Environmental and temperamental correlates of alcohol user patterns in grade 7 students

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ABSTRACT
AIMS – We examined the effects of temperamental dispositions, friends using alcohol and parental monitoring on grade 7 students’ alcohol use patterns. DESIGN – The analyses were drawn from a cross-sectional survey of 3710 grade 7 students (mean age =12.53) that participated in a large Norwegian school-based intervention study. Alcohol user patterns were measured through combining self-reported lifetime alcohol experience, heavy episodic drinking and any alcohol involvement in the previous 30 days. Behavioural inhibition/activation sensitivity (BIS/BAS), parental monitoring and the number of friends using alcohol were measured through the adolescents’ self-report. RESULTS – As many as 68.8% of boys and 83.3% of girls were non-users of alcohol, whereas 9.1% of boys and 3.9% of girls reported use of alcohol last month. Heavy episodic drinking last month was reported by 3.1% of the boys and by 0.8% of the girls. A multinomial regression analysis revealed strong associations between the number of friends using alcohol and alcohol user patterns, moderate inverse associations between parental monitoring and alcohol user patterns, and a weak association between BIS/BAS components and alcohol user patterns. CONCLUSION – The results demonstrate the importance of socio-environmental factors in a period in which alcohol use is predictive of later negative outcomes.
KEYWORDS – monitoring, early onset alcohol, behavioural inhibition, peer influence

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Early initiation of alcohol use is a potential risk factor for alcohol dependence and disorder in adulthood (Grant & Dawson, 1997; Hingson, Heeren, & Winter, 2006), although the mechanisms involved are not known. Children and adolescents who begin to drink before turning 15 are four times more likely to be alcohol-dependent later in life than individuals starting to drink after the age of 20 (Grant & Dawson, 1997). Longitudinal cohort studies have indicated that a 10% delay in the debut age can reduce the intake of alcohol in adolescents by 35% (Pedersen & Skrondal, 1998). The younger the children and adolescents are when they begin to use alcohol, the greater the probability that they will engage in risky behaviours, such as using marijuana and cocaine, having sex with multiple partners and earning low grades in school (Grunbaum et al., 2004).

The association between the early onset of drinking and later problems makes it crucial to understand the causal mechanisms involved in early alcohol use, including the appraisal of risk and protective factors. Current knowledge is limited because previous studies of the risk and protective factors of underage drinking have tended to focus on mid-adolescence.
rather than early adolescence (those aged 10–13). Because the rate of alcohol use is typically reported to be low in early adolescence, research has concentrated on substance use in general rather than early adolescent use of alcohol (Zucker, Donovan, Masten, Mattson, & Moss, 2008). The few available studies show that alcohol use in early adolescence is low prevalent (Maggs, Staff, Patrick, Wray-Lake, & Schulenberg, 2015), but related to a diverse set of risk and protective factors including gender (Maggs et al., 2015), alcohol outcome expectancies (Maggs et al., 2015; Tucker et al., 2014), internalising (Richmond, Laursen, Kerr, & Stattin, 2015; Virtanen et al., 2015) and externalising behaviours (Virtanen et al., 2015) and resistance skills (Tucker et al., 2014). The diversity suggests that the mechanisms in early alcohol use are complex and involve a range of social and individual factors.

A comprehensive model of early alcohol use must incorporate both individual and environmental factors. Person x environment theories such as the biological sensitivity to context theory (Boyce & Ellis, 2005; Ellis, Boyce, Belsky, Bakermans-Kranenburg, & van IJzendoorn, 2011) and the differential susceptibility theory (Belsky, 2005) predict that some individuals are more sensitive to negative (risk-promoting) and positive (development-enhancing) environmental conditions than others. Individuals with different personality characteristics vary in how vulnerable or susceptible they are to environmental stressors and adversity (such as high peer drinking pressure, harsh or inconsistent parenting), as well as to the extent they are positively affected by contextual supports and resources (such as warm and consistent parenting) (Ellis et al., 2011).

