

Contribution of Time of Drinking Onset and Family History of Alcohol Problems in Alcohol and Drug Use Behaviors in Argentinean College Students

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Abstract — **Aims:** The aim of the study was to analyze independent and potential interactive effects of age at drinking onset and family history of alcohol abuse on subsequent patterns of alcohol drinking, alcohol-related problems and substance use. **Methods:** Participants were college students (60.3% females, mean age = 20.27 ± 2.54 years) from the city of Córdoba, Argentina. Several measures were used to assess alcohol, tobacco and drug use. The Spanish version of the Brief Young Adult Alcohol Consequences Questionnaire was used to assess alcohol-related problems. Factorial analyses of variance, or its non-parametric equivalent, were performed to explore differences in substance use behaviors and alcohol-related problems in subjects with early or late drinking onset and with or without family history of alcohol abuse. Chi-square tests were conducted to analyze the association between these two risk factors and categorical measures of alcohol, tobacco and drug use. **Results:** Early onset of drinking was associated with amount of consumption of alcohol including up to hazardous levels, as well as tobacco and drug use. However, the frequency of alcohol problems and frequency of episodes of alcohol intoxication were only related to age of onset in those with a positive family history of alcohol problems. **Conclusion:** Delaying drinking debut is particularly important in the prevention of future alcohol problems in those adolescents who have a family history of such problems.

INTRODUCTION

Between 40 and 50% of college students of western countries report episodes of elevated alcohol drinking (4/5 US standard drinks or equivalent per drinking occasion, for women and men, respectively) (Dawson *et al.*, 2004; D'Alessio *et al.*, 2006; Johnsson *et al.*, 2008). This pattern of alcohol consumption is associated with a higher risk of developing a broad range of negative consequences, including alcohol dependence (Hingson *et al.*, 2009; Masten *et al.*, 2009) and drug use disorders (Dawson *et al.*, 2010). It has been shown that drinking 4/5 drinks per drinking occasion has significant accuracy as a screener for drug use and drug use disorders (Dawson *et al.*, 2010).

Despite the scarcity of large, nation-wide epidemiological studies, some evidence suggests that heavy alcohol drinking during college is an important health issue in Argentina (SEDRONAR, 2006). Studies conducted in Argentinean adolescents (Pilatti *et al.*, 2013a) and Argentinean college students (Garimaldi *et al.*, 2013; Vera *et al.*, 2013) indicated that the prevalence of alcohol use and alcohol-related problems are similar to those observed in USA. Pilatti *et al.* (2013a) identified, through latent class analysis, five different classes of substance use in an Argentinean sample of adolescents (13–18 years old). Two of these classes encompassed 35% of the total sample and were characterized by heavy alcohol consumption. A recent study (Garimaldi *et al.*, 2013) found that around 40% of college students reported weekly consumption of more than five drinks per drinking occasion. Similarly, around half of college women reported to drink 1–2 times a week the equivalent to >50 g of alcohol (Vera *et al.*, 2013). These data underscore the importance of studying risk factor associated with problematic alcohol drinking in Argentinean adolescents and young adults.

Individual differences in personality traits (McAdams and Donnellan, 2009), exposure to social models of alcohol use (Del Boca *et al.*, 2004), age at first drinking (Dawson, 2000; DeWit *et al.*, 2000; Goudriaan *et al.*, 2007), alcohol expectancies (Greenbaum *et al.*, 2005) and family history of alcohol abuse (Dawson, 2000; LaBrie *et al.*, 2010; Jenkins *et al.*, 2011) are some of the predictors of excessive alcohol use among college students. Age at drinking onset (Grant and Dawson, 1997; DeWit *et al.*, 2000) and family history of alcohol problems (Buscemi and Turchi, 2011) are indicated as two of the most important risk factors.

The relationship between a family history of alcohol problems (FH+) and greater likelihood of excessive alcohol drinking and alcohol disorders has been well documented. FH+ college students exhibited, when compared with FH– counterparts, greater alcohol consumption (Kushner and Sher, 1993; LaBrie *et al.*, 2009, 2010) and greater frequency of alcohol-use problems (Leeman *et al.*, 2007). Some studies found a gender-related effect, with FH+ males exhibiting greater relative vulnerability than FH+ females to problematic alcohol consumption (Jackson *et al.*, 2001; Andersson *et al.*, 2007; LaBrie *et al.*, 2010). For instance, LaBrie *et al.* (2010) observed that a family history of alcohol problems was associated with a 41 and 14% increase in alcohol drinking, among males and females, respectively.

