



Alcohol use and abuse in young adulthood: Do self-control and parents' perceptions of friends during adolescence modify peer influence? The TRAILS study



Leenke Visser^{a,*}, Andrea F. de Winter^a, René Veenstra^{b,c}, Frank C. Verhulst^d, Sijmen A. Reijneveld^a

^a Department of Health Sciences, University Medical Center Groningen, University of Groningen, Antonius Deusinglaan 1, 9713 AV Groningen, The Netherlands

^b Department of Sociology, University of Groningen, Grote Rozenstraat 31, 9712 TG Groningen, The Netherlands

^c Department of Psychology, University of Turku, Turku, Finland

^d Department of Child and Adolescent Psychiatry, Erasmus Medical Center/Sophia Children's Hospital, Wytemaweg 8, 3015 CN Rotterdam, The Netherlands

HIGHLIGHTS

- Peer alcohol use affects young adults' alcohol use and abuse.
- Self-control and parents' perceptions may modify this, but evidence is lacking.
- Peer alcohol use was related to use and abuse, low self-control only to abuse.
- Peer influence was not modified by parents' perception of peers or by self-control.
- Peer influence and self-control should be separate targets in terms of prevention.

ARTICLE INFO

Available online 19 August 2013

Keywords:

Alcohol use
Peer
Self-control
Parents
Adolescence
Young adulthood

ABSTRACT

Aims: To assess the influence of peer alcohol use during adolescence on young adults' alcohol use and abuse, and to assess to what extent parents' perception of their adolescent child's friends and adolescent's self-control modify this influence.

Methods: We analyzed data from the first, third, and fourth wave of a population-based prospective cohort study of 2230 adolescents conducted between 2001 and 2010 (mean ages: 11.1, 16.3, and 19.1, respectively). Alcohol use and abuse were measured at T4 by self-report questionnaires and by the Composite International Diagnostics Interview (CID-I), respectively. Peer alcohol use, self-control, and parents' perception of their adolescent child's friends were measured at T3. We adjusted for gender, age, socioeconomic-status, parental alcohol use, and adolescent baseline alcohol use.

Results: Peer alcohol use during adolescence was related to young adults' alcohol use and abuse [odds ratio (95% confidence interval): 1.31 (1.11–1.54) and 1.50 (1.20–1.87), respectively]. Neither parents' perception of their adolescent child's friends nor self-control modified this relationship. Alcohol abusers were more likely to have low self-control than alcohol users. No differences were found between alcohol users and abusers regarding their parents' perception of their friends and peer alcohol use.

Conclusions: Peer alcohol use during adolescence affects young adults' alcohol use and abuse. We found that self-control was only related to alcohol abuse. Peer influence was not modified by parents' perception of peers or by self-control. Peer alcohol use and self-control should thus be separate targets in the prevention of alcohol use/abuse.

© 2013 Published by Elsevier Ltd.

1. Introduction

Young adulthood is a pivotal stage for alcohol use further on in life. In the United States, 86.7% of the 18-year-olds reported having used alcohol at least once, 68.1% reported having used alcohol more than five times, and 18.4% reported alcohol abuse (Young et al., 2002). Alcohol abuse refers to a psychiatric disorder, defined in the DSM-IV as a condition in which alcohol use is disruptive to an individual's personal life.

* Corresponding author at: Department of Health Sciences, University Medical Center Groningen, University of Groningen, P.O. Box 196, 9700 AD Groningen, The Netherlands. Tel.: +31 50 363 3036; fax: +31 50 363 6251.

E-mail addresses: L.Visser01@umcg.nl (L. Visser), A.F.de.Winter@umcg.nl (A.F. de Winter), D.R.Veenstra@rug.nl (R. Veenstra), F.Verhulst@erasmusmc.nl (F.C. Verhulst), S.A.Reijneveld@umcg.nl (S.A. Reijneveld).

This disruption can manifest in different ways such as recurrent drunk driving, arrests for alcohol-related disorderly conduct, recurrent arguments, for example, with family about the consequences of alcohol use, or absences from school or work due to alcohol use (American Psychiatric Association, 1994). Alcohol abuse carries substantial costs in terms of juvenile justice, healthcare, and mental health services (Hawkins, Catalano, & Miller, 1992).

Peer relationships are highly important in the lives of young people. A considerable number of studies have shown that the drinking levels of peers were positively related to alcohol consumption among young adults (Cruz, Emery, & Turkheimer, 2012; Guo, Hawkins, Hill, & Abbott, 2001; Jones-Webb et al., 1997; Larsen, Overbeek, Granic, & Engels, 2012; Lee et al., 2012; Nguyen, Rahman, Emerson, Nguyen, & Zabin, 2012; Talbott, Moore, & Usdan, 2012). However, most of these studies focused on the level of use without taking into account whether or not the level of alcohol use led to disruption in subjects' personal life. Because alcohol use and abuse represent varying levels of alcohol consumption, it is likely that the extent of peer influence will differ between patterns of alcohol use.

