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Longitudinal Analysis of the Role of Family Functioning in Substance Use

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Abstract Substance use during adolescence and emerging adulthood is a risk factor for subsequent substance abuse, and it may be related to emotional and behavioral problems. Research shows the importance of family relationships in preventing substance use. However, much of the research in this field comes from large cross-sectional and epidemiological studies, and there is a lack of longitudinal studies that analyze both the intra-individual change and the protection factors associated to it. Using HLM analysis, the present longitudinal study found a linear increase of substance use throughout adolescence and emerging adulthood. We found no differences in early adolescence between sexes, but boys increased substance use more than girls throughout adolescence. Moreover, adolescents who remembered caring mothers during childhood reported less substance use during early adolescence, and those with more cohesive families showed less increase in substance use during adolescence and emerging adulthood. Finally, we discuss the importance of family care and family cohesion on preventing substance use during adolescence and emerging adulthood.

Keywords Family · Substance use · Adolescence · Emerging adulthood · Longitudinal analysis

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Introduction

The interval between puberty and early adulthood is a developmental stage in which experimentation and risk-taking are relatively frequent and even normative. From puberty many adolescents begin to consume alcohol, tobacco, or cannabis (Kuntsche and Müller 2012; Ramos et al. 2011). Throughout adolescence substance use gradually increases until reaching its peak during emerging adulthood, at which point it begins to decrease (Chassin et al. 2004; Maggs and Schulenberg 2004).

The fact that substance use is widespread among young people should not lead us to ignore its negative consequences for health. Ample empirical evidence indicates that substance abuse provokes important short-, medium- and long-term difficulties, both at the physical and the psychological level (Chassin et al. 2009). There are a great deal of studies revealing that consumption of alcohol and other harmful substances during adolescence can alter the normal neurological development of the brain when it is in an intense process of maturation (Lydon et al. 2014; Squeglia et al. 2009; Squeglia et al. 2012). This would have an important impact at psychological and behavioral levels, even facilitating the development of addictive behavior. In fact, early initiation in substance use is one of the main predictors of subsequent abusive consumption (Chambers et al. 2003). Several longitudinal studies have found adolescents whose early substance use initiation is associated with a significant increase in consumption and worse subsequent consequences (Chassin et al. 2002; Abroms et al. 2005; Wilks et al. 2004). The idea that early substance use can lead to subsequent abusive consumption is also consistent with data from animal experimentation showing that adolescents, in contrast to adults, present a different sensitivity to the effects of drugs, which makes

them more vulnerable to addictions (Higuera-Matas et al. 2008; Spear and Varlinskaya 2005).

The great social concern generated by adolescent substance use is revealed in the large amount of prevalent data from cross-sectional studies. These studies showed an increase in substance use over time throughout adolescence and emerging adulthood and higher substance use among males compared with females (Jiménez-Iglesias et al. 2013; Kuntsche et al. 2004). Nevertheless, these differences between the sexes are narrowing in many Western countries (Keyes et al. 2011; Kuntsche et al. 2011). However, there is a lack of data coming from longitudinal research that analyzes developmental trajectories of substance use throughout adolescence and emerging adulthood, and none in a Spanish context. But only longitudinal studies allow to identify the diversity of trajectories that are masked in the global substance use increase found in cross-sectional studies (Chassin et al. 2002; Flory et al. 2004; Maggs and Schulenberg 2004; Schulenberg and Maggs 2002). Longitudinal studies indicate that there are no differences in substance use between the sexes at the beginning of adolescence, but males increase substance consumption over time more than females. So, during late adolescence and emerging adulthood men present higher levels of substance use than women (Biehl et al. 2007; Duncan et al. 2006).