Age at drinking onset has been consistently related to greater incidence of drug use (Lo, 2000; Hingson *et al.*, 2008), greater risk of developing alcohol use disorders (AUD, alcohol abuse and alcohol dependence; Dawson, 2000; DeWit *et al.*, 2000; Hingson *et al.*, 2006; Warner *et al.*, 2007; Jenkins *et al.*, 2011), involvement in physical fights or car accidents (Hingson *et al.*, 2009) and unsafe genderual intercourse (Stueve and O'Donnell, 2005). Adolescents who started to drink at early ages, but not those that delayed drinking onset,

rapidly progressed toward risky alcohol consumption patterns (Lo, 2000; Warner and White, 2003; Pitkänen *et al.*, 2005). In an influential study, DeWit *et al.* (2000) found that 14% of early, but only 2% of late, drinkers met alcohol dependence criteria 10 years after alcohol initiation. Similarly, Jenkins *et al.* (2011) observed that females who started to drink before the age of 16 were 3.6 times more likely to meet criteria for alcohol use disorders than females with later alcohol debut.

Only a few studies have analyzed the complex association between family history and early drinking experiences in predicting substance use and problems (Dawson, 2000; Warner *et al.*, 2007; Jenkins *et al.*, 2011). Using a cross-sectional design with a large, nationally representative sample of US adults, Dawson (2000) found that the link between family history of alcoholism and early onset of alcoholism was based on the facilitative effect of family history on early drinking debut. Warner *et al.* (2007) followed for 20 years a sample of adolescents and, at the termination of the study, they identified three drinking trajectories: no or low problem, adolescence-limited problem and escalating problem drinking. Age at first drinking and family history, alongside with feeling drunk during the first alcohol experience, increased the likelihood of belonging to one of the two problematic drinking trajectories. More recently, Jenkins *et al.* (2011) showed that a family history of alcohol abuse was one of the factors that allowed distinguishing between early drinkers who developed alcohol use disorders from those early drinkers who did not.

It seems that results are not yet conclusive regarding the complex association of family history and age at drinking onset on subsequent alcohol drinking and alcohol-related problems. Therefore, it is of particular interest to clarify the effect and potential interactions of these two risk factors. One theory ('A') suggests that each factor independently and orthogonally increases risk of AUD. Some twin studies have suggested that a genetic, instead of an environmental, risk factor underlies greater vulnerability for AUD in FH+ subjects (Slutze *et al.*, 2002). In its extreme presentation, the latter viewpoint considers early onset of drinking a behavioral symptom of genetic vulnerability for AUD that lacks a causal role in the etiology of AUD. This 'marker hypothesis theory' ('B'; Guttmanova *et al.*, 2012) suggests that early alcohol initiation and adult expression of AUD derive from a common genetic factor (also see Prescott and Kendler, 1999). Yet another scenario (theory 'C') is early alcohol initiation directly increasing subsequent alcohol intake by, for instance, interfering upon normal brain development. Animal models indicate that binge ethanol intoxication during adolescence alters the development of glutamatergic and dopaminergic transmitter systems in genetically heterogeneous strains of rats, and that these changes are later associated with increased probability of alcohol self-administration (Pascual *et al.*, 2009; Fabio *et al.*, 2013). It is also possible (theory 'D') that family history affects AUD both through a direct path (Warner *et al.*, 2007), and through an indirect path (Dawson, 2000) by increasing the likelihood of early contact with alcohol, which in turn further increases the probability of AUD. Finally yet importantly, a synergistic effect between family history of alcohol problems and early onset of drinking is also possible. The facilitative effect of early drinking on later alcohol drinking could be significantly higher in subjects featuring a positive family history of alcohol-related problems (theory 'E').