Peer influence can easily be understood using Ajzen and Fishbein's theory of planned behavior that aims to explain health behaviors like alcohol use (Taylor, 2003). According to this theory, showing a specific health behavior is the result of the intention to perform the behavior. This behavioral intention depends on the attitude toward the behavior, the perceived subjective norms regarding the behavior, and the perceived control over the behavior. The attitude toward the behavior depends on the beliefs about and evaluations of the outcome. The subjective norms are the individual beliefs what others think he/she should do and his/her motivation to comply with this. In adolescence, both parents and peers are major 'others' regarding this. The perceived control is the extent to which a person believes he/she is capable of performing the particular behavior. An important factor leading to control is the degree of vulnerability to the temptation. The self-control theory (Gottfredson & Hirschi, 1990) provides a good framework for the effect of this vulnerability on perceived control; this theory has originally been developed to predict criminal behavior delinquency but it may also be applicable for alcohol use. According to the self-control theory, people with low self-control have the tendency to respond to stimuli in the environment in a way that makes them exceed their norms. Using these two theories as framework we examined the influence of peer alcohol use, parents' perception of their adolescent child's friends, and adolescent's self-control on young adults' alcohol use and abuse.

Parents remain important in young adults' lives, even though the relative influence of peers may gradually increase during adolescence (Fraleigh & Davis, 1997). Parents' perception of their adolescent child's friends may affect the influence of these peers. For example, the influence of having drinking peers may decrease when parents perceive these friends negatively, as their adolescent child may interpret this as disapproval of their friends' behavior. Evidence is lacking on whether in fact parents' perception of their adolescent child's friends modifies the influence of those friends.

In addition, self-control may affect the influence of peers' alcohol use and abuse. Low self-control has been shown to have a risk-enhancing effect on alcohol use (Griffin, Scheier, Acevedo, Grenard, & Botvin, 2012; King, Fleming, Monahan, & Catalano, 2011; Wills & Dishion, 2004). Young adults low in self-control may be more sensitive to the influence of peers and, conversely, young adults high in self-control may be more able to resist temptations of peers (Dishion, Nelson, Winter, & Bullock, 2004). As far as we know only one study has examined the moderating effect of self-control on the relationship between peer alcohol use and young adults' alcohol use (Wills, Pokhrel, Morehouse, & Fenster, 2011). This study found a stronger relationship among persons with low self-control than among persons with high self-control. Some other studies have shown that self-control also modifies the effects of other contextual factors, such as parental support (Stice & Gonzales, 1998), media influence (Wills et al., 2010), and negative life events (Wills, Sandy, Yaeger,

& Shinar, 2001), and substance use. We expect that peer influence will be modified by self-control, that is, that peer influence increases in cases of low self-control.

The aim of this study was therefore to assess the influence of peer alcohol use on young adults' alcohol use and abuse. In the next step, we assessed to what extent parents' perception of their adolescent child's friends and adolescent's self-control modified the influence of his/her peers. We assessed both use and abuse, as we expect that any modifying effects will vary by level of use.

2. Methods

2.1. Sample and procedure

The TRacking Adolescents' Individual Lives Survey (TRAILS) is a prospective population study of Dutch adolescents, with biennial or triennial follow-up assessments. The target sample involved children living in urban and rural areas in the northern provinces of the Netherlands. The study began in 2001 when the children were aged 10–12. Seventy-six percent of the eligible households ($n = 2230$) were enrolled in the study (i.e., both child and parent agreed to participate). Responders and non-responders did not differ with respect to the prevalence of teacher-rated problem behavior and to the associations between socio-demographic variables and mental health indicators (De Winter et al., 2005). The present study uses data from the first, third, and fourth wave of TRAILS. At the first wave, the mean age of the children was 11.09 ($SD = 0.56$). Of the 2230 baseline participants, 1816 (81.4%) participated at T3 (mean age = 16.27, $SD = 0.73$) and 1881 (84.3%) at T4 (mean age was 19.1, $SD = 0.60$) (Nederhof et al., 2012).

During the first measurement wave, well-trained data collectors visited one of the parents or guardians (preferably the mother: 95.6%) at their homes to administer an interview covering a wide range of topics including developmental history, somatic health, parental psychopathology, and care utilization. In addition to the interview, the parent was asked to fill out questionnaires. The adolescent filled out questionnaires at school or other testing locations, under the supervision of one or more TRAILS assistants. During the third and fourth measurement wave the adolescent and the parent again filled out questionnaires. In addition, at the fourth measurement wave, mental disorders were assessed by trained interviewers with the computer-assisted version of the Composite International Diagnostic Interview (CIDI). Participants could indicate their preferred location for the interview. The options were at home, on the condition that a suitable room was available (i.e., no noise disturbance and without anyone else present), at one of two central locations in the region, or at the University of Groningen.

2.2. Measures

Alcohol abuse was measured at T4 using the World Health Organization Composite International Diagnostics Interview (CIDI) (Kessler & Ustun, 2004). The CIDI is a comprehensive, fully structured interview that assessed current and lifetime mental disorders according to the definitions and criteria of DSM-IV. The CIDI also assessed the age of onset of the disorder. The most frequent (76.8%) criterion met for alcohol abuse within the TRAILS sample was: "recurrent substance use in situations in which it is physically hazardous (e.g., driving an automobile or operating a machine when impaired by substance use)."

Alcohol use was assessed at T4 by asking on how many days (separately for weekdays and weekend days) the respondent usually drank alcohol. Both scores were summed, resulting in a score ranging from 0 to 7 days a week. From these measurements a three-category variable was constructed: "abuser" (those who reported alcohol abuse regarding the CIDI at which the age of onset was after T3), "user" (those who reported using alcohol at least one day a week, but did not report alcohol abuse), and "non-user" (those who reported no weekly alcohol use). The difference between alcohol abuse and alcohol use is that alcohol

abuse is related to many harmful consequences for society as a whole and for others in the drinker's environment.

