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## **Emotional and psychosocial factors associated with drunkenness and the use of tobacco and cannabis in adolescence: Independent or interactive effects?**

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## **Emotional and psychosocial factors associated with drunkenness and the use of tobacco and cannabis in adolescence: Independent or interactive effects?**

### *Abstract*

*Background:* Although previous research has examined emotional and psychosocial factors associated with substance use, there is a paucity of studies examining both at the same time, and insufficient attention has been paid to how these factors may interact.

*Objectives:* The aim of this study was to simultaneously examine the contributions from emotional (emotional control and depression) and psychosocial (peers' conventional behaviour, peers' substance use and parent-child relationships) factors to drunkenness and the use of tobacco and cannabis in adolescence.

*Methods:* Sample consisted of 1,752 adolescents aged 15 to 16 years who had participated in the 2014 edition of the WHO Health Behaviour in School-aged Children survey in Spain. Data were collected by means of anonymous online questionnaires, and hierarchical multiple regression models (with sex and age as controls and including interactions among the examined predictors) were used for statistical analysis.

*Results:* Emotional and psychosocial factors showed significant interactive effects on substance use. Emotional control, which tended to buffer the effects of potential risk factors, and peers' substance use were consistent predictors of substance use. In contrast, the role of other factors depended on the substance under study, with depression and peers' conventional behaviour being part of interactive terms for tobacco use and cannabis use only, and the quality of parent-child relationships being absent from the final model on cannabis use.

*Conclusions/Importance:* Exploring interactions and potential substance-specific effects is fundamental to reach a better understanding of how emotional and psychosocial factors work in concert relative to substance use in adolescence.

*Keywords:* adolescence; drunkenness; tobacco; cannabis; emotional control; depression; parent-child relationships; peers; interactions.

Substance use—mainly including alcohol, tobacco and cannabis—tends to begin and escalate during adolescence (Currie et al., 2012; Moreno, Ramos, Rivera, Jiménez-Iglesias & García-Moya, 2012). Alcohol is clearly the most frequently used substance in adolescence. Given the wide social acceptance of alcohol use (Pons & Buelga, 2011) and its links to social recreation and leisure (Hibell et al., 2012), some experimentation with alcohol consumption in adolescence is considered to be normal (Currie et al., 2012), but recent data warn that drunkenness-oriented alcohol use is increasing in a number of countries (Kunstche, Rehm & Gmel, 2004; Sánchez-Queija, Moreno, Rivera & Ramos, 2015). In addition, despite a predominant view of tobacco as a harmful substance with negative health effects (Akre, Michaud, Berchtold & Suris, 2010), tobacco is also frequently used in adolescence, and its use steeply increases around the age of 15 years (Moreno et al., 2012). Finally, cannabis has also been the focus of significant attention in studies of adolescent substance use (e.g., Menghrajani, Klaue, Dubois-Arber & Michaud, 2005; Repetto, Zimmerman & Caldwell, 2008) because it is the most frequently used illegal drug during this developmental stage (Hibell et al., 2012).

Drunkenness-oriented alcohol use, tobacco use and cannabis use during adolescence are important matters of public health concern for several reasons. First, substance use is significantly associated with a number of adverse physical, psychological and social consequences (Lavikainen & Lintonen, 2009; Windle, 2003). In addition, substance use during adolescence can disrupt normative brain development (Chambers, Taylor & Potenza, 2003; Squeglia et al., 2012) and trigger the onset of certain mental disorders for individuals with some genetic predisposition (Bagot, Milin & Kaminer, 2015). Furthermore, higher tolerance to some of the negative consequences of substance use during adolescence can contribute to subsequent increases in substance use (Spear, 2011).

Research on the factors that predict substance use during adolescence has been guided by different perspectives on adolescent risk-taking behaviour. Emotional development research, which focuses on affective decision-making and emotional regulation, and social development research, which examines the contributions of social environments, are among the most prominent of such perspectives (Boyer, 2006).

With regard to emotional development perspectives, individual characteristics such as emotional control and depression have been associated with substance use. Impulsivity and, more broadly, dysfunctional styles of emotion regulation have been regarded as key features of risk-taking behaviours during adolescence (Cooper, Wood, Orcutt & Albino, 2003). Engaging in substance use entails giving priority to short-term rewards over long-term potential negative effects, a decision that impulsive individuals are more likely to make (Cooper, Agocha & Sheldon, 2000; Cooper et al., 2003). Accordingly, numerous studies indicate that emotion regulation plays an important role in adolescents' engagement in substance use, with impulsivity being significantly associated with greater substance use (Cooper et al., 2000; Magar, Phillips & Hosie, 2008). Some empirical studies also suggest that negative affect and depression can be prospective predictors of substance use. Some individuals may engage in substance use to alleviate negative affect (Buckner, Keough & Schmidt, 2007; Cooper et al., 2000); in fact, depressive symptoms have been significantly associated with increases in marijuana use (Repetto et al., 2008). However, findings on the role of depressive symptoms in adolescent substance use have been considered inconsistent to some extent, and the possibility has been suggested that negative affect is linked to substance use only under certain circumstances (Chassin, Hussong & Beltran, 2009).

Most social development research has focused on peer influence and parent-child relationships (Boyer, 2006). Although different aspects of adolescents' relationships with peers have been examined, peers' substance use has been identified as one of the strongest

predictors of adolescent substance use (Branstetter, Low & Furman, 2011; Chassin et al., 2009; Heimisdottir, Vilhjalmsson, Kristjansdottir & Meyrowitsch, 2010; Jaccard, Blanton, & Dodge, 2005). Substance use in adolescence usually occurs with peers, and it can be through peers that some adolescents first access certain substances (Morales, Ariza, Nebot, Pérez & Sánchez, 2008; Pons & Buelga, 2011). It has also been emphasized that adolescents learn to conform or deviate from social norms through their peer group (Dorius, Bahr, Hoffmann & Harmon, 2004), where they are concurrently exposed to both adaptive and maladaptive models of behaviour (Prinstein, Boergers & Spirito, 2001). Adolescents will likely conform to peers' attitudes and behaviours regarding substance use as a way to strengthen their relationships, as well as befriend peers who are similar to them in the first place, with both mechanisms reinforcing similarity (Jaccard, Blanton & Dodge, 2005; Kobus, 2003).