There is considerable evidence of strong socio-ecological influences on early initiation, adolescent drinking and the later abuse of alcohol (for reviews see Hawkins, Catalano, & Miller, 1992; and Zucker et al., 2008). Parental practice and peer norms are emphasised as two of the most important socialising forces affecting adolescent behaviour, including alcohol and drug use (Dorius, Bahr, Hoffmann, & Harmon, 2004; Rose, Dick, Viken, & Kaprio, 2001; Ryan, Jorm, & Lubman, 2010). Parental alcohol and drug use, permissive parental norms regarding teen drinking, and greater peer deviance and drug use are significant predictors of underage drinking (Donovan, 2004).

Longitudinal studies have identified several aspects of parental practice that may protect against early adolescent alcohol involvement. One of these is parental monitoring (Mares, Lichtwarck-Aschoff, Burk, van der Vorst, & Engels, 2012; Van der Vorst, Engels, Meeus, & Dekovic, 2006). Parental monitoring can be operationalised as the extent to which parents are aware of who their children are with and where they spend their time outside the home or attending school (DiClemente et al., 2001). Parental monitoring may influence the child’s or youth’s behaviour directly by minimising his or her involvement in risky situations or indirectly by preventing associations with deviant peers (Reid, Patterson, & Snyder, 2002). Monitoring may also moderate the influence of peers on the risk of underage drinking (Dorius et al., 2004) and mediate the relationship between family type (intact or step-family) and alcohol use and delinquency in adolescence (Luther, 2008).
Several studies have documented that parents that actively monitor their children's behaviour have adolescents who drink less alcohol and are less likely to be involved in alcohol-related risk behaviours than other youths (Griffin, Botvin, Scheier, Diaz, & Miller, 2000). An inverse relationship between monitoring and adolescent drinking is observed in both normal and various at-risk samples (e.g. ethnic minorities, single-parent families, children of alcoholics) (Forehand, Miller, Dutra, & Chance, 1997). However, some studies indicate that the relationship might be reciprocal across time. For example, Stice and Barrera (1995) observed that absence of parental support at first measurement predicted later youth substance use, whereas first measurement substance use predicted later decreases in parental support. However, lack of research means that little is known about how parental monitoring relates to or might function as a protective factor against early adolescent drinking, when the base rate of drinking alcohol is low.

Youths are much more likely to drink and use drugs if their friends use alcohol or narcotics (Brook, Brook, Arencibia-Mireles, Richter, & Whiteman, 2001; Dorius et al., 2004; Newcomb & Bentler, 1989; Vitaro, Brendgen, & Tremblay, 2000). This influence “may stem from the peers’ ability to offer a combination of psychological encouragement as well as observable behaviour to entice adolescents toward deviance” (Dorius et al., 2004, p. 166). However, there has been debate regarding whether the effect of peer drinking might be bidirectional; namely, adolescents who drink choose friends with similar habits and attitudes. Some studies have reported such bidirectional effects of peer drinking (Curran, Stice, & Chassin, 1997; Norton, Lindrooth, & Ennett, 1998). Peer alcohol use has also been shown to influence alcohol use in early adolescence. Oxford, Oxford, Harachi, Catalano, and Abbott (2001) observed that peer deviancy was one of the strongest predictors of early substance use initiation in a longitudinal study of fourth to sixth graders. Similar results were reported by Jackson (1997): children who began drinking alcohol at an early age reported a higher exposure to peer drinking and perceived higher drinking prevalence among their peer group than children who did not drink. Another result from this study was that the relation of factors, such as peer alcohol use, was not highly differentiated in relation to the initiation and experimentation stages of alcohol use in early adolescence (Jackson, 1997).