Friends' alcohol use and parents' perception of their adolescent child's friends were both measured at T3 by the friends questionnaire developed by TRAILS. First, participants were asked to list the names of their most important friends (up to 7). Subsequently, for each friend they reported whether he/she used alcohol in the previous month (0 = no; 1 = yes) and whether their parents liked this friend (ranging from 1 = positive; 5 = negative). For friends' alcohol use, scores were transformed to proportion of friends who use alcohol, and subsequently we categorized these scores as 0 = "none of the friends used alcohol"; 1 = "1 to 50% of the friends used alcohol"; 2 = "51 to 99% used alcohol"; and 4 = "all friends used alcohol." For parents' perception of their adolescent child's friends, scores were transformed into averages.

Self-control was assessed at T3 by the Dutch parent version of the Early Adolescent Temperament Questionnaire-Revised (EATQ-R) (Putnam, Ellis, & Rothbart, 2001). The EATQ-R is a questionnaire based on the temperamental model developed by Rothbart, Ahadi, & Evans (2000). For the present study we used the scale Effortful control (11 items, $\alpha = .86$) which denotes the capacity to voluntarily regulate behavior and attention. Examples of items are: "Has a difficult time tuning out background noise and concentrating when trying to study"; "Is often in the middle of doing one thing and then goes off to do something else without finishing it"; "Pays close attention when someone tells him/her how to do something" (R); or "Is usually able to stick with his/her plans and goals" (R). Items could be rated on a 5-point scale. Higher scores reflect less self-control.

Socioeconomic status (SES) was assessed at T1 on the basis of family income, the educational level of both parents, and the occupational level of both parents using the International Standard Classification of Occupations (ISCO) (Ganzeboom & Treiman, 1996). An index of SES was created by averaging the standardized scores of the five indicators (Veenstra et al., 2005).

Parental alcohol use was assessed at T3 by using a frequency-quantity measurement. Frequency was measured by asking, "On how many weekdays (Monday to Thursday) and on how many weekend days (Friday to Sunday) do you/does your partner usually drink alcohol?" Quantity was measured by asking, "How many glasses a day did you/did your partner usually drink on weekdays?" (9-point scale ranging from "I never drink on a weekday" to "11 glasses or more") and "How many glasses a day did you/did your partner usually drink on weekend days?" (11-point scale ranging from "I never drink on a weekend day" to "20 glasses or more"). The responses could be given separately for father and mother. The frequency scores for the weekdays and the weekend days were multiplied by the quantity scores, and then both scores were summed. We combined the scores for father and mother by taking the mean.

At T1 adolescent alcohol use was measured by asking: "How often have you drunk alcohol (e.g., a bottle of beer or a glass of wine)?" The possible answers were no, never; 1 time; 2–3 times; 4–6 times; or 7 times or more. The measurement was derived from the 'self-reported delinquency scale' (Moffitt & Silva, 1988).

2.3. Missing data

Non-responders on the CIDI were more often male, were more often ethnic minorities, had a lower SES, were more likely to live in a one-parent family, and were more likely to have a total score of the Child Behavior Checklist in the clinical range at the baseline. To minimize the risk of bias and the loss of statistical power multiple imputation was used (Donders, van der Heijden, Stijnen, & Moons, 2006). Twenty data sets were created based on different estimated underlying distributions. They were analyzed in an identical way, and the odds ratios and standard errors were pooled in order to obtain single odds ratios and standard errors.

2.4. Statistical analysis

For the analysis of the present study, subjects whose age of onset of alcohol abuse was preceded or was equal to their age at T3 ($n = 335$) were excluded from the analysis. This resulted in a final sample of 1895 participants. First, we computed descriptive statistics for all the included variables. Subsequently, multinomial logistic regression analyses were run. Three different comparisons were made: abusers were compared to users and non-users, and users were compared to non-users. For each comparison three models were constructed. In the first model, we analyzed the effect of friends' alcohol use during adolescence on young adults' alcohol use. In the second model, we added parents' perception of the adolescent's friends. In the third model, the interaction between friends' alcohol use and parents' perception of the adolescent's friends was added. In each model we controlled for gender, age, SES, alcohol use of parents, and adolescent baseline alcohol use. In the next step, we repeated these analyses including self-control instead of parents' perception of the adolescent's friends. Finally, we analyzed the influence of friends' alcohol use, parents' perception of the adolescent's friends, and self-control, simultaneously, adjusting for the same variables as in previous analyses. Two-way interactions were only added when significant. To correct for a non-linear relationship with young adults' alcohol use, we also adjusted for the square of SES and the square of parental alcohol use (Chen, Cohen, & Chen, 2007). The scores for parents' perception of friends, self-control, and age were standardized.

3. Results

Table 1 presents the percentages, means, and standard errors of the included variables for the different patterns of alcohol use. At T4, 258 participants (13.6%) reported onset of alcohol abuse after T3, 1458 participants (76.9%) reported alcohol use (i.e., at least one day a week) but did not report alcohol abuse, and 179 participants (9.4%) reported no alcohol use (i.e., not weekly). The non-alcohol users, alcohol users and alcohol abusers differed with statistical significance on gender ($\chi^2 = 45.4$, $p < .001$), proportion of friends who use alcohol ($\chi^2 = 19.4$, $p < .01$), alcohol use of parents ($F = 5.9$, $p < .01$), parents perception

Table 1

Percentages, means, and standard errors of included variables for the total sample, non-alcohol users, alcohol users, and alcohol abusers at T4.

