$, model 3: χ^2 (12) = 125.88, $p < .001$, model 2 and 4 did not significantly increased the explained variance and are therefore not presented in this table.

Attrition. The attrition in this sample was substantial. At T2, 27.8% of the participants dropped out. An attrition analysis was performed to examine the differences in alcohol use at T1 between participants who dropped out on T2, and participants who finished T2. Because of the zero inflated Poison distribution of the original continuous variable alcohol use at T1, a chi-square test was performed with the ordinal variable of alcohol use at T1. Results indicated that differences in alcohol use at T1 between dropouts and non-drop outs were not significant, χ^2 (2) = 1.51, p = .471. Thus, participants who dropped out at T2 did not report significant more or less alcohol use per week than participants who finished T2.

Discussion

The purpose of the present study was to examine the predicting effects of alcohol availability at home, impulsivity, and drinking motives on alcohol use in adolescence. Specifically, the present study investigated the interactions of impulsivity and drinking motives with alcohol availability at home in predicting adolescent alcohol use. Results of cross-sectional analyses confirmed that alcohol availability at home was positively related to alcohol use. Additionally, social and enhancement motives were positively related to alcohol use. Contrary to the expectations, impulsivity, coping or conformity motives did not increase explained variance. Importantly, no significant interactions were found, meaning that interactions of alcohol availability at home with impulsivity or drinking motives did not predict alcohol use better than model 2 with only main effects. Results of longitudinal analyses revealed that alcohol availability at home significantly positively predicted alcohol use. However, when controlling for use at T1, alcohol availability at home did not longer add significance to the

model. Previous alcohol use predicted alcohol use, and only social motives did significantly increase the explained variance. Against the expectations, impulsivity and other drinking motives did not increased the explained variance. Again, no interactions were found in the longitudinal analyses. These results indicate that alcohol use can be best predicted by previous alcohol use and reports of social motives six months earlier. Surprisingly, in both cross-sectional and longitudinal analyses, girls were more likely to report heavy drinking. However, these results were probably due to the fact that girls were underrepresented in this sample. Consequently, proportionally, girls seemed to engage more in heavy weekly drinking than boys. Therefore, these results cannot be generalised to the general population.

Alcohol Availability at Home

Contrary to previous research (Peeters et al., 2016; Van Den Eijnden et al., 2011), alcohol availability did not add significance to the model when controlling for previous alcohol use. Several explanations can be put forward to understand this result. First, high correlations and no significant differences were found between alcohol use at T1 and T2, which may be due to the relative short interval between the two waves. Relatedly, alcohol use at T1 was the strongest predictor of alcohol use at T2, and alcohol availability at home did not add significance to this predictive effect. Second, the overall alcohol use in this sample was low, which may be due to the relative young age of this sample. Probably, significant results can be found in samples with older adolescents which reported more alcohol use.

Impulsivity

Aforementioned explanations can also partly explain that no relation was found between impulsivity and adolescent alcohol use. Thus, impulsivity did not predict alcohol use better than previous use or drinking motives. Previous research was not consistent about the relation between impulsivity and alcohol use, which could be explained by the heterogeneity of operationalisation and measurement of impulsivity (Coskunpinar et al. 2013; Dick et al. (2010). In addition, most of the previous studies that did find a positive relation, used a specific aspect of alcohol use (e.g., alcohol onset, alcohol problems, binge drinking; Gunn et al., 2013; Nees et al., 2012; Simons et al., 2004). To our knowledge, the present study is the first that used a QF measure for alcohol use in combination with impulsivity, which can explain deviant results.

Additionally, the expectation that impulsivity interacted with alcohol availability at home in predicting alcohol use was not confirmed, meaning that impulsive adolescents were not more vulnerable to alcohol availability at home than less impulsive adolescents. The hypothesis was based on cross-sectional research (Papachristou et al., 2012). However, this

experimental study investigated a small, non-randomly selected social drinking sample, which differed substantially from the current sample. Hence, more longitudinal research to the moderating role of impulsivity in predicting alcohol use in adolescence is needed.