Other studies indicate that some children might be more disposed or vulnerable to early alcohol use than others (Hill et al., 2010; Nigg et al., 2006; Pardo, Aguilar, Molinuevo, & Torrubia, 2007; Zucker et al., 2008). Vulnerability to early alcohol use may be mediated through several motivational pathways, and one of them is individual differences in reinforcement sensitivity. According to Smillie, Loxton, and Avery (2011), a strong reactivity to rewarding stimuli appears to drive the use and abuse of substances, thus suggesting that addictions can be conceptualised as disorders of extreme desire. Consistent with this perspective, several authors have used constructs from Gray’s neuropsychological theory (Gray, 1981) to explain how personality traits might predispose individuals to develop psychopathological disorders such as alcohol and drug addic-
tions. According to this theory, there are two motivational systems that underlie human behaviour and personality: the Behavioural Approach System (BAS) and the Behavioural Inhibition System (BIS). The BAS and BIS systems regulate approach and avoidance behaviour, respectively, in response to environmental stimuli.

An individual with a strongly reactive BAS will have greater motivational reactions to conditional stimuli for reward and be more aware of cues for non-punishment or escape from punishment. High activity in this system may also generate impulsive behaviour. Recent studies suggest that BAS can be viewed as a multidimensional construct. The most common approach is to divide BAS sensitivity into three aspects that differ in what motivates the approach: a strong pursuit of appetitive goals (BAS Drive), responsiveness to reward (BAS Reward Responsiveness) and a tendency to seek out new potentially rewarding experiences (BAS Fun Seeking) (Carver & White, 1994). Whereas fun seeking is related to impulsivity and sensation-seeking, drive and reward responsiveness seem to measure approach motivation (Torrubia, Ávila, & Caseras, 2008). Drive also loads on a functional impulsivity and venturesomeness factor (Miller, Joseph, & Tudway, 2004). The function of the BIS is to make the individual aware of potentially dangerous situations or signals of punitive consequences. The system is thus associated with sensitivity to punishment (or non-reward) and novelty cues. The system’s outputs are increments in attention and arousal and the inhibition of ongoing behaviour (Corr, 2002). Self-reported BIS has been unitarily associated to neuroticism, anxiety and negative emotionality in adults (Carver & White, 1994; Jorm et al., 1999) and children (Bjørnebekk, 2009; Muris, Meesters, de Kanter, & Timmerman, 2005). However, unlike neurotic or anxiety-prone individuals who drink alcohol to cope with negative emotional states (e.g. Mezquita, Stewart, & Angeles Ruiperez, 2010), high BIS individuals would be motivated to avoid harmful effects of substance use (Baumann et al., 2014). Studies relating these constructs to alcohol use have observed distinct associations. A positive relationship between an excessive incentive drive (BAS reactivity) and an increased desire for alcohol drinking and alcohol abuse from early adolescence onward has been reported in several studies (Franken, Muris, & Georgieva, 2006; Hill et al., 2010; Pardo et al., 2007). Higher scores on scales measuring the BAS systematically relate to an early alcohol debut and higher scores on current and future alcohol consumption.

Evidence of a relationship between deficient inhibitory control or low awareness of potentially dangerous situations (low BIS) and alcohol and substance use is not obvious (Bijttebier, Beck, Claes, & Vandereycken, 2009). Some studies indicate that the relationship between the BIS and alcohol or drug use might be more complex than the link between the BAS and alcohol or drug use, in that a strong BIS, under some conditions, can be associated with an urge for alcohol (Kambourooulos & Staiger, 2007). Nevertheless, the zero-order correlations have revealed associations of low behavioural inhibition (low BIS) with nearly all alcohol use variables investigated (Franken et al., 2006; O’Connor, Stewart, & Watt, 2009; Willem, Bijttebier, & Claes, 2010).
In summary, the present literature supports the joint effect of parenting, peer factors and individual differences, but effects remain unclear, particularly in younger age groups. Do parental monitoring, then, peer drinking and differences in individual motivational dispositions discriminate between different patterns of alcohol use in early adolescence (i.e., before the age of 13)?