	Total n = 1895	Non-alcohol users n = 179	Alcohol users n = 1458	Alcohol abusers n = 258
Gender				
Female (%)	53.8	70.2	54.7	37.6
Age (mean, SE)	19.10 (0.02)	19.02 (0.06)	19.11 (0.02)	19.13 (0.06)
Socioeconomic status (mean, SE)	-0.04 (0.02)	-0.15 (0.07)	-0.04 (0.03)	0.00 (0.08)
Friends using alcohol (%)				
No	14.1	23.1	13.5	11.5
1–50%	12.5	15.1	12.4	11.2
51–99%	28.2	27.8	28.5	26.9
100%	45.2	34.1	45.6	50.5
Alcohol use of parents (mean, SE)	7.54 (0.20)	6.48 (0.61)	7.46 (0.23)	8.73 (0.55)
Parents' negative perception of friends (mean, SE) ^a	1.68 (0.02)	1.59 (0.05)	1.68 (0.02)	1.75 (0.04)
Low self-control (mean, SE) ^b	2.79 (0.02)	2.72 (0.07)	2.76 (0.03)	2.98 (0.05)
Baseline alcohol use (mean, SE) ^c	0.54 (0.03)	0.36 (0.07)	0.54 (0.03)	0.70 (0.09)

SE = standard error.

^a Parents' negative perception of friends ranged from 1 (positive) to 5 (negative).

^b Low self-control ranged from 1 (high) to 5 (low).

^c Baseline alcohol use ranged from 0 (no, never) to 4 (7 times or more).

Table 2

Multinomial logistic regression for the effect of alcohol use of friends and parents' negative perception of friends on different patterns of alcohol use: odds ratios^a (OR) and 95% confidence intervals (CI).

	Alcohol users vs. non-alcohol users	Alcohol abusers vs. non-alcohol users	Alcohol abusers vs. alcohol users
<i>Model 1</i>			
Alcohol use of friends	1.31 (1.11–1.54)**	1.50 (1.20–1.87)**	1.15 (0.97–1.35)
<i>Model 2</i>			
Alcohol use of friends	1.30 (1.09–1.54)**	1.48 (1.18–1.86)**	1.14 (0.97–1.34)
Parents' negative perception of friends	1.16 (0.95–1.41)	1.32 (1.02–1.71)*	1.14 (0.97–1.34)
<i>Model 3</i>			
Alcohol use of friends	1.29 (1.08–1.54)**	1.47 (1.17–1.86)**	1.14 (0.97–1.34)
Parents' negative perception of friends	1.19 (0.83–1.69)	1.34 (0.85–2.13)	1.13 (0.80–1.61)
Alcohol use of friends * parents' negative perception of friends	0.99 (0.83–1.18)	0.99 (0.81–1.22)	1.00 (0.87–1.16)

^a Adjusted for gender, age, socioeconomic status, alcohol use of parents, and adolescent baseline alcohol use.

* $p < 0.05$.

** $p < 0.01$.

of friends ($F = 4.9, p < .01$), self-control ($F = 13.0, p < .001$), and baseline alcohol use ($F = 6.1, p < .01$) and did not differ with statistical significance on age ($F = 1.9, p < .15$) and socioeconomic status ($F = 2.2, p < .11$).

Table 2 shows the results of the multinomial logistic regression analyses for the influence of the alcohol use of friends during adolescence and of parental perception of adolescent child's friends on young adults' alcohol use. The first model assessed the effect of friends' alcohol use, adjusted for gender, age, SES, alcohol use of parents, and adolescent baseline alcohol use. Users and abusers at T4 were more likely to have friends at T3 who used alcohol as compared to non-users (OR = 1.31, 95% CI = 1.11–1.54 and OR = 1.50, 95% CI = 1.20–1.87, respectively). No differences were found for abusers as compared to users (OR = 1.15, CI = 0.97–1.35). In the second model, we added parents' perception of their adolescent child's friends. For abusers at T4, it was more likely that their parents had a negative perception of their friends at T3 (OR = 1.32, 95% CI = 1.02–1.71) as compared to non-users. No

Table 3

Multinomial logistic regression for the effect of alcohol use of friends and self-control on different patterns of alcohol use: odds ratios^a (OR) and 95% confidence intervals (CI).

	Alcohol users vs. non-alcohol users	Alcohol abusers vs. non-alcohol users	Alcohol abusers vs. alcohol users
<i>Model 1</i>			
Alcohol use of friends	1.31 (1.11–1.54)**	1.50 (1.20–1.87)**	1.15 (0.97–1.35)
<i>Model 2</i>			
Alcohol use of friends	1.31 (1.11–1.55)**	1.48 (1.18–1.85)**	1.13 (0.96–1.33)
Low self-control	0.97 (0.79–1.18)	1.26 (0.97–1.63)	1.30 (1.09–1.56)**
<i>Model 3</i>			
Alcohol use of friends	1.27 (1.07–1.52)**	1.44 (1.14–1.83)**	1.14 (0.96–1.34)
Low self-control	1.28 (0.88–1.88)	1.70 (1.06–2.73)*	1.33 (0.92–1.93)
Alcohol use of friends * low self-control	0.85 (0.71–1.03)	0.85 (0.68–1.07)	0.99 (0.84–1.17)

^a Adjusted for gender, age, socioeconomic status, alcohol use of parents, and adolescent baseline alcohol use.