In contrast, research is less clear regarding the role of family relationships. Some studies suggest that the contribution of family is modest or even non-significant (e.g., Kuntsche et al., 2004), whereas others suggest that supportive family relationships are significantly associated with reduced substance use during adolescence (Branstetter et al., 2011; Kjaerulff, Rivera, Jiménez-Iglesias & Moreno, 2014). Supportive parent-child relationships increase adolescents' social competence and make them less vulnerable to the influence of deviant peers (Dorius et al., 2004). Furthermore, such relationships can dissuade adolescents from engaging in substance use by somehow making parents psychologically present in adolescents' minds when the opportunity to use substances arises (Jiménez-Iglesias, Moreno, Rivera & García-Moya, 2013; Kerr & Stattin, 2003). That said, the effect size of the reported associations between parent-child relationships and substance use tends to be small (Jiménez-Iglesias et al., 2013; Kjaerulff et al., 2014) and can substantially vary depending on the substance under study (Allen, Donohue, Griffin, Ryan & Turner, 2003).

Therefore, different approaches have provided valuable insight into substance use during adolescence, but some relatively unexplored aspects warrant further attention. First, it is unfortunate that research studies have tended to examine the sets of factors corresponding to the particular theoretical framework of reference in isolation, which has resulted in a scarcity of studies examining both emotional and psychosocial factors at the same time (Boyer, 2006). Second, the roles of some factors, such as depression and parent-child relationships, are not completely clear. Finally, insufficient attention has been paid to how the aforementioned factors interact and work in concert to explain adolescent substance use. Although some studies have moved in this direction, most have been conducted in undergraduate samples (e.g., Auerbach, Abela & Ho, 2007; Buckner et al., 2007), and replicating findings and expanding the number of factors under examination in this area of research is of paramount importance (Hussong & Hicks, 2003).

Therefore, the aims of the current study are to simultaneously examine the contributions of a number of emotional and psychosocial factors, including emotional control, depression, peers' conventional behaviour, peers' substance use and quality of parent-child relationships, in adolescents' substance use and to explore how those factors interact to explain adolescents' substance use. Given that previous research suggests that the links between some of the examined factors and substance use may be substance specific (Allen et al., 2003; Branstetter et al., 2011), the former aim will be conducted separately for drunkenness, tobacco use, and cannabis use.

## **Method**

### **Participants**

Participants came from a representative sample of Spanish adolescents who had participated in the 2014 edition of the WHO international survey *Health Behaviour in School-aged Children* (HBSC) in Spain. Specifically, a random multi-stage sampling strategy stratified by

conglomerates that took into account autonomous region, type of educational centre (state versus private) and habitat (rural versus urban) was used to draw a representative sample of school-aged adolescents in Spain.

The current study focused on the adolescents who had answered the questions herein analysed. More specifically, the sample consisted of 1,752 adolescents (50.5% boys and 49.5% girls) aged 15 to 16 years ( $M = 15.42$ ,  $SD = 0.52$  years) who had answered the Spain HBSC questionnaire form A. Younger adolescents were excluded because the scales measuring depression, emotional control and cannabis use were not included in their questionnaires.

### **Measures**

In addition to the demographic variables of sex and age, the following measures in the Spain HBSC questionnaire 2014 (form A) were used for the purpose of this study.

**Emotional control.** This is a subscale from the reduced version of the *Emotion Regulation Index for Children and Adolescents (ERICA)*; MacDermott, Gullone, Allen, King, & Tonge, 2010). This scale consists of 8 items, such as “I have trouble waiting for something I want” and “I do things without thinking about them first”, that are answered on a 5-point Likert scale. Higher scores in this scale represent higher levels of emotional control.

**Depression.** This variable was assessed by means of the Center for Epidemiology Depression Scale 12 (CED-S; Roberts & Sobhan, 1992), comprising 12 items, such as “felt depressed”, “felt that everything was an effort” and “enjoyed life”. After the applicable items are reversed-coded, scores range from 0 to 36, with higher scores being indicative of a greater presence of depressive symptoms.

**Quality of parent-child relationships.** This is a composite factorial score ( $M=5$ ,  $SD=2$ ) that has been regarded as a useful tool in global assessments of parent-child relationships as perceived by the adolescents (García-Moya, Moreno & Jiménez-Iglesias, 2013). It includes

the following key dimensions: affection (including items such as "my mother/father is loving" and "my mother/father makes me feel better when I'm upset"), ease of communication (including items such as "how easy is it for you to talk to the following persons [mother/father] about things that really bother you?"), parental knowledge (including items such as "how much your father/your mother knows about who your friends are") and satisfaction with family relationships (measured by means of the item "In general, how satisfied are you with the relationships in your family?").

Peers' conventional behaviour. This measure was developed from a set of optional HBSC items assessing behaviours in the peer group (Gaspar de Matos et al., 2009), and it assesses the frequency of the following conventional behaviours: getting on well with parents, doing well at school, participating in sport and participating in cultural activities. Average scores are obtained from adolescents' responses about the frequencies of these behaviours in their peer group on a Likert scale from 1 = most of their friends exhibit the behaviour *never or almost never* to 3 = most of their friends exhibit the behaviour *very often*. Previous analyses have supported the unidimensionality of this scale (García-Moya, Moreno & Rivera, 2014).

Peers' substance use. This measure is also part of the optional HBSC items assessing behaviours in the peer group (Gaspar de Matos et al., 2009), and it includes the following four items: Most of the friends in my group... "smoke cigarettes", "drink alcohol", "get drunk" and "have used drugs to get stoned".