Method
Participants
This article builds on data collected from 3710 grade 7 students in 63 Norwegian primary schools (grades 1 to 7). The sample consists of two cohorts (C1, C2) of seventh graders with parental consent participating in an ongoing effectiveness study of a culturally adapted version of the School-Wide Positive Behavior Intervention and Support model (SWPBIS) (Ogden, Sørlie, Arnesen, & Meek-Hansen, 2012; Sprague & Walker, 2005). Data for the present study were, however, collected prior to the initiation of the intervention. The sample (N = 3710) comprised 75.7% of all seventh graders in the actual schools (N = 5,396), with a mean age of 12.53 (SD = 0.55) Approximately one-half of the participants were boys (C1 = 50.2% and C2 = 51.8%), and about 19% (C1 = 18.7% and C2 = 19.2%) had an ethnic minority background (the majority were from Pakistan, India, Somalia or Eastern Europe), 6.5% of whom reported that they typically communicated in a language other than Norwegian at home (C1 = 6.5% and C2 = 6.6%).

Procedure
The students (N = 3710) completed a questionnaire at the end of the seventh grade (in June 2009 or 2010) by Internet or pencil in their classes during one or two school lessons. The response rates for students with parental approval were high (C1 = 92% and C2 = 89.8%). The Norwegian Social Science Data Services (NSD) approved the study, and the standards of the Regional Committee for Medical Research Ethics, South Norway, were followed throughout the conduct of the study.

Measures
Alcohol user groups: Alcohol-related variables were measured through a translated version of selected items from the Oregon Healthy Teen Survey (OHT, Oregon Department of Human Services, 2011). Alcohol debut was measured by asking the students to rate “How old were you when you had more than a sip or two of beer, wine, or hard liquor (for example, vodka, whisky, or gin) for the first time?”. The response options ranged from 0 = has never to 6 = 13 or more years. The remaining two items were “During the previous 30 days, on how many days did you have ... at least one drink of alcohol (... 5 or more drinks of alcohol in a row?).” The response options ranged from 0 = 0 days to 6 = all days or 6 = 20 or more days. In the analysis, we differentiated between “Alcohol experience” (0 = has never tasted alcohol or 1 = has tasted alcohol); “Experimentation with alcohol in the previous 30 days” (0 = No use or 1 = Use); and “Heavy episodic drinking (HED) last 30 days” (0 = No use or 1 = HED) by recoding the data into dichotomous variables. Based on these dichotomies we constructed user patterns, distinguishing between non-users (no alcohol experience), users with alcohol experience (any alcohol experience), recent users (use last month)
and recent heavy episodic drinking (heavy episodic drinking last month).

**Parental monitoring**: Parental monitoring was measured using five student-rated items translated from the Oregon Healthy Teen Survey (2011): “How often does at least one of your parents know what you are doing when you are out of the home?”; “How often does at least one of your parents know where you are after school?”. The response options ranged from 1 = never to 4 = always. The remaining three items were: “When I am not at home, one of my parents knows where I am and who I am with.”; “Would your parents know if you came home late?”; and “If you drank alcohol without permission, would you be caught by your parents?”. The response options were 1 = NO!, 2 = no, 3 = yes, 4 = YES! Cronbach’s alpha in the current sample was 0.78. In the analysis, a total mean score ranging from 1 to 4 was computed.

**Peer drinking**: Peer drinking was measured by asking the students to rate how many of their four best friends, ranging from 0 = 0 friends to 4 = 4 friends, had used alcohol during the previous year.

**Behavioural inhibition/activation sensitivity**: Bjørnebekk’s (2009) youth version of Carver and White’s BAS/BIS scales (Carver & White, 1994) were used to assess sensitivity in the behavioural inhibition system (BIS) and the behavioural approach system (BAS). The scales include one inhibitory factor (BIS scale) and three approach factors (BAS Drive, BAS Reward Responsiveness and BAS Fun Seeking). The BIS scale includes items that refer to the anticipation of punishment. The BAS Drive scale (BAS-D) is composed of items pertaining to the persistent pursuit of desired goals. The BAS Fun Seeking scale (BAS-FS) features items that reflect both a desire for new rewards and a willingness to approach a potentially rewarding, spontaneous event. The BAS Reward Responsiveness scale (BAS-RR) consists of items that focus on positive responses to the occurrence or the anticipation of a reward. Prior results indicate that two of the scales (BAS-D and BAS-RR) reflect key concepts of the BAS, whereas the third (BAS-FS) has a broader focus and is equally related to reward reactivity and impulsivity (Smillie, Pickering, & Jackson, 2006). Therefore, we have chosen to focus on BAS Drive and BAS-RR in this paper. To minimise the number of questions, BAS-FS was not measured in the present study. The items were rated on a four-point scale (4 = true for me, 3 = fairly true for me, 2 = partly true for me, and 1 = not at all true for me). An example item from the BAS Drive scale includes “I go out of my way to get the things I want”. An example item from the BAS-RR scale includes “I am thrilled when good things happen to me”. An example item from the BIS scale includes “I worry about making mistakes”. Empirical studies on normal populations of sixth graders (Bjørnebekk, 2007) and young offenders (Bjørnebekk & Howard, 2012) have documented the reliability and validity of the Norwegian youth version of both the BAS and BIS measures. Cronbach’s alpha in the current sample was 0.78 for the BIS subscale, 0.81 for the BAS Drive subscale and 0.82 for the BAS-RR. In the analysis, we used a mean score for each of the components.