* $p < 0.05$.

** $p < 0.01$.

Table 4

Multinomial logistic regression for the effect of alcohol use of friends, parents' negative perception of friends, and self-control on different patterns of alcohol use: odds ratios^a (OR) and 95% confidence intervals (CI).

	Alcohol users vs. non-alcohol users	Alcohol abusers vs. non-alcohol users	Alcohol abusers vs. alcohol users
Alcohol use of friends	1.30 (1.10–1.54)*	1.46 (1.16–1.83)*	1.12 (0.95–1.33)
Parents' negative perception of friends	1.17 (0.95–1.43)	1.30 (1.00–1.68)	1.11 (0.94–1.31)
Low self-control	0.95 (0.77–1.16)	1.22 (0.94–1.58)	1.29 (1.08–1.54)*

^a Adjusted for gender, age, socioeconomic status, alcohol use of parents, and adolescent baseline alcohol use.

* $p < 0.01$.

significant differences were found for users as compared to non-users and for abusers as compared to users. In the next step, we analyzed whether parents' perception of their adolescent child's friends modified the influence of friends' alcohol use (Model 3). This was not the case.

Table 3 shows the results of the multinomial logistic regression analyses assessing the influence of the adolescent's self-control. The first model assessed the effect of friends' alcohol use as in previous multinomial logistic regression analyses. Users and abusers were more likely to have friends who used alcohol as compared to non-users. In the second model, we added self-control. A significant effect was found for the influence of self-control: abusers were more likely to have low levels of self-control as compared to users (OR = 1.30, 95% CI = 1.09–1.56). No differences were found between users (OR = 0.97, 95% CI = 0.79–1.18) and abusers (OR = 1.26, 95% CI = 0.97–1.63) as compared to non-users. Furthermore, the significant effect of friends' alcohol use persisted in this model. In the third model, the modification effect of self-control on the relationship between friends' alcohol use during adolescence and alcohol use as a young adult was assessed. This did not yield significant modifications.

In Table 4 the results are shown for the joint influence of friends' alcohol use, parents' perception of their adolescent child's friends, and the adolescent's self-control. The results regarding the effect of friends' alcohol use are comparable to those of the preceding analyses: users and abusers were more likely to have friends who used alcohol than non-users (OR = 1.30, 95% CI = 1.10–1.54 and OR = 1.46, 95% CI = 1.16–1.83, respectively), whereas no difference was found for abusers compared to users. No significant associations were found between parents' perception of their adolescent child's friends and young adults' alcohol use. A significant difference was found for the influence of self-control for abusers compared to users (OR = 1.29, 95% CI = 1.08–1.54).

4. Discussion

The aim of this study was to assess the influence of peer alcohol use during adolescence on young adults' alcohol use and abuse, and to what extent parents' perception of their adolescent child's friends and adolescent's self-control modified this influence of peers. We found that having friends who used alcohol in adolescence increased the risk of alcohol use and abuse in young adulthood. Secondly, the impact of friends' alcohol use during adolescence on young adults' alcohol use was modified neither by parents' perception of their adolescent child's friends nor by the adolescent's self-control. Finally, we found that the extent of peer influence and of parents' perception of friends did not significantly differ between alcohol use and abuse but that the extent of self-control did: alcohol abusers were more likely to show low levels of self-control than alcohol users. This did not have an effect on its modifying role, however, as this was absent in all cases.

Our finding that friends' alcohol use during adolescence is associated with young adults' alcohol use and abuse is in line with previous studies (Cruz et al., 2012; Guo et al., 2001; Jones-Webb et al., 1997; Larsen et al., 2012; Lee et al., 2012; Nguyen et al., 2012; Talbott et al., 2012). This

finding also confirms the theory of planned behavior regarding the influence of adolescent' attitude toward alcohol use and the influence of perceived subjective norm regarding showing this behavior (Taylor, 2003). The finding can be explained in two ways. First, adolescents may select friends who show similar behavior regarding alcohol drinking as themselves, that is, having drinking friends is a consequence of their own drinking behavior (Cruz et al., 2012; Dishion et al., 2004; Jaccard, Blanton, & Dodge, 2005; Urberg, Luo, Pilgrim, & Degirmencioglu, 2003). However, we excluded participants at the third wave (i.e., the moment of friends' drinking) who already abused alcohol. This effectively ruled out the alternative explanation of selection of drinking friends by those already using/abusing alcohol. A second explanation is that alcohol abuse is a consequence of friends' drinking. This explanation seems most reasonable, because friends' alcohol use was assessed prior to the onset of alcohol abuse in our sample. Drinking peers may function as role models, resulting in imitation of their drinking behavior (Bot, Engels, Knibbe, & Meeus, 2005; Cruz et al., 2012; Urberg et al., 2003), and drinking may become a joint social activity. Moreover, adolescents internalize their friends' norms regarding alcohol consumption and may be encouraged by their friends to consume alcohol (Borsari & Carey, 2001; Gibbons et al., 2004). This explanation may have important implications regarding the targeting of prevention to adolescents and their peers.