Moreover, longitudinal studies also permit us to detect factors related both to the initial levels of substance use and its trajectory through time. Family context can be an important protective factor against problem behaviors, such as substance use (Kelly et al. 2011; Stice and Barrera 1995). Parental control or monitoring has clearly shown its influence in the prevention of substance use (DiClemente et al. 2001; Dick et al. 2007; Dishion and Loeber 1985). Moreover, the affective dimension of parent–child relationships has also been shown to be relevant. Specifically, the affective bond with parents, parental responsiveness and support, and family cohesion are variables that have been postulated to be factors that prevent adolescent substance use (Baumrind 1991; Farrell et al. 1995; Kopak et al. 2012). The mechanisms that may explain this relationship are of two types. Firstly, according to the Theory of Social Control (Akers and Sellers 2004; Gottfredson and Hirschi 1990), adolescents usually show a natural tendency toward deviant behaviors that are offset by the prosocial control carried out by the family and other institutions. When adolescents grow up in an environment of affection and closeness to their parents, they are inclined to act in non deviant ways in order to attain their approval. In contrast, if the parent–child relations are marked by detachment, antisocial tendencies will be openly manifested.

Another mechanism that may justify the relationship between family relationships and substance use is of neuronal character. According to this mechanism, a link between the affective bond established in childhood and substance use can be found. The first data in support of this influence comes from animal experimentation, which has revealed the relation of close physical contact between mother and offspring to the production of oxytocin and dopamine. Taking into account that dopamine plays an important role in prefrontal brain development, it has been proposed that strengthening the inputs of dopamine is the mechanism through which affection in parenting style and warm emotional experiences with parents and caregivers will contribute to the maturity of the prefrontal cortex. Some of the functions of the prefrontal cortex are impulse control, decision-making and anticipation of results (Casey et al. 2011; Eisler and Levine 2002; Somerville et al. 2010; Steinberg 2007). Therefore, such prefrontal maturation promoted by parental affection would allow adolescents a better regulation of their behavior, so preventing the onset of addictions (Steinberg 2007). In fact, there is important empirical support for the relation between low self-control and some risk-taking behaviors such as substance use (De Ridder et al. 2012; Ford and Blumenstein 2013). In a similar vein, there is empirical evidence finding that children living in family contexts characterized by lack of affection and who develop insecure attachments are at greater risk of emotional and behavioral problems in adolescence and emerging adulthood (Cicchetti et al. 1995; Kassel et al. 2007).

The main goal of the present study was to analyze the influence of family relationships on the trend of substance use in a sample of Andalusian (South Spain) youths throughout adolescence and emerging adulthood. The longitudinal design allows us to analyze the intra-individual change in substance use throughout this period, our second goal. Although many studies have focused on some concrete substances such as tobacco or alcohol, in this work, we decided to combine the use of different substances into a single variable, enabling us to compute an interval variable that provides clear advantages for statistical analysis (Simons-Morton 2007). The first step was to analyze the substance use trend throughout adolescence and emerging adulthood. Our hypothesis was that, although there is a general trend of continued increasing substance use, there will be differences between participants, both in consumption at the beginning of adolescence and in the magnitude of the increase over time. The second step was to analyze whether initial substance use and the trajectories followed are different as a function of sex and family cohesion. In this regard, we hypothesized that boys will increase substance consumption over time more than females, and that both initial substance use and its increase over time would be lower among subjects who reported better family relationships.

Method

Participants

This work is a longitudinal study of a specific group of adolescents. It all begins with cross-sectional research on a sample made up of 513 adolescents between 12 and 19 years of age, from ten different schools in the city of Seville (southern Spain) and its province. The choice of primary and secondary schools where the adolescents were recruited took into account criteria such as whether they were rural or urban and the socioeconomic level of the families. For further information about the sampling procedure (Parra et al. 2004; Sánchez-Queija and Oliva 2015).

Of the initial sample of 513 adolescents, 136 were early adolescents between 12 and 14 years of age who were followed for 10 years, until the participants reached 21 or 23 years of age. Specifically, all participants completed the assessment instruments at four different stages: early adolescence (Wave 1), mid adolescence (Wave 2), late adolescence (Wave 3), and during early adulthood (Wave 4). There were 136 adolescents for W1, 114 for Wave 2, 101 for Wave 3 and 90 for Wave 4. The final sample included 90 adolescents (Table 1). Of the 136 participants for W1, 90 continued until W4, which is more than two-thirds of the initial sample. The average ages in early (W1), mid (W2), late (W3) adolescence and early adulthood (W4) were: W1 (M_{age} = 13.11; SD = .44); W2 (M_{age} = 15.38; SD = .56); W3 (M_{age} = 17.85; SD = .52); W4 (M_{age} = 21.73; SD = .61).