As mentioned, there have been few, if any, studies that analyzed these phenomena in South American populations. Argentina is a South American country largely influenced by European immigration and culture. Therefore, early onset of drinking is likely to be favored by the parental belief—common in some European countries—that children may be protected from AUD if they experience limited drinking at home under parental supervision (van Der Vorst *et al.*, 2010). A recent study (Pilatti *et al.*, 2013b) found that alcohol initiation, including sipping and tasting behaviors, had taken place in 58% of Argentinean children aged 8–12 years. Early alcohol debut in these children occurred mainly in family settings under supervision of parents or adults.

The present study aimed to provide more information on the role of family history of alcohol problems and early onset of drinking on later alcohol and drug use behaviors. Specifically, the study analyzed, in a sample of Argentinean college students, independent and potential interactive effects of age at drinking onset and family history of alcohol abuse on subsequent patterns of alcohol drinking, alcohol-related problems and substance use.

MATERIALS AND METHODS

Sample

A total of 424 questionnaires were administered to a sample of undergraduate college students who were enrolled in psychology, biology and engineering courses at the National University of Cordoba (Argentina). The sample was selected based on accessibility. The confidentiality of the participants was guaranteed and the voluntary participation was emphasized. Verbal informed consent was obtained before questionnaire administration. No identifiable information was collected. Twenty-two cases were eliminated because >20% of data were missing (Downey and King, 1998), yielding a sample of 402 students. To examine the effect of age at first drinking, only those reporting lifetime alcohol use ($n = 384$) were selected (Jenkins *et al.*, 2011). Twenty-four cases were eliminated due to illogical and inconsistent patterns of response (Dawson, 2003). The final sample comprised 360 cases (60.3% females, 54.7% enrolled in psychology courses). The majority of the students were first-year (63.3%), 12.5% were in their second year, 4.2% third year, 8.1% fourth year and 12% were fifth year. The mean age of 20.27 years ($SD = 2.54$ years) was statistically similar across males and females.

Procedure

Questionnaires were administered collectively in the classrooms. All sessions were led by the principal researcher assisted by three trained senior undergraduates. They explained the aim of the study, instructed the participants on how to complete the instruments, answered their questions regarding test completion and stayed until all participants had completed the survey. Participants were not compensated (i.e. monetary or otherwise) and did not receive any course credit for their participation. No major incidents occurred during test administration that took ~35 min. Data were gathered during a 6-month period.

Measures

Alcohol use

Alcohol use was defined as drinking at least one glass of any alcoholic beverage. Participants were asked about lifetime, regular (last month) and recent (last week) alcohol use. Three additional questions asked for (1) the type of alcoholic beverage usually consumed (e.g. beer, wine, vermouth, *fernet*, vodka/rum and cider), (2) last year frequency (i.e. from 1–4 times per year to 2–3 times per week) and (3) quantity (i.e. from 1–2 glasses to >12 glasses) of usual drinking of the selected beverage. *Fernet* is a type of Italian amaro that contains up to 43% alcohol by volume and is very popular among drinkers in Argentina. Answers to questions one and three were used to calculate the amount of grams of alcohol consumed per drinking occasion and number of standard drinks consumed per drinking occasion. The grams of alcohol consumed were determined based on known alcoholic contents in each alcoholic beverage. More in detailed, glasses consumed were first transformed to milliliters of alcohol consumed per drinking occasion. This step was performed individually for each type of alcohol beverage. For mixed drinks (i.e. *fernet*, vermouth), we considered the usual amount of the alcoholic beverage needed to prepare a 250-ml glass of the corresponding drink. One glass of beer or cider was defined as having a volume of 250 ml. One glass of wine was defined as having a volume of 150 ml and one glass of vermouth as having 125 ml. One glass of *fernet* and one glass of any spirituous beverages (i.e. vodka) were defined as having a volume of 75 ml of the alcoholic beverage. Then, this value (in milliliters) was multiplied by the reported number of glasses consumed per drinking occasion. Finally, and considering the alcohol content of each beverage type and the alcohol density, we calculated the number of grams of alcohol consumed per drinking occasion. One standard drink was defined as containing 14 g of alcohol (Dawson, 2003).