Another main finding of our study is that the influence of friends' alcohol use was not modified by parents' perception of these friends, nor by adolescents' self-control. Parents of abusers had a more negative perception of their adolescent child's friends than parents of non-users, but that did not modify the influence of friends' alcohol use. This result does not confirm the theory of planned behavior regarding the subjective norms of parents perceived by adolescents (Taylor, 2003). Parents thus seem not to be able to transfer their perception of their adolescent child's friends effectively to their child. Furthermore, self-control on the part of the adolescent also did not modify the influence of friends' alcohol use. This is in contrast with the findings of Wills et al. (2011), who found that the association between peer substance use and adolescents' levels of substance use was stronger for individuals with low self-control than for individuals with high self-control. An explanation for this contrast may be that they used cross-sectional data, making reverse causality a likely explanation.

Interestingly, the extent of peer influence did not differ significantly between alcohol use and abuse. This confirms the findings of a longitudinal study by Windle (1996), and, partly, of a cross-sectional study by Colder and Chassin (1999). Windle (1996) compared problem drinking (i.e., reporting high alcohol consumption and reporting problems due to drinking) to heavy drinking (i.e., reporting high alcohol consumption but not reporting problems due to drinking) regarding the percentage of friends who drank. They did not find any significant difference. Colder and Chassin (1999) compared problem use to various other levels of alcohol use with respect to the affiliations with alcohol-using peers and found a significant difference between problem use and moderate use, but not with other levels of use. The differences with our study may be due to the different operationalizations of alcohol use and abuse. Their outcome was a combination of different levels of use and of different levels of alcohol-related problems. Another explanation may be the cross-sectional design of their study.

Regarding self-control, we found that young adult abusers were more likely to have low levels of self-control in adolescence than young adult users. This finding confirms the self-control theory (Gottfredson & Hirschi, 1990). One explanation may be that adequate self-control is needed to prevent socially accepted moderate alcohol use from derailing into alcohol abuse. This may contribute to the frequent co-occurrence of alcohol abuse with aggression and other acting-out behavior (Brook, Cohen, Whiteman, & Gordon, 1992).

Worth to mention is that probably the associations studied would have been stronger if the early onset alcohol abusers had not been excluded. Parents of those, excluded, participants probably had a more

negative perception of their adolescent child's friends than the other parents. Furthermore, excluded participants probably had a lower self-control and more friends who used alcohol. However, exclusion of those participants led to stronger evidence on causal relationships as a major criterion for causality is that the cause precedes the effect in time (Rothman, 2002).

4.1. Strengths and limitations

The major strengths of this study are its large sample size, the availability of parental report of alcohol use and its longitudinal design. Longitudinal studies can provide more evidence of a causal association than cross-sectional studies (Grobbee & Hoes, 2009). Other strengths of this study are the use of a standardized psychiatric assessment tool (the CIDI) that has a good reliability and validity (Andrews & Peters, 1998; Haro et al., 2006), and the adjustment for important confounding variables. One limitation is that the level of alcohol use relied on self-report. However, the questionnaires were filled out anonymously, which is a valid method of measuring alcohol use (Del Boca & Noll, 2000). Another limitation is the use of peer alcohol use as reported by adolescents. It is shown that report of peer alcohol use is somewhat congruent with one's own use (Bauman & Ennett, 1996). This may result in an overestimation of the relationship between peer and adolescent alcohol use.

4.2. Implications

The results of the present study imply that peer alcohol use affects alcohol use and abuse by young adults, whereas low self-control only affects alcohol abuse. Alcohol prevention programs aimed at reducing alcohol use should focus on learning skills to resist peer pressure. Prevention programs aimed at reducing the risk of alcohol abuse may benefit from a focus on enhancing self-control (Na & Paternoster, 2012), in addition to a focus on peer refusal skills (Wolfe, Crooks, Chiodo, Hughes, & Ellis, 2012) and awareness of the possible negative consequences. Considering the large impact of alcohol use and abuse on adolescent health, this topic deserves further study.

Role of funding sources

Funding for this study was provided by various external grants from the Netherlands Organization for Scientific Research (NWO), ZonMW, GB-MaGW, the Dutch Ministry of Justice, the European Science Foundation, and BBMRI-NL, who had no involvement in the design of the study, the analysis or interpretation of the data, the writing of the report, or the decision to submit the paper for publication.

Contributors

LV, AFW, RV, and SAR designed the study. LV performed the statistical analysis. LV, AFW, and SAR wrote the first draft. RV and FCV provided substantial feedback on the manuscript. Each of them has approved the final manuscript.

Conflict of interest

The authors do not have financial or other conflicts of interest that may affect their contribution to this manuscript.

Acknowledgements

This research is part of the TRacking Adolescents' Individual Lives Survey (TRAILS). Participating centers of TRAILS include various departments of the University Medical Center and University of Groningen, the Erasmus University Medical Center Rotterdam, the University of Utrecht, the Radboud Medical Centre Nijmegen, and the Parnassia Bavo group, all in the Netherlands. TRAILS has been financially supported by various grants from the Netherlands Organization for Scientific Research (NWO), ZonMW, GB-MaGW, the Dutch Ministry of Justice, the European Science Foundation, BBMRI-NL, and the participating universities. We are grateful to all adolescents, their parents, and teachers who participated in this research, and to everyone who worked on this project and made it possible.