Adolescents' substance use. The three dependent variables of interest in the current study included drunkenness, tobacco use, and cannabis use. Specifically, adolescents were asked, "Have you ever had so much alcohol that you were really drunk in the last 30 days?", "On how many days (if any) have you smoked cigarettes in the last 30 days?", and "Have you ever taken cannabis (sometimes called pot, dope or weed) in the last 30 days?". These measures for the assessment of substance use have been derived from the *European School*



*Survey Project on Alcohol and other Drugs* (ESPAD) study (Hibell et al., 2000). The answer options range from 0 (*No, never*) to 10 (*Yes, more than 10 times*) for drunkenness and from 0 (*Never*) to 30 (*30 days*) for tobacco and cannabis use.

## **Procedure**

Data collection complied with the three requisites established in the international HBSC protocol (Roberts et al., 2009): students answered the questionnaires by themselves, data collection took place at the school during school hours, and participants' anonymity was ensured. Passive consent was obtained from the participants' parents. The instrument and all procedures employed in the Spanish part of the HBSC study were approved by the Experimentation Ethical Committee of the University of Seville (Spain).

Statistical analyses were conducted using IBM SPSS 22 and included preliminary descriptive analyses by sex and age, Student's *t*-tests and correlations, and bivariate correlations between the predictors and each of the three dependent variables. Then, hierarchical multiple regression analyses were used to examine the relationships between the predictors and the dependent variables on drunkenness, tobacco use and cannabis use, controlling for the effects of sex and age. In line with the aims of this study, interactions between the predictors were also analysed. As recommended by Dawson (2014), predictors were z-standardized prior to regression analyses to prevent multicollinearity problems and to facilitate the interpretation of interactions.

Three-step hierarchical linear regression analyses were conducted, and the increments in  $R^2$  at each step were calculated. Specifically, sex and age were routinely entered as control variables in step 1. The main effects of the predictors (i.e., emotional control, depression, quality of parent-child relationships, peers' conventional behaviour and peers' substance use) were included in step 2, and all possible two-way interaction terms between those predictors were entered in step 3. Non-significant interaction terms from that complete model's step 3

were excluded, and a final model was then calculated to allow for optimal interpretation (Dawson, 2014). When the results of the final model indicated that the association between a given predictor and the dependent variable was dependent on two moderators, an additional model of contrast including the 3-way interaction term (and any additional necessary 2-way interaction terms, if any) was tested, with the significance of the term examined.

Significant interactions were plotted using the worksheets developed by Dawson (2014). In the absence of a science-based rationale behind the selection decisions for the values of the moderators upon which to probe for significant interactions,  $+1SD$  and  $-1SD$  levels of the moderator variables were used (Aiken & West, 1991). Simple slope  $t$ -tests for 2-way interactions (Cohen, Cohen, West & Aiken, 2003) and slope difference  $t$ -tests for 3-way interactions (Dawson, 2014) were also calculated.

## Results

Descriptive statistics and bivariate analyses of substance use by sex and age are presented in Table 1. Significant differences between boys and girls were found in drunkenness and cannabis use. In addition, significant positive correlations were found between age and the three dependent variables (i.e., drunkenness, tobacco use and cannabis use).

-Table 1-

Bivariate correlations were also calculated to generally investigate the relationships between the examined variables prior to conducting the regression analyses (see Table 2). Significant moderate associations were found among drunkenness, tobacco use and cannabis use. In addition, small to moderate correlations were found between the predictors and the aforementioned dependent variables: emotional control and quality of parent-child relationships showed significant negative correlations with drunkenness, tobacco use and cannabis use; peers' conventional behaviour was negatively associated with tobacco and cannabis use; and peers' substance use and depression were positively associated with the

three dependent variables. The sizes of the correlations with the three examined substances were quite homogeneous, except for depression, whose correlation with drunkenness, despite being significant, was of a lower magnitude than those found with tobacco use and cannabis use. The predictors also tended to correlate with each other, with the highest correlations being found between depression and quality of parent-child relationships and between depression and emotional control.

-Table 2-

The results for drunkenness are presented in Table 3. The final model (model 3) explained 15.1% of the variability in drunkenness, with the interaction terms accounting for 5.4% of the variability. Drunkenness was significantly associated with age ( $p < .01$ ); older adolescents showed a higher frequency of drunkenness. The 3-way interaction term emotional control x peers' substance use x parent-child relationships also made a significant contribution towards explaining drunkenness ( $p < .001$ ). The interaction plot is presented in Figure 1.

-Table 3-

The interaction plot for this term (see Figure 1) shows that the role of emotional control seemed to be different in the group of adolescents reporting higher levels of peer substance use and low-quality parent-child relationships (slope 2; black diamonds) in comparison with any of the remaining groups, in the sense that low emotional control in those circumstances was associated with a marked increase in drunkenness. In addition, lower levels of peer substance use were associated with less drunkenness (see slopes 3 and 4; white and black squares), with adolescents reporting both low peer substance use and high-quality parent-child relationships (slope 3; white squares) exhibiting the lowest levels of drunkenness irrespective of emotional control. *T*-tests for slope differences indicated that there were no significant differences in the associations between emotional control and drunkenness between slopes 1 and 3 ( $t = 0.240, p = .810$ ), 1 and 4 ( $t = 0.440, p = .660$ ) or 3 and 4 ( $t = 0.219,$

$p = .826$ ). In contrast, the association of emotional control and drunkenness represented by slope 2 was significantly different compared to slope 1 ( $t = 5.584, p < .001$ ), slope 3 ( $t = -5.071, p < .001$ ) or slope 4 ( $t = -4.695, p < .001$ ).

The results for tobacco use are presented in Table 4. The final model (model 3) explained 18.9% of the variability in tobacco use, with the interaction terms accounting for 4.7% of the total explained variance. Tobacco use was significantly associated with age ( $p < .05$ ) and with the following interactions terms: emotional control x depression ( $p < .01$ ), emotional control x peers' substance use ( $p < .001$ ) and parent-child relationships x peers' conventional behaviour ( $p < .001$ ). Interaction plots are herein presented.