**Background variables**: Child gender (1 = boy or 2 = girl) and ethnic or native background (0 = Norwegian as a main language or 1 = Norwegian as a second language)
were included in the models as there appear to be gender (Grucza, Norberg, Bucholz, & Bierut, 2008) and ethnic differences (Alvanzo et al., 2011) in alcohol use. Studies have also suggested a moderating influence of gender regarding the relationship between monitoring and alcohol use (Allen et al., 2008; Forehand et al., 1997; Griffin et al., 2000; Niemeier, 2006). There is also evidence of gender differences in the BIS and BAS (Heym, Ferguson, & Lawrence, 2008).

**Analysis**

Bivariate associations between alcohol user patterns and other study variables were conducted using one-way ANOVA and chi-square contingency tests with nominal independent variables.

Multivariate effects of independent variables were assessed using multinomial regression analysis with Stata 13.1. The design effect of clustered observations from the same school was modelled using robust estimation with design-adjusted standard errors.

The dependent variable was alcohol user pattern, using non-users as the reference group. A multinomial regression analysis computes the odds of belonging to category $k$ as compared to the reference category. With four categories, the multinomial regression can be seen as three logistic regression models, with separate regression coefficients specified for the odds of belonging to a user category as compared to the reference group of non-users. Thus, the effect of independent variables may differ across user group–non-user comparisons.

**Results**

Table 1 shows the frequency of drinking patterns, stratified by sex. There was an overall sex by user group association, likelihood-ratio chi-square (3) = 109.86, $p < .001$. Table 1 shows that the proportion of non-users was higher among girls. As many as 9.1% of the boys (3.1% heavy episodic drinkers) had been drinking the last month, whereas 3.9 % of girls had been drinking the last month (0.8% heavy episodic drinkers).

Table 2 shows the mean level of individual and environmental characteristics of non-users, users, recent users and recent heavy episodic drinkers, with F-tests for the difference in the means. The groups differed on all included variables. The students with alcohol use in the previous month scored lower on the BIS and BAS-RR but higher on the BAS Drive. For the environmental variables, students with any alcohol experience reported lower monitoring and a higher number of friends using alcohol. The effect size was moderate for monitoring, large for number of friends using alcohol, but weak for the individual variables. Post hoc tests with Bonferroni correction revealed differences between all user groups for the number of friends using alcohol, and for parental monitoring. For the BIS/BAS variables, users and non-user differed on BIS and BAS Drive, but not on BAS Reward Responsiveness. Recent users and recent heavy episodic drinkers differed on reward responsiveness, but not on BIS and BAS Drive.

Table 3 shows the result of a multinomial regression analysis, using non-users as the reference group. The regression computes the odds of being a non-user to the odds of belonging to each of the other user
Table 1. Prevalence of alcohol user patterns in grade 7 students.

|                  | Boys                      |                     | Girls                   |                     |
|------------------|---------------------------|---------------------|-------------------------|---------------------|
|                  | Percentage | 95% Cl    | n     | Percentage | 95% Cl    | n     |
| Non-user         | 68.8        | (65.8 to 71.6) | 1195   | 83.3       | (81.0 to 85.3) | 1438   |
| User             | 22.1        | (19.8 to 24.6) | 384    | 12.9       | (11.2 to 14.7) | 222    |
| Recent User      | 6.0         | (4.9 to 7.5)   | 105    | 3.1        | (2.3 to 4.2)   | 54     |
| Recent HED*      | 3.1         | (2.3 to 4.1)   | 54     | 0.8        | (0.4 to 1.4)   | 13     |

Note. * HED – Heavy episodic drinking.