References

- American Psychiatric Association (1994). *Diagnostic and statistical manual of mental disorders: DSM-IV* (4th ed.) Washington, DC: American Psychiatric Association.

- Andrews, G., & Peters, L. (1998). The psychometric properties of the composite international diagnostic interview. *Social Psychiatry and Psychiatric Epidemiology*, 33, 80–88.
- Bauman, K. E., & Ennett, S. T. (1996). On the importance of peer influence for adolescent drug use: Commonly neglected considerations. *Addiction*, 91, 185–198.
- Borsari, B., & Carey, K. B. (2001). Peer influences on college drinking: A review of the research. *Journal of Substance Abuse*, 30, 929–947.
- Bot, S. M., Engels, R. C., Knibbe, R. A., & Meeus, W. H. (2005). Friend's drinking behaviour and adolescent alcohol consumption: The moderating role of friendship characteristics. *Addictive Behaviors*, 30, 929–947.
- Brook, J. S., Cohen, P., Whiteman, M., & Gordon, A. S. (1992). Psychosocial risk factors in the transition from moderate to heavy use or abuse of drugs. In M. D. Glantz, & R. W. Pickens (Eds.), *Vulnerability to drug abuse* (pp. 359–388). Washington, DC: American Psychological Association.
- Chen, H., Cohen, P., & Chen, S. (2007). Biased odds ratios from dichotomization of age. *Statistics in Medicine*, 26, 3487–3497.
- Colder, C. R., & Chassin, L. (1999). The psychosocial characteristics of alcohol users versus problem users: Data from a study of adolescents at risk. *Development and Psychopathology*, 11, 321–348.
- Cruz, J. E., Emery, R. E., & Turkheimer, E. (2012). Peer network drinking predicts increased alcohol use from adolescence to early adulthood after controlling for genetic and shared environmental selection. *Developmental Psychology*, 48, 1390–1402.
- De Winter, A. F., Oldehinkel, A. J., Veenstra, R., Brunnekreef, J. A., Verhulst, F. C., & Ormel, J. (2005). Evaluation of non-response bias in mental health determinants and outcomes in a large sample of pre-adolescents. *European Journal of Epidemiology*, 20, 173–181.
- Del Boca, F. K., & Noll, J. A. (2000). Truth or consequences: The validity of self-report data in health services research on addictions. *Addiction*, 95(Suppl. 3), S347–S360.
- Dishion, T. J., Nelson, S. E., Winter, C. E., & Bullock, B. M. (2004). Adolescent friendship as a dynamic system: Entropy and deviance in the etiology and course of male antisocial behavior. *Journal of Abnormal Child Psychology*, 32, 651–663.
- Donders, A. R., van der Heijden, G. J., Stijnen, T., & Moons, K. G. (2006). Review: A gentle introduction to imputation of missing values. *Journal of Clinical Epidemiology*, 59, 1087–1091.
- Fraleigh, R. C., & Davis, K. E. (1997). Attachment formation and transfer in young adults' close friendships and romantic relationships. *Personal Relationships*, 4, 131–144.
- Ganzeboom, H. B. G., & Treiman, D. J. (1996). Internationally comparable measures of occupational status for the 1988 international standard classification of occupations. *Social Science Research*, 25, 201–239.
- Gibbons, F. X., Gerrard, M., Lune, L. S. V., Wills, T. A., Brody, G., & Conger, R. D. (2004). Context and cognitions: Environmental risk, social influence, and adolescent substance use. *Personality and Social Psychology Bulletin*, 30, 1048–1061.
- Gottfredson, M. R., & Hirschi, T. (1990). *A general theory of crime* (1st ed.). Stanford, CA: Stanford University Press.
- Griffin, K. W., Scheier, L. M., Acevedo, B., Grenard, J. L., & Botvin, G. J. (2012). Long-term effects of self-control on alcohol use and sexual behavior among urban minority young women. *International Journal of Environmental Research and Public Health*, 9, 1–23.
- Grobbée, D. E., & Hoes, A. W. (2009). *Clinical epidemiology: Principles, methods and applications for clinical research* (1st ed.). Sudbury: Jones and Bartlett.
- Guo, J., Hawkins, J. D., Hill, K. G., & Abbott, R. D. (2001). Childhood and adolescent predictors of alcohol abuse and dependence in young adulthood. *Journal of Studies on Alcohol*, 62, 754–762.
- Haro, J. M., Arbabzadeh-Bouchez, S., Brugha, T. S., de Girolamo, G., Guyer, M. E., Jin, R., et al. (2006). Concordance of the composite international diagnostic interview version 3.0 (CIDI 3.0) with standardized clinical assessments in the WHO world mental health surveys. *International Journal of Methods in Psychiatric Research*, 15, 167–180.
- Hawkins, J. D., Catalano, R. F., & Miller, J. Y. (1992). Risk and protective factors for alcohol and other drug problems in adolescence and early adulthood: Implications for substance abuse prevention. *Psychological Bulletin*, 112, 64–105.
- Jaccard, J., Blanton, H., & Dodge, T. (2005). Peer influences on risk behavior: An analysis of the effects of a close friend. *Developmental Psychology*, 41, 135–147.
- Jones-Webb, R., Short, B., Wagenaar, A., Toomey, T., Murray, D., Wolfson, M., et al. (1997). Environmental predictors of drinking and drinking-related problems in young adults. *Journal of Drug Education*, 27, 67–82.