-Table 4-

For the interaction between emotional control and depression (see Figure 2, plot a), the relationship between emotional control and tobacco use was always negative, but the slope was higher for adolescents with high depression scores. Simple slope tests indicated that having low versus high levels of emotional control was not significantly associated with tobacco use when depression scores were low (simple slope  $b = -0.412, p = .130$ ), but lower levels of emotional control (i.e., higher impulsivity) were significantly associated with greater tobacco use for adolescents with high scores in depression (simple slope  $b = -1.596, p < .001$ ). Regarding the interaction between peers' substance use and emotional control (see Figure 2, plot b), the association between peers' substance use and adolescents' tobacco use tended to be positive, but it was notably more so for adolescents with low emotional control. Simple slope tests showed that—whereas for adolescents with low emotional control, higher substance use in the peer group was significantly associated with higher tobacco use (simple slope  $b = 2.265, p < .001$ )—the relationship between peers' substance use and tobacco use was not significant for adolescents with high levels of emotional control (simple slope  $b = 0.301, p = .312$ ). Finally, as shown in Figure 2 plot c, a higher quality of parent-child

relationships was significantly associated with lower tobacco use when peers' conventional behaviour was low (simple slope  $b = -1.207, p < .001$ ), but the association was not significant when the presence of conventional behaviour in the peer group was high (simple slope  $b = 0.127, p = .661$ ).

The results for cannabis use are presented in Table 5. The final model (model 3) accounted for 13.3% of the variability in cannabis use, with interactions representing 3.4%. Being a boy ( $p < .01$ ) and peers' substance use ( $p < .01$ ) were positively associated with cannabis use. The interaction terms emotional control x depression and peers' conventional behaviour x emotional control were also significantly associated with cannabis use ( $p < .001$  and  $p < .05$ , respectively).

The interaction between emotional control and depression is plotted in Figure 3a. Simple slope tests indicated that having low versus high levels of emotional control was not significantly associated with cannabis use when depression scores were low (simple slope  $b = 0.128, p = .445$ ). In contrast, lower levels of emotional control (i.e., higher impulsivity) were significantly associated with higher cannabis use for adolescents with high depression scores (simple slope  $b = -1.078, p < .001$ ). Regarding the interaction between emotional control and peers' conventional behaviour, as shown in Figure 3 plot b, the association between emotional control and adolescents' cannabis use always tended to be negative, but it was more negative for adolescents experiencing a low presence of conventional behaviour in their peer groups. More specifically, simple slope tests showed that lower emotional control was significantly associated with higher cannabis use for adolescents with low levels of conventional behaviour in their peer groups (simple slope  $b = -0.713, p < .001$ ), but this association was not significant when peers' conventional behaviour was high (simple slope  $b = -0.237, p = .170$ ).

-Table 5-

## Discussion

The present study analysed the relationships among emotional and psychosocial factors and the frequency of drunkenness, tobacco use and cannabis use in a representative sample of adolescents aged 15 to 16 years. As expected, some results tended to replicate well-known findings in the study of adolescent substance use. For example, our results are consistent with recent studies that indicate an increasing gender convergence regarding drunkenness (de Looze et al., 2015, Kjaerulff et al., 2014) and tobacco use (Moreno et al., 2012) and a higher prevalence of cannabis use in boys (Guxens et al., 2007; Moreno et al., 2012). The same applies to the unambiguous effects of emotional control and peers' substance use that were observed to act upon the three substance use behaviours. Impulsivity has been regarded as a generalized risk factor for risk behaviour in adolescence, including substance use (Cooper et al., 2003). Peers' substance use has been portrayed as one of the most reliable and influential predictors of adolescent substance use (Branstetter et al., 2011; D'Amico & McCarthy, 2006; Prinstein et al., 2001), and some recent studies specifically suggest that the adolescent brain seems to be especially sensitive to rewards coming from the peer group (see Steinberg, 2010).

Importantly, however, the analyses of interactions in the present study provided a deeper and a more nuanced view of the role of the examined factors beyond the aforementioned general findings. First, rather than exerting a consistent independent effect, emotional control tended to serve a generalized risk-buffering role among adolescents exposed to emotional or psychosocial risk factors for substance use: low-quality parent-child relationships and high peer substance use in predicting drunkenness; substance-using peers or depressive symptoms in predicting tobacco use; and depressive symptoms or low presence of peers' conventional behaviours in predicting cannabis use. However, emotional control was unimportant in the absence of these risk factors. Predominant peer substance use in adolescence, a developmental stage in which identification with the peer group is central and in which substance use can be part of the group culture (Pons & Buelga, 2011), along with

low-quality relationships with parents, which can accentuate the need for acceptance in other contexts and make the adolescent more likely to show conformity with his or her peers as a way to strengthen their ties (Pons & Buelga, 2011), give rise to an environment in which high levels of emotional control are fundamental. Similarly, from the obtained findings, one can hypothesize that poor emotional control may crystallize into higher tobacco or cannabis use only for those experiencing high levels of negative affect or, alternatively, that negative affect tends to lead to an increased likelihood of substance use only when it is not adequately managed.

This finding on the interaction between emotional control and depression significantly contributes to our understanding of the role played by depressive symptoms in adolescent substance use, a facet for which scientific literature has offered few conclusions. In particular, the sizes of reported associations tend to be low (e.g., Escobedo et al., 1998), and neither the direction of the association nor the responsible underlying mechanisms seems to be clear in adolescence (Chassin et al., 2009; Martini, Wagner & Anthony, 2002). One of the most prototypical characteristics of individuals with substance use problems (compared to controls) is their increased tendency to act impulsively in response to negative emotional states (Verdejo-García, Bechara, Recknor & Pérez-García, 2007). In one of the few studies examining interactions, Buckner et al. (2007), who analysed potential mechanisms linking depressive symptoms with cannabis use in undergraduates, concluded that depressive individuals were less able to tolerate psychological distress, which led them to use cannabis as a way to regulate their negative emotions. However, there is a paucity of previous research exploring these kinds of interaction in normative adolescents, so ours is a novel finding that deserves further examination.