Hazardous drinking

Four questions asked for (1) lifetime, (2) last 3 months and (3) last month drunkenness episodes (yes, no) and (4) number of drunkenness episodes during the previous month (four categories: none, 1–5 times, 6–9 times, 10–14 times, 15 or more times). Additionally, and using a 4/5 drinks per drinking occasion measure as a cut point, participants were classified as heavy episodic drinkers ($\geq 4.01/5.01$, females and males, respectively) or non-heavy episodic drinkers ($\leq 4/5$, females and males, respectively) (Fillmore and Jude, 2011).

Age at first drinking

Age at drinking onset was assessed with the following question: (1) How old were you the first time you drank a glass or more of any alcoholic beverage? Response options were: before the age of 12 years, between the ages of 13 and 15 years, between the age of 16 and 19 years and after the age of 20 years. Following the criteria outlined by Jenkins *et al.* (2011), participants who indicated first drinking by the age of 15 or younger were classified as early onset (EO), while those who reported starting drinking at 16 years or older were classified as late onset (LO).

Family history of alcohol abuse

Participants indicated whether they had, or had had, a biological relative (mother, father, grandmother, grandfather) with a current or previous history of alcohol abuse. Similar measures have been used in previous studies (LaBrie *et al.*, 2010). Participants who indicated that at least one relative had a current or previous history of alcohol abuse were classified as having a positive history of alcohol abuse (FH+) and the rest of the participants were classified as having a negative history of alcohol abuse (FH–).

Tobacco use

Five questions asked about (1) lifetime, (2) last month and (3) last week tobacco use, (4) number of cigarettes smoked per day (from 1–2 to >20 cigarettes per smoking day), and (5) frequency of smoking (from less than monthly to daily). One question was used to assess age at first tobacco use: (1) How old were you the first time you smoked cigarettes? Response options were: before the age of 12 years, between 13 and 15 years, between 16 and 19 years and after the age of 20 years.

Drug use

Four questions asked for (1) lifetime, (2) last month and (3) type of drug use (i.e. marijuana, cocaine, ecstasy, inhalants, a freebase cocaine locally known as *paco* (Epele, 2011), and recreational use of prescription drugs), and (4) frequency of drug use during the last year (from less than monthly to more than three times per week). Answers to this last question were used to calculate number of days with drug use during the last year. The following question asked for age at first drug use: (1) How old were you the first time you use any drug (different from alcohol or tobacco)? Response options were: before the age of 12 years, between the ages of 13 and 15 years, between the ages of 16 and 19 years and after the age of 20 years.

Negative consequences of alcohol drinking

The Spanish version of the Brief Young Adult Alcohol Consequences Questionnaire (Kahler *et al.*, 2005) was used to assess alcohol-related problems. The original English version was translated to Spanish by two independent translators. Versions were compared and subjected to discussion until final consensus was reached. Using a dichotomous (yes/no) response format, participants indicate whether they have experienced each of the 24 possible consequences of drinking alcohol (e.g. ‘My drinking has gotten me into genderual situations I later regretted’, ‘I have driven a car when I knew I had too much to drink to drive safely’) during the past 3 months. The total score reflects the total number of consequences that the individual has experienced in that time frame. The B-YAACQ showed adequate reliability ($\alpha = 0.84$) in previous (Kahler *et al.*, 2008; Verster *et al.*, 2009) and in the present study ($\alpha = 0.81$).

Statistical analyses

Descriptive analysis inspected the occurrence of alcohol, tobacco and drug use behaviors. Appropriate measures were taken to check whether the data set was adequate for parametric tests. Homogeneity of variance was analyzed through Levene’s test and normality of the distribution was assessed

through inspection of asymmetry and kurtosis scores. When homogeneity of variance was not achieved and asymmetry/kurtosis scores were higher than 2.0, non-parametric alternatives were selected. There were three missing cases in the variable 'monthly number of alcohol intoxication episodes', two missing cases in 'monthly number of drug consumption episodes', one missing case in 'family history of alcohol abuse' and two missing cases in 'negative consequences of drinking'. These were not replaced.