Table 2. Individual and environmental characteristics of alcohol user patterns in grade 7 students.

|                  | Non-user | User | Recent user | Recent HED |
|------------------|----------|------|-------------|------------|
|                  | M | SD  | M | SD  | M | SD  | M | SD  |
| Monitoring       | 3.38a | 0.51 | 3.08a | 0.56 | 2.74a | 0.59 | 2.43a | 0.84 |
| Friends drinking | 0.17a | 0.59 | 0.94a | 1.39 | 1.85a | 1.52 | 2.28a | 1.64 |
| BIS              | 2.65ab | 0.64 | 2.51a | 0.70 | 2.46b | 0.77 | 2.25a | 0.96 |
| BAS-D            | 2.36ab | 0.72 | 2.48a | 0.75 | 2.65b | 0.78 | 2.55  | 0.85 |
| BAS-RR           | 3.22ab | 0.55 | 3.20a | 0.57 | 3.17c | 0.67 | 2.91abc | 0.96 |

Note. *** p<.001. Means in a row sharing subscripts are significantly different from each other (p<0.05). BIS Behavioural Inhibition Sensitivity; BAS-D Behavioural Activation Sensitivity, Drive subcomponent; BAS-RR Behavioural Activation Sensitivity, Reward Responsiveness subcomponent.

Table 3. Multinomial regression analysis of alcohol user pattern regressed on environmental and individual variables.

| Independent variable | User | Recent user | Recent HED |
|----------------------|------|-------------|------------|
|                      | Exp (B) | 95%CI | Exp (B) | 95%CI | Exp (B) | 95%CI |
| Gender               | 0.59*** | (0.48 to 0.72) | 0.57** | (0.38 to 0.84) | 0.26** | (0.11 to 0.66) |
| Ethnicity            | 0.71ns | (0.40 to 1.27) | 0.58ns | (0.20 to 1.66) | 1.37ns | (0.56 to 3.33) |
| Friends using alcohol | 2.22***ab | (2.00 to 2.46) | 3.04***a | (2.66 to 3.48) | 3.62***b | (2.95 to 4.44) |
| Monitoring (SD units) | 0.67***ab | (0.60 to 0.75) | 0.46***a | (0.39 to 0.55) | 0.34***b | (0.24 to 0.49) |
| BIS (SD units)       | 0.91ns | (0.82 to 1.00) | 0.90ns | (0.73 to 1.12) | 0.91ns | (0.64 to 1.29) |
| BAS Drive (SD units) | 1.12* | (1.00 to 1.24) | 1.30* | (1.01 to 1.67) | 1.17ns | (0.85 to 1.61) |
| BAS-RR (SD units)    | 1.02ns | (0.91 to 1.13) | 0.95ns | (0.78 to 1.16) | 0.83ns | (0.60 to 1.16) |

Note. *** p<0.001, ** p<0.01, * p<0.05, ns non-significant at 0.05 level of significance. Estimates in a row sharing subscripts are significantly different from each other (p<0.05). c. reference category is Non-user. Pseudo R-squared full model= 0.191. BAS-RR: Reward Responsiveness.