Finally, some of the interactions found in the present study may also explain to some extent the mixed findings in previous research on the role of parent-child relationships, where

both modest and non-significant effects (e.g., Kunstche et al., 2004) and significant ones have been reported (Kjaerulff et al., 2014). Simons-Morton (2002) concluded that parental involvement acted as a risk-buffering factor against tobacco use for adolescents with peers with behavioural problems, a result which coincides with the present study, which nonetheless has gone one step further by documenting the interactions of parent-child relationships with the presence of peers' conventional behaviour and with substance-using peers for tobacco use and drunkenness respectively.

Lastly, the present study also makes some valuable contributions regarding substance-specific factors. In other words, different patterns emerged when comparing the models obtained for drunkenness, tobacco use and cannabis use, meaning that a set of common factors does not seem to suffice for fully explaining adolescent substance use.

First, the aforementioned combination of depressive symptoms and poor emotional control was significantly associated with increased tobacco and cannabis use, but depressive symptoms were absent from the model on drunkenness. Previous research had reported weak or conflicting effects of depressive symptoms (Chassin et al., 2009), and some studies had revealed non-significant effects of depression once other relevant factors, such as impulsivity and avoidance coping, were controlled for (Cooper et al., 2003). Future research may contribute to clarifying these results by exploring whether the motives for use vary for different substances. Some studies indicate that, unlike in adults, coping motives for drinking are not very common among adolescents, where alcohol is predominantly viewed as a substance linked to partying and enjoying social situations with friends (for a review, see Kunstche, Knibbe, Gmel & Engels, 2005). Along the same lines, Pons and Buelga (2011) stated that although emotional instability could be considered a prominent risk factor for alcohol problems in adulthood, that link is substantially less clear in adolescence, during which alcohol motives related to group bonding and fun prevail.



Another factor that was significant for tobacco and cannabis use but that was absent from the final model on drunkenness was peers' conventional behaviour. Perceived approval of use among close friends seems to be a robust predictor of adolescents' substance use intentions (Olds, Thombs & Tomasek, 2005). Therefore, whereas conventional peers are likely to disapprove of tobacco and cannabis use, the same may not apply to alcohol use, which is very prevalent among adolescents and widely socially accepted (Megías et al., 2007; Pons & Buelga, 2011).

Furthermore, an unexpected finding was the non-significance of parent-child relationships in predicting cannabis use. It is interesting that this discrepancy in cannabis compared to alcohol and tobacco seems to coincide with the results from a meta-analysis that concluded that the size of parental influence was substantially smaller for marijuana use compared to tobacco and alcohol use (Allen et al., 2003). It would seem that cannabis use is a behaviour for which peers seem to have an increased influence in comparison with other substances (Allen et al., 2003), with the vast majority of regular cannabis users in secondary education obtaining cannabis from their friends (Morales et al., 2008). However, other studies have indicated that family is important for cannabis use (Guxens et al., 2007; Jovic et al., 2014), although such effects, when found, have usually been small (Dorius et al., 2004; Jiménez-Iglesias et al., 2013).

In our view, a number of alternative hypotheses should be explored before ruling out a significant effect of the quality of parent-child relationships on adolescent cannabis use. It may be the case that other, more specific family dimensions that were not analysed in the present study, such as time spent with parents (Best et al., 2005) or parental rules on substance use (de Looze et al., 2012), bear clearer associations with cannabis use. Family effects on cannabis use may also be indirect, in the sense that high-quality family relationships can, for instance, decrease the likelihood of affiliation with substance-using

peers (Ladd & Pettit, 2002; Mounst, 2002). Indeed, according to Urberg, Luo, Pilgrim and Degirmencioglu (2003), family bonding is the strongest predictor of whether adolescents befriend peers who use substances at a higher rate than they do. Finally, developmental aspects deserve further examination, as previous research has indicated that protective effects of family for cannabis initiation between the ages of 11 and 13 years vanish in older adolescents (Tang & Orwin, 2009). The aforementioned reasons, along with the inherent complexities involved in the study of family influences on adolescent substance use (see Darling & Cumsille, 2003 for a review), make it advisable to further investigate the role of family on cannabis use.

This study has some limitations that should be taken into account in the interpretation of its findings. First, the cross-sectional design does not allow for drawing conclusions on the direction of the relationships found, which may be bidirectional. Second, it could be argued that a separate analysis of different substance use behaviours fails to reflect the fact that those behaviours usually co-occur (Agrawal, Budney & Linskey, 2012; de Looze et al., 2012). Nevertheless, the separate analyses in the present study revealed some specificity in the factors associated with drunkenness, tobacco and cannabis use that would otherwise have been obscured. Finally, some studies have warned about the fact that adolescents' self-reports tend to overestimate their similarities with their friends (Kobus, 2003; Maxwell, 2002), which may have resulted in some inflation of the associations between peer variables and adolescents' substance use. That said, the use of self-reports has been considered to represent a valid and reliable approach to adolescents' actual substance use when the questionnaires are administered at school and confidentiality and anonymity are ensured (Brenner, Billy & Grady, 2003), as in the present study.

Despite the aforementioned limitations, this study also has a number of strengths. It provides a more nuanced view of substance use and reveals some interesting and novel

findings on both common and substance-specific factors associated with drunkenness, tobacco use and cannabis use in adolescence. In addition, the present study not only includes both psychosocial and emotional factors, which to date had been more extensively studied in isolation (Boyer, 2006), but also goes an important step beyond by exploring the interactions between them, thereby reaching a better understanding of how factors such as emotional control, depression, peers' characteristics and parent-child relationships work in concert relative to substance use. Thanks to this approach, the present study has contributed to shedding some light on previous conflicting findings on the role of parent-child relationships and, most notably, depression, which we hope will encourage future research to continue exploring these features.