Total frequency of problems with alcohol and monthly number of days with alcohol ingestion exhibited adequate normality values (asymmetry: 0.78 and 1.14, kurtosis: 0.34 and 0.44, for total frequency of problems and monthly number of days, respectively). Monthly number of alcohol intoxication episodes and number of drug consumption episodes during the last year did not exhibit homogeneity of variance [$F(3,354) = 21.79$, $F(3,352) = 18.05$, both P 's < 0.0001]. Asymmetry and kurtosis scores were 2.5 and 8.6, and 3.02 and 8.93, for number of alcohol and drug intoxication episodes, respectively.

Preliminary analysis indicated that, across variables, gender (i.e. male or female) did not exert a significant main effect nor was involved in any significant interaction with the remaining factors. Specifically, separate 2 (gender) \times 2 (family history of problems) \times 2 (time of drinking onset) ANOVAs indicated that males and females exhibited similar frequency of problems with alcohol and similar monthly number of days with alcohol ingestion [$F(1,347) = 0.05$, and $F(1,351) = 0.03$, respectively; both P 's > 0.80]. Furthermore, no interaction involving gender reached statistical significance. Monthly number of alcohol intoxication episodes and number of drug consumption episodes during the last year were also similar across males and females [$U = 13,754.50$, and $U = 14,047$, respectively; both P 's > 0.05]. Therefore, the data were collapsed across gender for all of the subsequent analyses and for representation in the figures.

Total frequency of problems with alcohol and monthly number of days with alcohol ingestion were separately analyzed through a factorial ANOVA that included family history of problems with alcohol (positive or negative: FH+ or FH-, respectively) and time of drinking onset (early or late onset: EO and LO, respectively). Monthly number of alcohol intoxication episodes and number of drug consumption episodes during the last year were analyzed through non-parametric tests. Specifically, for both variables differences between EO and LO drinkers, in each of the family history categories, were analyzed via Mann-Whitney's U. Follow-up ANOVAs and pair-wise comparisons (Tuckey's *post hoc* tests) were used to further examine the loci of significant main effects or interactions.

Chi-square tests were conducted to analyze whether the age at drinking onset and a family history of alcohol abuse were associated with categorical measures of alcohol, tobacco and drug use. Specifically, the association between age at drinking onset (early or late) and (a) drinking behaviors (last month and last week alcohol use), (b) hazardous alcohol use (lifetime, last 3 months and last month drunkenness episodes, and drinking $\geq 4.01/5.01$ or $\leq 4/5$ per drinking occasion), (c) tobacco use behaviors (lifetime, last month and last week tobacco use), and (d) drug use behaviors (lifetime and last month) was analyzed. A similar set of Chi-square tests was conducted to explore the association between alcohol, tobacco and drug use

behaviors and family history (positive or negative) of alcohol abuse. Another set of Chi-square analysis analyzed the association between age at drinking onset and (i) tobacco and (ii) drug use initiation. Only participants who reported lifetime tobacco use ($n = 240$) and lifetime drug use ($n = 120$) were included in these last analyses.

Alpha value for rejection of hypotheses was set at $P < 0.05$ for all analyses.

RESULTS

Frequency of alcohol, tobacco and drug use

Alcohol use

Table 1 shows prevalence of last month and last week alcohol drinking. It also displays prevalence of heavy episodic drinking (defined as drinking 4.01/5.01 or more standard drinks in one drinking occasion, for females and males, respectively) and prevalence of drunkenness episodes. Men were more likely than women to report last week alcohol use, heavy episodic drinking and last month occurrence of drunkenness episodes. The majority of the students drank until drunkenness at least once in their lifetime, while almost half of them did it within the last 3 months. These results are presented in Table 1. Half of the students reported drinking one or more times per week, 37% reported drinking 1–3 times a month and 5.6% less than monthly (5.6%). Only 6.9% reported having abstained from alcohol for the entire last year.

Early onset (EO) was reported by 47.5% and late onset (LO) by 52.5%. Early and late drinkers did not differ in chronological age ($t = 1.17$, $P > 0.20$) but females were more likely than men to be late drinkers ($\chi^2 = 4.72$, $P < 0.05$).