At W4, most of the young people lived with their parents (77 % of the boys and 96.4 % of the girls). Half of the boys were employed, 43.3 % exclusively, and 16.7 % combined work with studies. The percentage of girls who were studying was greater—50 % were dedicated exclusively to their university or vocational and educational training, and almost 21 % were also working. None of the females, but one of the males in the sample, had children at the time when the data was collected.

The *attrition analysis* found no significant differences in terms of sex, parental educational level or rural/urban setting, neither in the variables overprotection nor in family cohesion. However, among those who continued, there were somewhat more adolescents who had attended charter schools compared with those who had attended public schools (χ^2 = 4.11, p = .043, Cramer's V = .042), and more adolescents who recalled higher maternal care (F (1, 129) = 6.13, p = .015, η^2 = .045).

Procedure

The first data collection (W1) took place during the 1998–1999 academic year, from September to June. The second (W2) took place from September 2000 to June 2001, the third (W3) from September 2002 to June 2003 and the fourth (W4) between the end of 2007 and the beginning of 2008.

The first step in W1 was to select the schools. Once the Board of Directors agreed to participate, the classrooms where the data would be collected were selected. Once parental permission was obtained, members of the research team applied the questionnaires anonymously and collectively. Even though participation was voluntary and without rewards, at W1 (13 years old) all students at the classroom filled in the questionnaires. To facilitate the subsequent follow-up, each participant was given a numeric identifier.

For W2, data collection was similar, since most of the girls and boys continued to be enrolled at the same school as in W1. In the third and fourth data collection (W3 and W4), once contact had been made with the adolescents, and they had agreed to continue collaborating in the research project, an appointment was made to complete the questionnaire. In W3 and W4 active consent was obtained from the adolescents, and their anonymity was ensured. In W3 and W4 participants completed the questionnaires individually or collectively in the researchers' office.

Measures

Parental Bonding Instrument

(PBI; Parker et al. 1979), adapted to Spanish by Ballús-Creus (1991) and Gómez-Beneyto et al. (1993). The PBI, used only at W1, assesses the adolescent's recall of the attachment bond with his or her mother during childhood. The 25 items' scale is composed of two dimensions: *Care subscale (Crombach´s alpha = .89)* and *Overprotection subscale (Crombach´s alpha = .83)*. The items were rated on a four-point Likert scale. High scores on the subscales indicate more mothers' care and overprotection.

Table 1 Sample description	Sex		Father socioeconomic status			Environment	
	Boys N (%)	Girls N (%)	Low N (%)	Medium N (%)	High N (%)	Rural N (%)	Urban N (%)
	35 (38.9)	55 (61.1)	40 (46.6)	19 (22.1)	27 (31.4)	22 (24.4)	68 (75.6)

Family Cohesion

We used the Cohesion sub-scale of the Spanish version of the *Family Adaptability and Cohesion Scale*, (FACES II, Olson et al. 1985). This is a 16 items' likert scale ranging from 1 to 5 that analyses family cohesion. The Spanish version of FACES II and III has been validated and widely used with Spanish and South American samples (López 2002; Martínez-Pampliega et al. 2006). The alpha reliability coefficients were W1/W2/W3/W4 = .69/.84/.87/.89.

Drug Use

This scale was elaborated for this research and includes four questions referring to consumption of tobacco, cannabis, and alcohol, and episodes of binge drinking (Oliva et al. 2008). Tobacco, alcohol and cannabis are the most commonly used substances among Spanish adolescents (Moreno et al. 2013). The adolescents should indicate the level of substance use on a scale ranging between 1 (*Never*) and 4 (*More than five times in your life*) in the case of consumption of cannabis and episodes of binge drinking, and between 1 (*Never*) and 5 (*Daily*) for alcohol or tobacco consumption (*More than 3 daily cigarettes*). We decided to ask for information about binge drinking and alcohol consumption in order to differentiate subjects with moderate alcohol consumption from those with a more problematic one. We combined the four ordinal items into a continuous single-interval measure (Simons-Morton 2007). The reliability according to Cronbach's alphas at W1/W2/W3/W4 was .71/.78/.79/.72 respectively.