patterns. Being a girl was associated with a lower risk of being a user, lower risk of having used alcohol the last 30 days and lower risk of heavy episodic drinking the last 30 days. Similarly a 1 SD increase (SD = 0.56) in parental monitoring more than halved the odds of being a recent user as compared to a non-user (Exp (B)=0.46). A
boy with average monitoring ($M = 3.28$) would have a 21.6% risk (girls 14.2%) of being a user, a boy at one SD above average monitoring would have a 16.0% risk (girls 10.1%). A higher number of friends using alcohol was associated with a higher risk of belonging to the heavy episodic drinking group. Controlling for all other covariates, BIS did not have statistically significant impact on the risk of belonging to any of the alcohol user patterns. In contrast, the BAS Drive component was associated with a higher risk of being a user and having used alcohol the last 30 days. BAS Drive was not related to the risk of heavy episodic drinking the last 30 days. Overall the independent variables accounted for 19.1% (pseudo R-squared) of the variance in alcohol user groups. Split by user group contrasts, the pseudo R-squared was 14.7% (user vs non-user), 37.3% (recent user vs non-user) and 48.1% (recent heavy episodic drinker vs non-user).

A follow-up analysis tested the homogeneity of associations across gender. For the user vs non-user comparison, the association between monitoring and user contrast was stronger for girls than for boys. Gender x monitoring interaction was not statistically significant for the other comparisons (HED vs non-user and Recent user vs non-user). For all other independent variables, the independent effects were homogeneous across gender.

**Discussion**

Our study indicates that non-use is the dominant alcohol user pattern among grade 7 students, but almost one in 10 boys and one in 25 girls had been drinking alcohol the last month. Heavy episodic drinking was infrequent, reported by fewer than 1 in 30 boys and by fewer than 1 in 100 girls. Controlling for these gender differences, we observed moderate to strong main effects of parental monitoring and peer drinking and weak main effects of the individual temperamental factors on alcohol user patterns.

The strong environmental association is notable because it occurred in an early adolescent sample at a developmental stage in which alcohol consumption is infrequent. One of the implications of this result is that parental monitoring might act as a protective factor against early alcohol use. Children who experience parental involvement in who their friends are, who they spend their time with and where they interact with peers are less likely to use alcohol. Children with friends that drink alcohol are more likely to use alcohol. Children’s temperamental dispositions appear to be less important for their alcohol use.

The relatively strong associations between user pattern and environmental factors mimic the results of several other studies on older cohorts (Dorius et al., 2004; Rose et al., 2001; Ryan et al., 2010) and reinforce the bulk of evidence on environmental influences on alcohol use. In addition, the current results are among the few to extend the range of generalisation to early adolescent cohorts. Showing that monitoring and friends’ use of alcohol is related to early adolescent alcohol use is particularly relevant relative to the result that early onset alcohol use predicts a number of negative outcomes during (Little, Cunningham, Shahar, & Widaman, 2002) and after adolescence (Zucker et al., 2008).

Our measure of monitoring targeted parents’ knowledge regarding offspring
activities. Such knowledge does not necessarily reflect parental behaviours but adolescents’ communication with parents (Eaton, Krueger, Johnson, McGue, & Iacono, 2009; Stattin & Kerr, 2000). Adolescents with a close relationship to parents might disclose more about their activities and social networks. Using this reinterpretation of the monitoring concept, a high score on monitoring would reflect open communication and flow of information. The relationship between monitoring and alcohol use might, to some extent, reflect the association between parent communication and alcohol use.

The relatively weak effects of the BIS are consistent with those observed in other studies (Franken et al., 2006; O’Connor et al., 2009; Willem et al., 2010), although slightly weaker. The relatively weak effects may reflect a number of factors. Initially, the current associations were observed in a younger age group than investigated in previous studies. Thus, one interpretation would be that the effect of reward sensitivity increases as a function of age as the normative reinforcement from peer groups becomes stronger. Importantly, and as expected, alcohol use was not prevalent in the current age group. Consequently, the main variation was whether the students had tried alcohol.

Although reinforcement sensitivity was not strongly related to alcohol use in the present study, some of the observed patterns are noteworthy. For example, BIS scores were inversely related to alcohol use. One possible interpretation is that in high BIS adolescents, the sensitivity to negative effects of alcohol, such as parental sanctions, and known side effects (e.g. nausea, blackout and hangover) may decrease the likelihood of early alcohol use (Iacono, Malone, & McGue, 2008; Pardo et al., 2007). It has been shown that a high BAS Drive is associated with more positive alcohol outcome expectancies (Lopez-Vergara et al., 2012; Wardell, Read, Colder, & Merrill, 2012), which could explain the positive bivariate association with pattern of alcohol use.