Tobacco use

Table 2 displays prevalence of lifetime, last month and last week tobacco use for the total sample and as a function of gender. No significant associations were found between tobacco indicators and gender. These results are presented in Table 2. Among those who indicated lifetime tobacco use ($n = 240$), 46% indicated they were current smokers ($n = 112$). The great majority of current smokers (85.7%) reported smoking at least once a week and 63.4% reported smoking up to five cigarettes per smoking day. Lifetime smokers were classified as early smokers (42.1%, tobacco onset before or at the age of 15) or late smokers (tobacco onset at the age of 16 or older).

Drug use

Table 2 shows prevalence of lifetime and last month prevalence of drug (other than alcohol and tobacco) use, and mean of number of drug use episodes in the last year, for the total sample and as a function of gender. No significant associations were found between drug use indicators and gender. These results are presented in Table 2. Almost 30% indicated any drug use during the last year. Almost of all them (98.1%) indicated marijuana as the most used drug, and two cases reported either amphetamine or ecstasy use. Among those who indicated last year drug use ($n = 99$), 34.3% reported using drugs at least once a week. Lifetime drug users who indicated their first drug experience occurred before the age of 19 (65.8%) were classified as early drug users, while those who

Table 1. Occurrence of alcohol use: for the total sample and as a function of gender

	Total (n = 360)	Males (n = 143)	Females (n = 217)	F/U/ χ^2 (gender)
FH+	22.5	20.3	24	$\chi^2 = 0.71$ ns
EO	47.5	54.5	42.9	$\chi^2 = 4.72^*$
Quantity of drinking				
$\leq 4/5$ drinks	55.5	47.6	60.8	$\chi^2 = 6.15^*$
$\geq 4.01/5.01^a$ drinks	44.5	52.4	39.2	
Alcohol use				
No last year drinking	6.9	7.0	6.9	$\chi^2 = 0.01$ ns
Last month drinking	84.4	85.3	83.9	$\chi^2 = 0.14$ ns
Last week drinking	55.5	62.9	49.8	$\chi^2 = 6.04^*$
Monthly DF	4.05 \pm 3.25	4.18 \pm 3.22	3.96 \pm 3.28	F = 0.03 ns
Drunkness episodes				
Lifetime	72.8	74.1	71.9	$\chi^2 = 0.22$ ns
Last 3 months	46.1	46.9	45.6	$\chi^2 = 0.05$ ns
Last month	25.3	31.5	21.2	$\chi^2 = 4.99^*$
Monthly drunkenness	0.87 \pm 1.68	1.12 \pm 1.93	0.71 \pm 1.48	U = 13754.5 ns
Alcohol problems	4.51 \pm 3.73	4.57 \pm 3.95	4.46 \pm 3.58	F = 0.05 ns

Data are presented as percentage of subjects that fell into each category. For continuous variables data are presented as means and standard deviation in each category.

EO, early drinking onset (first drinking by the age of 15 or younger); FH+, positive family history of alcohol abuse; Monthly DF, mean of drinking days per month.

^aHeavy episodic drinking: defined as drinking 4.01/5.01 or more drinks in one drinking occasion (females and males, respectively).

* $P < 0.05$.

Table 2. Occurrence of tobacco and drug use for the total sample and as a function of gender

	Total (n = 360)	Males (n = 143)	Females (n = 217)	U/ χ^2 (gender)
Tobacco use				
Lifetime	66.7	64.3	68.5	$\chi^2 = 0.54$ ns
Last month	33.6	28.7	36.9	$\chi^2 = 2.45$ ns
Last week	27.2	23.1	30	$\chi^2 = 1.95$ ns
Drug use				
Lifetime	33.3	39.4	29.5	$\chi^2 = 3.81$ ns
Last month	17.4	17.7	17.1	$\chi^2 = 0.021$ ns
Last year	17.01 \pm 42.02	18.56 \pm 45.24	17.01 \pm 42.02	U = 14,047
DU				ns

Data are presented as percentage of subjects that fell into each category. For continuous variables data are presented as means and standard deviation in each category.

Last year DU, mean of number of times with drug use in the last year.

reported drug onset after the age of 20 were classified as late drug users (34.2%).