Data Analysis

To study the intraindividual change of substance use over time and the influence of the family context in such change, we performed a linear hierarchical model with the statistical package HLM (Raudenbush et al. 2011). This analysis reveals individual patterns of change over time and, at the same time, allows analyzing which variables affect such patterns. That is, it shows the change of the dependent variable (DV) in each individual (Snijder and Bosker 2000). To perform this analysis, firstly, we elaborated the *null model* to verify possible variability in substance use between subjects throughout time. Subsequently, we performed the model of *random intersections* to check possible differences at the beginning of the study; and to determine whether the substance use trajectories were different for the participants of the sample. Lastly, we introduced in the model variables that explain both differences between individuals at beginning of the study, at age 13, and the diverse trajectories they followed throughout adolescence and emerging

adulthood. To assess the fit of each model we used two indexes. On the one hand, the deviance provided by the program itself, although there is no required value in order to consider the model correct, better models obtain low deviance indexes (Raudenbush and Bryk 2002). On the other hand, the pseudoR^2, an index that should be interpreted like the R^2 of multiple regression. PseudoR^2 is obtained by squaring the correlation between the value predicted in the DV by the model and the real value of that DV (Hox 2002; Singer and Willett 2003).

Results

The results (Table 2) revealed both an increase in substance use during adolescence and emerging adulthood and also an increase in inter-individual variability in substance use over time. There was not a clear developmental trend with regards to family cohesion during the time of the study.

We began the Linear Hierarchical Model (Table 3) by establishing the *null model*, which showed that the mean consumption at the four measurement times differed between participants, $\delta^2 = .33$, $\chi^2 (89) = 277.82$, $p < .001$. This value, along with the residual variance, $\delta^2 = .62$, allowed calculation of the intraclass correlation:

$$\rho = \frac{\sigma_{r_0}^2}{\sigma_{r_0}^2 + \sigma_e^2} = \frac{0.33}{0.33 + 0.62} = 0.35$$

Basically, 35 % of the variability in substance consumption throughout adolescence was explained by the subjects. The model showed a deviance of 952.70. The model of *random intersections and slopes* (Model 1) showed the variability in consumption among the participants at the beginning of the investigation, $\sigma_{r_0}^2 = .25$, $p < .001$, and their different evolution across the years of study, $\sigma_{r_1}^2 = .06$, $p < .001$. This data evidences the fact that there are different individual trajectories. In this model, the deviance dropped to 799.40.

The next step was to introduce the variable sex at the second level of analysis, both in the intercept and in the slope (Model 2). The results revealed no significant differences in substance use between boys and girls at age 13. However they presented different slopes throughout adolescence and emerging adulthood: the increase in substance use was lower in girls than in boys. The deviance dropped to 764.

Model 3 describes the role of care in adolescent substance use, and Model 4 adds overprotection to care. Care and overprotection were included at intercept and at slope. In these two models sex was removed from the intercept because model 2 showed that there were no significant differences between boys and girls at the beginning of the

Table 2 Descriptive analysis of the sample as a function of the instruments used

	Wave 1			Wave 2			Wave 3			Wave 4		
	M	SD	Range	M	SD	Range	M	SD	Range	M	SD	Range
Care	29.68	4.9	12–36	NA	NA		NA	NA		NA	NA	
Overprotection	16.78	4.74	6–32	NA	NA		NA	NA		NA	NA	
Cohesion	52.37	6.39	38–68	56.76	9.87	24–77	55.6	10.46	29–79	57.89	10.15	27–79
Drug use	1.43	.55	1–3.75	2.04	.88	1–4.25	2.45	.95	1–4.25	2.65	.96	1–4.67

NA not applicable

study. The sex variable is kept at level 2 (slope). As can be seen in Models 3 and 4, family history influenced the onset level of substance use at age 13 (intercept), but not the increase produced throughout adolescence and emerging adulthood (slope). The data indicated that at age 13, adolescents who recalled having received more care in childhood showed lower substance use. Overprotection did not significantly contribute to change in substance use.

Model 5 shows the role of family cohesion, both at the intercept and in the interaction with the slope, keeping the sex variable at level 2. The data indicates that adolescents who reported lower family cohesion showed more substance use at age 13, and also increased their consumption over time.