The current study is not without limitations. About 75% of the eligible students chose to participate in the study. Previous studies have found similar consent rates (Audrain, Tercyak, Goldman, & Bush, 2002; de Winter et al., 2005). The characteristics of non-participants in the present study are unknown. However, based on previous research there is reason to expect a selection on demographic background variables. In other studies non-responders have a higher proportion of parents with low education and from ethnic backgrounds. Still, the effects of non-response on predictor–outcome associations appear to be modest (de Winter et al., 2005; Gerrits, van den Oord, & Voogt, 2001). Based on this, among responders there is reason to expect a selection of adolescents with highly educated parents, but not a strong bias in estimated associations.

The cross-sectional design provides a weak basis for causal interpretations. The lack of longitudinal perspective might be particularly important for the BAS components, as it has been reported that early adolescence is a period with individual changes in the incentive value of rewards (Colder et al., 2013). A cross-sectional analysis only captures the cross-sectional covariation between BIS/BAS and alcohol status. Only longitudinal data can decide whether an increase in BAS Drive will
eventually increase the risk of early alcohol use.

All measures were based on student self-reports, including parental monitoring, which is a limitation regarding the interpretation of the monitoring concept: adolescents’ perceptions of parental monitoring may not always be accurate. However, it should be noted that the current indicators were moderately correlated with parental reports in a subsample of parents with a magnitude comparable to that observed in other studies (Stattin & Kerr, 2000). Self-report on some of the temperamental aspects and alcohol use can be seen as preferable to parental reports, as adolescents are more likely to have first-hand knowledge about fears and inhibitions as well as of their own alcohol involvement. Still, by not including multiple informants there is a risk of common method bias.

Our study did not include parental factors such as parental warmth and permissive rules against alcohol use. These are environmental factors that might contribute to lower alcohol use in young people, and are potentially relevant for early alcohol use. Further, our study did not include the BAS Fun Seeking subcomponent, which relates to alcohol use in older samples (Willem, Bijttebier, Claes, & Uytterhaegen, 2012). This might represent an “omitted variable” problem. However, given the relatively weak correlations among the subcomponents, this omission is not likely to have biased the regression estimates of the included BAS variables.

This study focused on the role of reward sensitivity in motivation for early alcohol use, but there are also other important motivational mechanisms. One motivational pathway is internalising traits, such as depressed affect during childhood (Crum et al., 2008; Virtanen et al., 2015). Alcohol initiation and subsequent use can be viewed as affect regulation and self-medication to cope with negative emotional states (Richmond et al., 2015). In line with the self-medication mechanism, depressed mood in childhood is a risk factor for early alcohol involvement (Crum et al., 2008) and an increased risk of a high-consumption trajectory into later adolescence and adulthood (Virtanen et al., 2015). In future studies, it would be interesting to include information on the role of internalising traits, as such traits might increase the risk of early alcohol use (Crum et al., 2008; Virtanen et al., 2015), independently of reinforcement sensitivity.

Our study also has notable strengths. To our knowledge, it is the first study to examine the joint effects of temperamental traits and parental monitoring on alcohol use in a truly early adolescent sample. Early adolescence represents a particularly relevant group to focus on, because early alcohol use is a significant marker of a range of negative outcomes. Identifying the risk factors and characteristics of early drinkers is crucial in the development of more effective alcohol prevention programmes. A second strength is that the study included a large, diverse sample of normally developing children. From a statistical point of view, the size of the sample is particularly valuable for testing user patterns, where data for some patterns sometimes is sparse. A third strength is that most of our results correspond well with prior results from studies that focus on older age groups.

In conclusion, this study emphasises
the joint effects of family environmental influences, friends’ drinking and temperamental traits on early adolescents’ alcohol use. From a preventive perspective, our study is a call for increased and continued research attention to the individual differences that modulate the response to forceful environmental socialisation agents.

Declaration of interest None.

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