Drinking Motives

Reports of drinking motives in the present study were in line with previous research (Kuntsche et al., 2014 & Schelleman-Offermans et al., 2011). Different from previous research (Schelleman-Offermans et al., 2011), in the present study only social and enhancement motives were significantly related to alcohol use, meaning that external motives were risk factors for alcohol use. Only social motives added significance to the model when predicting alcohol use over time. Drinking because of social motives was therefore a strong positive predictor of alcohol use over time. These results may be due to the fact that the present study controlled for alcohol use at T1, which strongly predicted alcohol use at T2. Further, the sample of Schelleman-Offermans et al. (2011) consisted of only alcohol using participants. The current sample consisted of drinkers and non-drinkers, from which the latter group was overrepresented. Due to our small sample size, it was impossible to use only the drinkers for the analyses.

The expectation that social motives moderate the relation between alcohol availability at home and adolescent alcohol use was not confirmed. Results indicated that, adolescents with social motives were not more vulnerable to alcohol availability at home than adolescents without social motives. The review of Kuntsche et al. (2005) mentioned the lack of longitudinal research to the effects of drinking motives on alcohol use and the variety in terms of how drinking motives were measured. More longitudinal research, in which drinking motives are clearly defined and measured, is needed in order to understand the long-lasting or moderating effects of different drinking motives.

Strengths and Limitations

The combination of cross-sectional and longitudinal design offers the possibility to reveal both associations and predictive relations over time. The present study used hierarchal models, which provided a complete picture of alcohol use over time in this sample. In addition to these strengths, some limitations should be addressed. First, the present study used a relatively small samples of 341 participants (cross-sectional) and 241 participants (longitudinal), and sample attrition (28.7%) was substantial. However, attrition analyses revealed no significant differences between drop-outs and non-drop-outs. Therefore, attrition is not likely to have affected the results. Excluding participants because of missing data reduced the power somewhat further. Second, boys were overrepresented in this sample, and

participants were students at special education schools. Thus, caution should be paid when generalising these results to a general population. Third, the interval of six months between the waves was relatively short to reveal differences in alcohol use. The overall time period of the Implicit study covered two years, but due to the increasing attrition over time, only the first two waves were used in the present study. The fourth limitation is the zero-inflated Poisson distribution of the QF measure. Specifically, 56.8% of the participants did not report alcohol use at T2. Hence, the original continuous data were recoded into ordinal data with three categories. Although detailed information was lost, these three categories yield more information than a dichotomous variable. Fifth, the QF measure measured weekly drinking only, thus no conclusions can be drawn about daily drinking behaviour. Finally, data in this study were based on retrospective self-reports. This could lead to memory biases or socially desirable answers. However, adolescent's self-report measures of alcohol frequency and quantity have proved to be a reliable measure of alcohol use (Koning et al., 2010), so self-report did not seem to affect our results.

Conclusions and Implications

The present study contributes to previous research on risk factors of alcohol use in adolescence. New hypotheses were tested, which yielded new insights in mechanisms of adolescent alcohol use. In short, alcohol availability at home, social, and enhancement motives can function as potential risk factors of alcohol use in adolescence. Longitudinal analyses emphasised the importance of previous alcohol use and social motives in predicting adolescent alcohol use over time. Although alcohol availability at home predicted alcohol use over time, it did not significantly increased the explained variance when controlling for previous alcohol use. Thus, adolescent alcohol use can be best predicted by previous alcohol use and social motives. Because this finding contradicts previous research, future longitudinal research to the role of alcohol availability at home is needed. Larger samples of representative drinking adolescents and larger time intervals between two waves are desired in further research. The present findings could provide cautious practical implications. A focus on prevention of alcohol use may be desirable in order to decrease alcohol use in adolescence (Koning, Van Den Eijnden, Verdurmen, Engels, & Vollebergh, 2011). In addition, the present study again emphasised the predictive role of social motives in adolescents drinking behaviour. Therefore, more attention could be paid to social aspects of adolescent drinking. Finally, it could be an added value to increase parental awareness of the positive relation between the availability of alcohol at home and the alcohol use of their adolescents.

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