Lastly, Model 6 introduces the variables maternal care at the intercept (level 1), and sex and family cohesion at slope (level 2). This model shows that adolescents who recalled more maternal care during childhood consumed less substance. Moreover, boys increased substance consumption more than girls and children in families with lower cohesion showed greater increase in substance use over time. This model explained 32 % of the variability in substance use. In turn, the respective PseudoR^{2}s have shown the improvement of the diverse models both at the beginning of the research (intercept) and during adolescent and emerging adulthood (slopes). The best model was number 6.

Discussion

The results of the present study showed different trajectories of substance use during adolescence and emerging adulthood, and also showed that family relationships influence both the initial level of substance use at age 13 and the different trajectories of substance use throughout time.

Adolescents presented different levels of substance use at age 13 and they also experienced different increasing substance use trajectories during the next 10 years. Previous studies of substance use throughout adolescence and emerging adulthood usually describe the increase of consumption and its normative trajectory, without analyzing individual differences. Few works have taken into account the advantages of hierarchical methods, which provide a more complete picture of individual change, showing the quantity and structure of intraindividual change (Ram and Gerstorf 2009). Our study extends prior works on substance use by focusing not so much on normative changes, as on the within-subject variability hidden behind the linear trajectory of increased consumption between initial adolescence and emerging adulthood. In addition, our data has also allowed us to determine the relationship between some variables and the magnitude of this increase. Firstly, significant sex differences emerged. Although in early adolescence boys and girls substance use was similar, boys increased their consumption throughout time more than girls.

Boys' higher substance use, especially at late adolescence, has been found in diverse studies, both in Spain (ESTUDES 2013; Ramos and Moreno 2010) and in other western countries (Kuntsche and Müller 2012; Kuntsche et al. 2004). There is evidence indicating that in recent decades the gap between boys and girls has shrunk as a consequence of changing lifestyles (Keyes et al. 2011; Kuntsche et al. 2011), such that some studies find no sex differences in adolescence (Moreno et al. 2013). However, in late adolescence and early adulthood, substance use is usually more frequent in males (Chen and Jacobson 2012; Wilsnack et al. 2002). An explanation for this higher consumption among boys is that girls present earlier psychosocial maturity, which could lead them to stabilizing substance use sooner. Some studies have also outlined the role of greater parental monitoring of girls in their lower substance use (Svensson 2003). Whereas in the case of boys such monitoring is probably lower from late adolescence onwards, in the case of girls, it persists for more years.

The results also confirm the hypothesis proposed about the role of family relationships, both in substance use at the beginning of adolescence and in its change throughout time. We found that maternal care during childhood was significantly related to consumption at age 13 in that substance use was lower among those adolescents who recalled more caring relationships. This memory had no relationship with the trajectory of substance use from that age onwards.

Table 3 Hierarchical linear model or multilevel model of substance consumption

	Null model β (t, df)	Model 1 β (t, df)	Model 2 β (t, df)	Model 3 β (t, df)	Model 4 B (t, df)	Model 5 β (t, df)	Model 6 β (t, df)
Intercept							
Intercept (participants)	2.14 (29.4**, 89)	1.53 (22.2**, 89)	1.54 (12.83**, 89)	2.47 (4.59**, 88)	3.04 (4.89**, 87)	2.55 (5.03**, 88)	2.5 (5.09***, 88)
Sex		NA	−.017 (−.12, 88)	NA	NA	NA	NA
Care				−.03†	−.04 (−2.16*, 87)	NA	−.03 (2.14*, 88)
Overprotection					−.02 (−1.74, 87)	NA	NA
Cohesion				NA	NA	−.02 (−2.09 *, 88)	NA
Slope							
Intercept (time)		.41 (11.93**, 89)	.50 (8.71**,88)	.82 (3.64**, 87)	.74 (2.67**, 86)	1.03 (3.96**, 87)	1.11 (4.64***, 87)
Sex		NA	−.14 (−2.04)	−.14 (−2.15*, 87)	−.14 (−2.14*, 86)	−.13 (−2.00*, 87)	−.13 (−2.03*, 87)
Care				−.01 (−2.16*, 87)	−.01 (−1.33, 86)	NA	NA
Overprotection					.003 (.43, 86)	NA	NA
Cohesion				NA	NA	−.01 (−2.07*, 87)	−.01 (−2.60**, 87)
Intra-subject deviance	952.70	763.13	764	764.02	775.85	765.24	761.4
Random effect (variance)	.62	.25	.25	.25	.25	.25	.25
Intercept		.26***	.26***	.23***	.24***	.25***	.24***
Curve		.06***	.05***	.05***	.05***	.05***	.05***
Total pseudoR²							
$R^2_{Y,\hat{Y}}$		.22	.24	.30	.31	.29	.32
Level 1 pseudoR²							
R^2_e		.6	.6	.6	.6	.6	.6
PseudoR² intercept							
$R^2_{\tau_0}$			−.019	.075	.109	.046	.076
PseudoR² curve							
$R^2_{\tau_1}$		.066	.066	.098	.082	.131	.133