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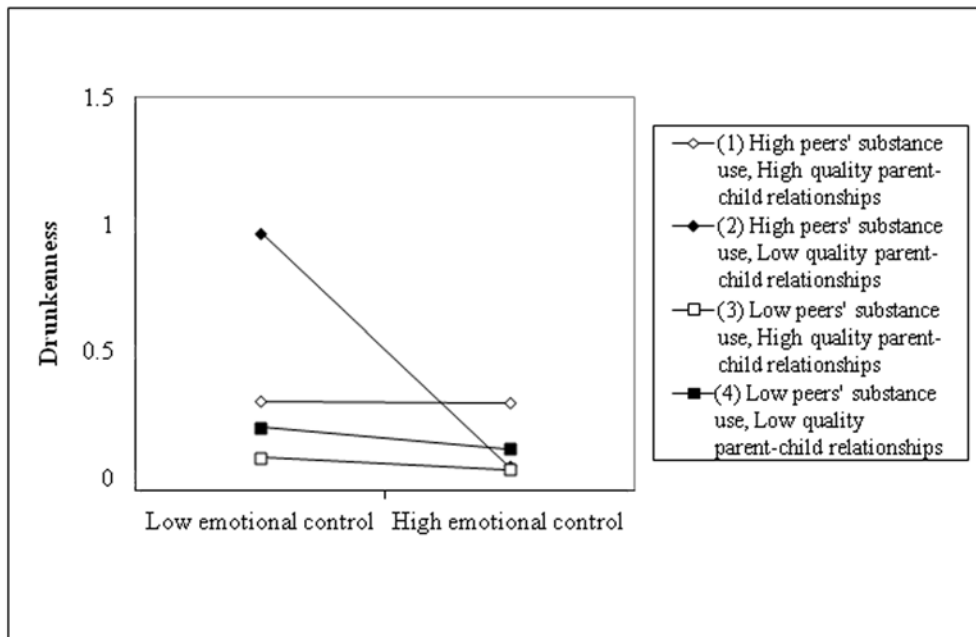
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## Figures



*Figure 1.* Interaction plot for the significant three-way interaction, involving emotional control, peers' substance use and quality of parent-child relationships, in the analysis of adolescent drunkenness.

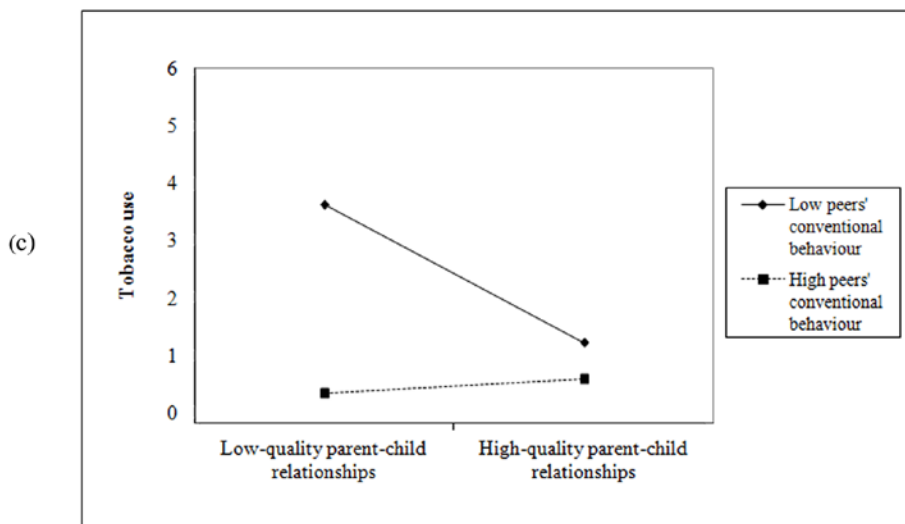
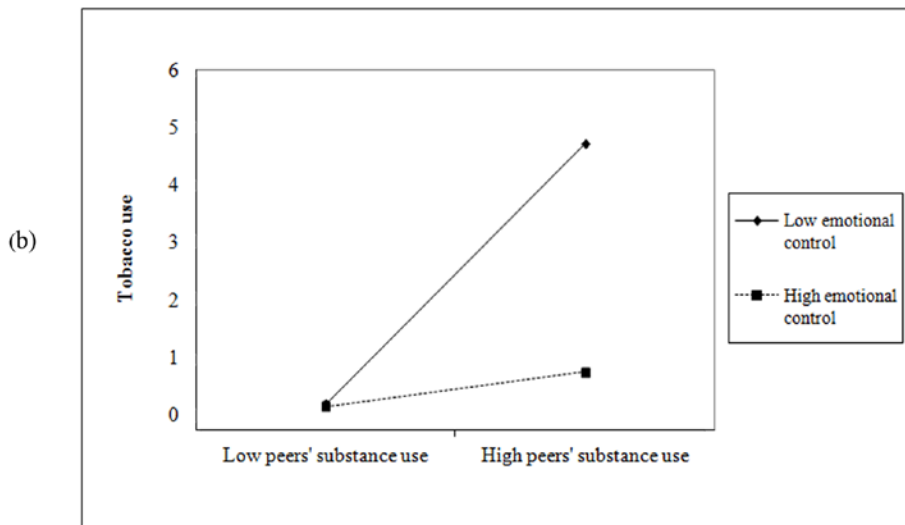
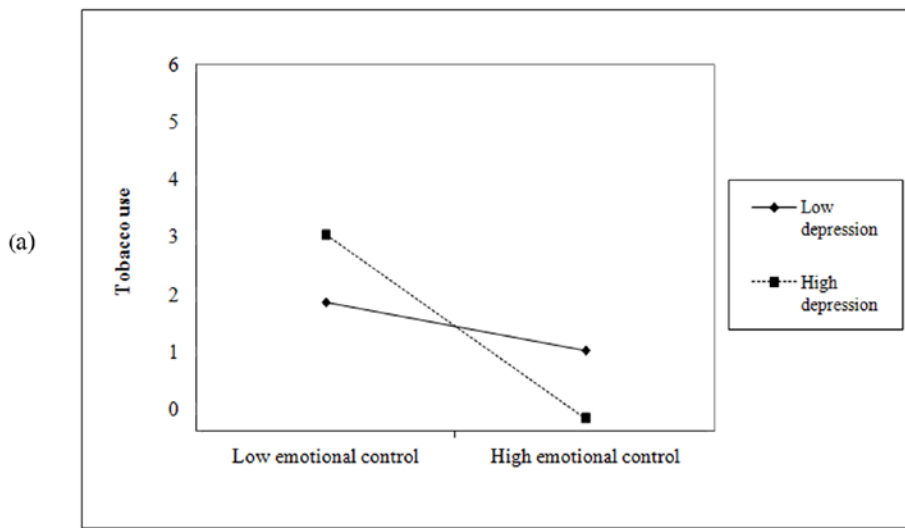


Figure 2. Interaction plots for the significant two-way interactions in the analysis of adolescent tobacco use: emotional control by depression (a), peers' substance use by emotional control (b) and quality of parent-child relationships by peers' conventional behaviour(c).