- Kessler, R. C., & Ustun, T. B. (2004). The world mental health (WMH) survey initiative version of the world health organization (WHO) composite international diagnostic interview (CIDI). *International Journal of Methods in Psychiatric Research*, 13, 93–121.
- King, K. M., Fleming, C. B., Monahan, K. C., & Catalano, R. F. (2011). Changes in self-control problems and attention problems during middle school predict alcohol, tobacco, and marijuana use during high school. *Psychology of Addictive Behaviors*, 25, 69–79.
- Larsen, H., Overbeek, G., Granic, I., & Engels, R. C. M. E. (2012). The strong effect of other people's drinking: Two experimental observational studies in a real bar. *The American Journal on Addictions*, 21, 168–175.
- Lee, J. O., Hill, K. G., Guttmannova, K., Bailey, J. A., Hartigan, L. A., Hawkins, J. D., et al. (2012). The effects of general and alcohol-specific peer factors in adolescence on trajectories of alcohol abuse disorder symptoms from 21 to 33 years. *Drug and Alcohol Dependence*, 121, 213–219.
- Moffitt, T. E., & Silva, P. A. (1988). Self-reported delinquency, neuropsychological deficit, and history of attention deficit disorder. *Journal of Abnormal Child Psychology*, 16, 553–569.
- Na, C., & Paternoster, R. (2012). Can self-control change substantially over time? Rethinking the relationship between self- and social control. *Criminology*, 50, 427–462.
- Nederhof, E., Jorg, F., Raven, D., Veenstra, R., Verhulst, F. C., Ormel, J., et al. (2012). Benefits of extensive recruitment effort persist during follow-ups and are consistent across age group and survey method. The TRAILS study. *BMC Medical Research Methodology*, 12, 93.
- Nguyen, L. T., Rahman, Z., Emerson, M. R., Nguyen, M. H., & Zabin, L. S. (2012). Cigarette smoking and drinking behavior of migrant adolescents and young adults in Hanoi, Vietnam. *Journal of Adolescent Health*, 50, S61–S67.
- Putnam, S. P., Ellis, L. K., & Rothbart, M. K. (2001). The structure of temperament in infancy through adolescence. In A. Elias, & A. Angleitner (Eds.), *Advances/proceedings in research on temperament* (pp. 165–182). Berlin: Pabst.
- Rothbart, M. K., Ahadi, S. A., & Evans, D. E. (2000). Temperament and personality: Origins and outcomes. *Journal of Personality and Social Psychology*, 78, 122–135.
- Rothman, K. J. (2002). *Epidemiology: An introduction* (1st ed.). New York: Oxford University Press.
- Stice, E., & Gonzales, N. (1998). Adolescent temperament moderates the relation of parenting to antisocial behavior and substance use. *Journal of Adolescent Research*, 13, 5–31.
- Talbot, L. L., Moore, C. G., & Usdan, S. L. (2012). Social modeling influences and alcohol consumption during the first semester of college: A natural history study. *Substance Abuse*, 33, 146–155.
- Taylor, S. E. (2003). *Health psychology* (5th ed.). Boston: McGraw-Hill.
- Urberg, K. A., Luo, Q., Pilgrim, C., & Degirmencioglu, S. M. (2003). A two-stage model of peer influence in adolescent substance use: Individual and relationship-specific differences in susceptibility to influence. *Addictive Behaviors*, 28, 1243–1256.
- Veenstra, R., Lindenberg, S., Oldehinkel, A. J., De Winter, A. F., Verhulst, F. C., & Ormel, J. (2005). Bullying and victimization in elementary schools: A comparison of bullies, victims, bully/victims, and uninvolved preadolescents. *Developmental Psychology*, 41, 672–682.
- Wills, T. A., & Dishion, T. J. (2004). Temperament and adolescent substance use: A transactional analysis of emerging self-control. *Journal of Clinical Child and Adolescent Psychology*, 33, 69–81.
- Wills, T. A., Gibbons, F. X., Sargent, J. D., Gerrard, M., Lee, H. R., & Dal Cin, S. (2010). Good self-control moderates the effect of mass media on adolescent tobacco and alcohol use: Tests with studies of children and adolescents. *Health Psychology*, 29, 539–549.
- Wills, T. A., Pokhrel, P., Morehouse, E., & Fenster, B. (2011). Behavioral and emotional regulation and adolescent substance use problems: A test of moderation effects in a dual-process model. *Psychology of Addictive Behaviors*, 25, 279–292.
- Wills, T. A., Sandy, J. M., Yaeger, A., & Shinar, O. (2001). Family risk factors and adolescent substance use: Moderation effects for temperament dimensions. *Developmental Psychology*, 37, 283–297.
- Windle, M. (1996). An alcohol involvement typology for adolescents: Convergent validity and longitudinal stability. *Journal of Studies on Alcohol*, 57, 627–637.
- Wolfe, D. A., Crooks, C. V., Chiodo, D., Hughes, R., & Ellis, W. (2012). Observations of adolescent peer resistance skills following a classroom-based healthy relationship program: A post-intervention comparison. *Prevention Science*, 13, 196–205.
- Young, S. E., Corley, R. P., Stallings, M. C., Rhee, S. H., Crowley, T. J., & Hewitt, J. K. (2002). Substance use, abuse and dependence in adolescence: Prevalence, symptom profiles and correlates. *Drug and Alcohol Dependence*, 68, 309–322.