Association effects and group differences as a function of time of drinking onset and family history of problems with alcohol

Age at first drinking and drinking measures

Age at drinking debut (early or late) was associated with most measures of usual and hazardous drinking. Age at drinking onset was associated with last week ($\chi^2 = 10.06$, $P \leq 0.01$) but not with last month drinking ($\chi^2 = 3.69$, $P = 0.055$). Inspection of the contingency tables showed that, compared with late drinkers, early drinkers were more likely to report last week alcohol use. Lifetime ($\chi^2 = 15.40$, $P \leq 0.001$), last 3 months ($\chi^2 = 7.75$, $P \leq 0.05$) and last month occurrence of drunkenness episodes ($\chi^2 = 8.02$, $P \leq 0.01$) were also associated with age at drinking onset. Specifically, relative to late drinkers, early

drinkers showed higher occurrence of lifetime, last 3 months and last month drunkenness episodes. An association between age at drinking initiation and heavy episodic drinking was also found ($\chi^2 = 11.55$, $P \leq 0.001$), indicating a greater incidence of heavy drinking episodes among early drinkers.

Family history of alcohol abuse and drinking measures

Having a positive history of alcohol abuse in the family was not associated with age at drinking onset ($\chi^2 = 0.45$, $P = 0.51$). This means that those with a positive family history of alcohol abuse were not significantly more likely to start drinking at an early age than those with a negative history of alcohol abuse. A family history of alcohol abuse was associated with occurrence of drunkenness episodes during the last 3 months ($\chi^2 = 4.58$, $P \leq 0.05$). Inspection of the contingency tables showed that, relative to those with positive family history, participants with a negative history of alcohol abuse were more likely to report drinking until they were drunk within the last 3-month period. No other measure of alcohol or other substance use was associated with family history of alcohol abuse. These results are presented in Table 3.

The ANOVA for total frequency of problems with alcohol yielded a significant main effect of time of drinking onset and a significant interaction between the latter variable and family history of problems with alcohol, $F(1,351) = 17.43$, $F(1,351) = 4.26$, respectively, both P 's < 0.05 . Tukey's *post hoc* tests revealed that timing of drinking onset did not affect frequency of problems in subjects with a negative family history of alcohol, but it did affect it in FH+ subjects. In the latter group, number of problems with alcohol was significantly higher in EO than in LO subjects. The *post hoc* also indicated significantly greater frequency of problems with alcohol in EO/FH+ than in LO/FH- subjects. These results are depicted in Fig. 1.

Table 3. Occurrence of alcohol use as a function of time at drinking onset and family history of alcohol abuse

	EO (<i>n</i> = 171)	LO (<i>n</i> = 189)	<i>F</i> / <i>U</i> / χ^2 (DO)	FH+ (<i>n</i> = 81)	FH- (<i>n</i> = 278)	<i>F</i> / <i>U</i> / χ^2 (FH)
FH+	24	21.2	$\chi^2 = 0.45$ ns			
EO				50.6	46.4	$\chi^2 = 0.45$ ns
Quantity of drinking						
≤4/5 drinks	46.2	64	$\chi^2 = 11.55$ ***	63	53.2	$\chi^2 = 2.1$ ns
≥4.01/5.01 ^a drinks	53.8	36		37	46.8	
Drinking frequency						
Last month drinking	83	81	$\chi^2 = 3.69$ ns	77.8	86.3	$\chi^2 = 3.49$ ns
Last week drinking	63.7	47.1	$\chi^2 = 10.06$ **	45.7	57.9	$\chi^2 = 3.79$ ns
Monthly DF	4.53 ± 3.45	3.61 ± 3.01	<i>F</i> = 9.48**	3.87 ± 3.21	4.10 ± 3.28	<i>F</i> = 0.45 ns
Drunkness episodes						
Lifetime	82.5	64	$\chi^2 = 15.40$ ***	69.1	73.7	$\chi^2 = 0.67$ ns
Last 3 months	53.8	39.2	$\chi^2 = 7.75$ *	35.8	49.3	$\chi^2 = 4.58$ *
Last month	32.2	19	$\chi^2 = 8.02$ **	22.2	26.3	$\chi^2 = 0.56$ ns
Monthly drunkenness	1.19 ± 2.05	0.57 ± 1.18	<i>U</i> = 13,856*	0.90 ± 2.07	0.86 ± 1.56	<i>U</i> = 10830.5 ns
Alcohol problems	5.26 ± 4.03	3.84 ± 3.30	<i>F</i> = 17.43***	4.55 ± 3.96	4.49 ± 3.67	<i>F</i> = 0.01 ns

Data are presented as percentage of subjects that fell into each category. For continuous variables data are presented as means and standard deviation in each category.