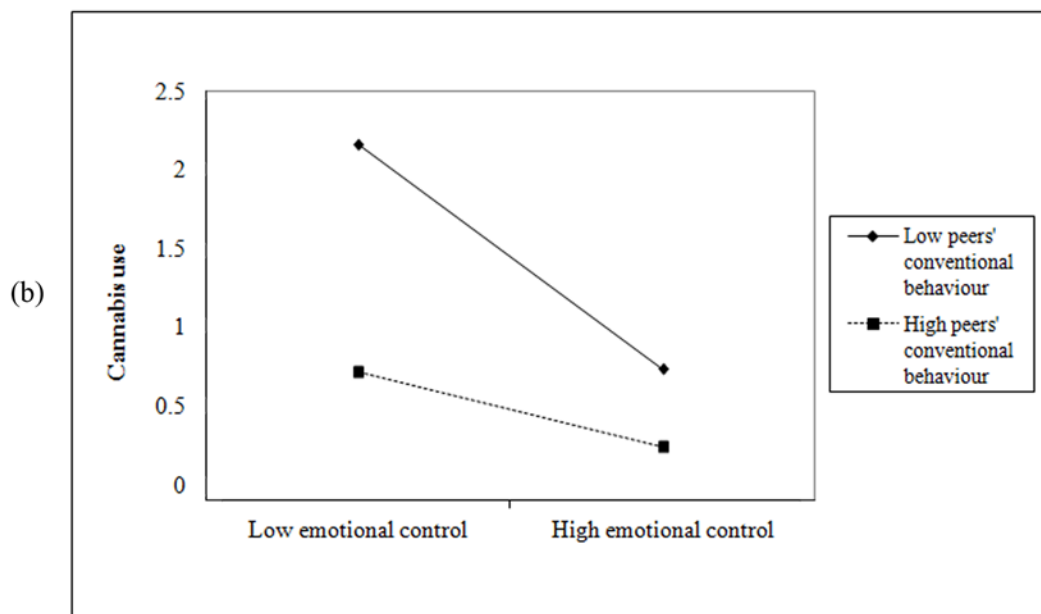
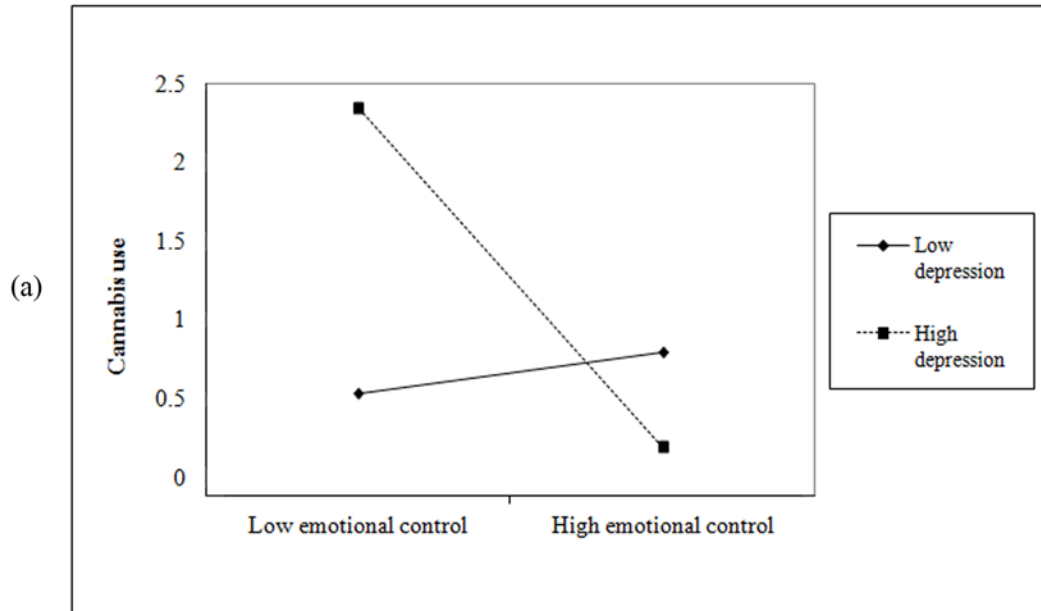


Figure 3. Interaction plots for the significant two-way interactions in the analysis of adolescent cannabis use: emotional control by depression (a) and emotional control by peers' conventional behaviour (b).

## Tables

Table 1. *Bivariate descriptive analyses of drunkenness, tobacco use and cannabis use by sex and age*

	Descriptives						Bivariate analysis				
	Total			Boys		n	Girls		n	Sex	Age
	<i>M</i>	<i>SD</i>	N	<i>M</i>	<i>SD</i>		<i>M</i>	<i>SD</i>		<i>t</i>	<i>r</i>
<b>Drunkenness</b>	.28	1.13	1653	.34	1.31	831	.22	.91	822	2.241*	.133**
<b>Tobacco use</b>	2.02	6.71	1657	1.93	6.64	830	2.11	6.79	827	-0.556	.126**
<b>Cannabis use</b>	.84	3.97	1407	1.11	4.68	686	.58	3.15	721	2.483*	0.91**

\*\* $p < .01$ ; \* $p < .05$ .