NA not applicable

* $p < .05$, ** $p < .01$, *** $p < .001$

† denotes $p < .1$

As commented in the introduction, there are at least two possible explanations for the relationship between care and low substance use at age 13. On the one hand, according to the social control theory (Akers and Sellers 2004), the bond with the parents would help the adolescent to accept conventional values and avoid engaging in misbehavior as a way of achieving parental approval. On the other hand, we can also refer to the probable positive effect that care during childhood could have on the development of the prefrontal cortex. This development would promote emotional and behavioral regulation, preventing subsequent substance use (Steinberg 2007).

There is also data indicating that insecure attachment, probably established due to a lack of parents' support and affection, is associated with abusive substance use (Brennan and Shaver 1995; Caspers et al. 2005; Kassel et al. 2007). There is even more abundant evidence supporting the relationship between insecure attachment and diverse indicators of psychological distress, such as low self-esteem (Griffin and Bartholomew 1994; Gamble and Roberts 2005), anxiety (Warren et al. 1997) or difficulties in emotional regulation (Thorberg and Lyvers 2010). These emotional difficulties play an essential role in the etiology of substance abuse, as they may represent an avoidant coping strategy to relieve the psychological distress generated by stressful situations (Kassel et al. 2007; McNally et al. 2003).

The fact that low cohesion in the family context was associated with an increase in substance use during adolescence and emerging adulthood supports this idea. The individuals who had worse family relationships were less likely to approach family figures as a way of coping with adversity. Instead, they tend to seek out other less healthy strategies, such as substance use, to regulate their negative moods and reduce anxiety (Thorberg and Lyvers 2010). It must be taken into account that, during adolescence and emerging adulthood, youths must face many challenges or developmental tasks that will test their coping strategies and may generate them a lot of stress (Arnett 2005).

The results of our study revealed that, although consumption of substances such as tobacco, alcohol, or cannabis are common during adolescence and emerging adulthood, caring family relationships play a significant role in its prevention. Thus, boys and girls who have experienced care and support during childhood, and enjoy a more cohesive family environment during adolescence and emerging adulthood, showed less substance use. Although they initiate consumption during these years, it does not reach the level of substance use observed among those who have grown up in less favorable family contexts.

Limitations, Future Directions and Implications

To conclude, we must refer to some limitations of the study, such as having a sample of only 90 subjects, which has placed some limits on the generalization of the results obtained. Also, having used self-reports as the only source of information may have increased the relationships found between the variables of the study. Lastly, the longitudinal nature of the study imposes an important limitation related to the use of the instruments, because the selection of measures at the beginning of the study clearly conditions the instruments employed in subsequent data collections. In spite of these limitations, the extension of the study throughout adolescence and emerging adulthood makes it a rare work in Spain. Likewise, the statistical techniques employed have allowed us to take a more in depth look at results found in previous research and to find responses that are not easily accessible from more traditional statistics.

Future studies should delve into the role of affection in the process underlying the relationship between the family context and substance use, as well as in the manner of alleviating the negative consequences of this consumption. In any case, public policies destined towards programs that help promote positive parenting seem necessary, to enhance parenting skills related to supporting children, showing affection and increasing family cohesion. These policies will be profitable both on a human level, by improving the capacity of boys and girls to regulate their own behavior in avoiding not only the abusive use of substances but also other externalizing problems, and on an economic level, by reducing the utilization of public health services.

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