Table 2. Pearson- *r* correlations among drunkenness, tobacco use, cannabis use and the examined emotional and psychosocial factors

	2	3	4	5	6	7	8
1. Drunkenness	.366**	.444**	-.179**	.080*	-.163**	-.028	.250**
2. Tobacco use	1	.481**	-.241**	.156**	-.189**	-.157**	.250**
3. Cannabis use	.481**	1	-.203**	.178**	-.149**	-.132**	.198**
4. Emotional control	-.241**	-.203**	1	-.342**	.274**	.163**	-.184**
5. Depression	.156**	.178**	-.342**	1	-.396**	-.137**	.153**
6. Parent-child relationships	-.189**	-.149**	.274**	-.396**	1	.186**	-.146**
7. Peers' conventional behaviour	-.157**	-.132**	.163**	-.137**	.186**	1	.104**
8. Peers' substance use	.250**	.198**	-.184**	.153**	-.146**	.104**	1

\*\*  $p < .01$ ; \*  $p < .05$

Table 3. Hierarchical multiple regression analysis of emotional and psychosocial factors on drunkenness

Variable	<i>B</i>	<i>SE</i>	<i>p</i>	<i>R</i> <sup>2</sup>	$\Delta R^2$	<i>rs</i> <sup>2</sup>
<i>Model 1</i>				.018**	--	
Constant	.312	.047	.000			
Sex	-.077	.064	.229			.001
Age	.135	.032	.000			.016
<i>Model 2</i>				.098**	.080**	
Constant	.309	.045	.000			
Sex	-.077	.062	.219			.001
Age	.084	.032	.008			.006
Emotional control	-.136	.033	.000			.014
Depression	-.037	.034	.279			.001
Parent-child relationships	-.122	.034	.000			.011
Peers' conventional behaviour	-.003	.032	.924			.000
Peers' substance use	.196	.033	.000			.030
<i>Model 3</i>				.151**	.054**	
Constant	.253	.045	.000			
Sex	-.082	.061	.179			.001
Age	.097	.031	.002			.008
Emotional control	-.132	.033	.000			.013
Depression	-.033	.034	.331			.001
Parent-child relationships	-.077	.034	.021			.004
Peers' conventional behaviour	.004	.031	.893			.000
Peers' substance use	.148	.033	.000			.016
Emotional control x parent-child relationships	.119	.029	.000			.013

Peers' substance use x emotional control	-.100	.032	.002	.008
Peers' substance use x parent- child relationships	-.027	.032	.385	.001
Emotional control x peers' substance use x parent-child relationships	.110	.029	.000	.011

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\*\* $p < .01$

Table 4. Hierarchical multiple regression analysis of emotional and psychosocial factors on tobacco use

Variable	<i>B</i>	<i>SE</i>	<i>p</i>	<i>R</i> <sup>2</sup>	$\Delta R^2$	<i>rs</i> <sup>2</sup>
<i>Model 1</i>				.015**	--	
Constant	1.924	.303	.000			
Sex	.299	.413	.470			.000
Age	.842	.209	.000			.015
<i>Model 2</i>				.142**	.126**	
Constant	1.987	.285	.000			
Sex	.180	.392	.646			.000
Age	.400	.200	.046			.003
Emotional control	-1.012	.211	.000			.019
Depression	.036	.217	.869			.000
Parent-child relationships	-.627	.212	.003			.007
Peers' conventional behaviour	-.963	.203	.000			.018
Peers' substance use	1.461	.206	.000			.041
<i>Model 3</i>				.189**	.047**	
Constant	1.438	.288	.000			
Sex	.234	.382	.540			.000
Age	.449	.195	.022			.004
Emotional control	-1.004	.205	.000			.018
Depression	.001	.212	.997			.000
Parent-child relationships	-.540	.208	.009			.005
Peers' conventional behaviour	-.982	.198	.000			.019
Peers' substance use	1.283	.202	.000			.031
Emotional control x depression	-.592	.179	.001			.008
Peers' substance use x	-.982	.194	.000			.020

emotional control

Parent-child relationships x				
peers' conventional behaviour	.667	.180	.000	.010

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*Note:* The 3-way interaction term emotional control x depression x peers' substance use (also including the additional necessary 2-way term peers' substance use x depression) was tested in an additional model of contrast but it was non-significant ( $p = .461$ ).

\*\*  $p < .01$

Table 5. Hierarchical multiple regression analysis of emotional and psychosocial factors on cannabis use

Variable	<i>B</i>	<i>SE</i>	<i>p</i>	<i>R</i> <sup>2</sup>	$\Delta R^2$	<i>rs</i> <sup>2</sup>
<i>Model 1</i>				.008*	--	
Constant	1.134	.182	.000			
Sex	-.481	.249	.053			.004
Age	.251	.125	.046			.004
<i>Model 2</i>				.099**	.091**	
Constant	1.217	.175	.000			
Sex	-.647	.242	.008			.006
Age	.044	.123	.719			.000
Emotional control	-.480	.129	.000			.012
Depression	.356	.132	.007			.006
Parent-child relationships	-.126	.131	.338			.001
Peers' conventional behaviour	-.472	.124	.000			.013
Peers' substance use	.671	.127	.000			.024
<i>Model 3</i>				.133**	.034**	
Constant	.962	.177	.000			
Sex	-.638	.237	.007			.006
Age	.067	.120	.576			.000
Emotional control	-.475	.127	.000			.012
Depression	.303	.131	.021			.004
Parent-child relationships	-.123	.129	.341			.001
Peers' conventional behaviour	-.485	.123	.000			.013
Peers' substance use	.669	.124	.000			.024
Emotional control x depression	-.603	.109	.000			.025
Peers' conventional behaviour	.238	.108	.028			.004

x emotional control

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*Note:* The 3-way interaction term emotional control x depression x peers' conventional behaviour was tested in an additional model of contrast (also including the additional necessary 2-way term peers' conventional behaviour x depression) but it was non-significant ( $p = .750$ ).

\*\*  $p < .01$ ; \*  $p < .05$