EO, early drinking onset; LO, late drinking onset; FH+, positive family history of alcohol abuse; FH-, negative family history of alcohol abuse; Monthly DF, mean of monthly drinking frequency.

^aHeavy episodic drinking: defined as drinking 4.01/5.01 or more drinks in one drinking occasion (females and males, respectively).

**P* < 0.05.

***P* < 0.01.

****P* < 0.001.

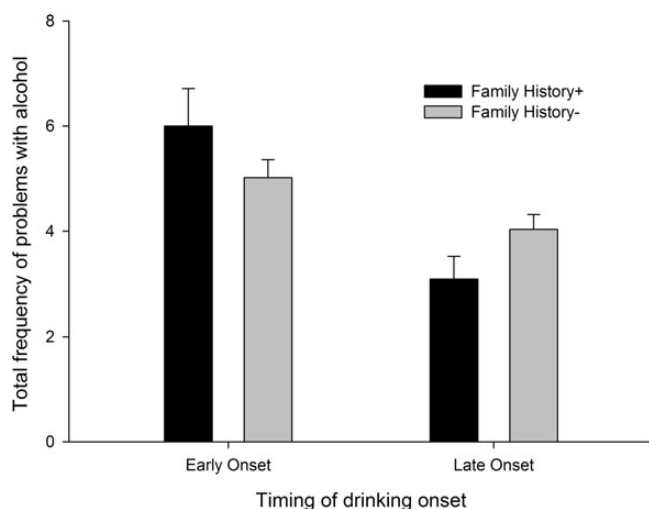


Fig. 1. Total frequency of problems with alcohol as a function of timing of drinking onset [early onset (first drinking by the age of 15 or younger) or late onset (first drinking by the age of 16 or older)] and positive or negative family history of alcohol abuse. Vertical bars indicate the standard error of the means.

Monthly number of alcohol intoxication episodes in FH- subjects was similar whether they had begun drinking early or late, *U* = 8648.5, *P* > 0.05. Time of drinking onset, on the other hand, significantly affected FH+ subjects. In the latter group, early drinkers had significantly more monthly alcohol intoxication episodes than late drinkers, *U* = 577.5, *P* < 0.05 (Fig. 2).

The ANOVA for monthly number of days with alcohol ingestion revealed a significant main effect of time of drinking onset, *F* (1,355) = 9.48, *P* < 0.005. Subjects that began to drink early in life exhibited significantly more days of alcohol consumption in a given month than counterparts that delayed alcohol initiation. Family history of problems with alcohol

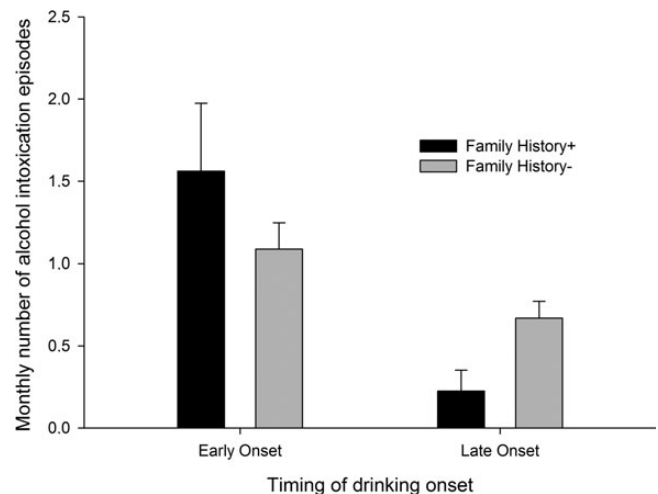


Fig. 2. Mean number of monthly drunkenness episodes as a function of timing of drinking onset [early onset (first drinking by the age of 15 or younger) or late onset (first drinking by the age of 16 or older)] and positive or negative family history of alcohol abuse. Vertical bars indicate the standard error of the means.

did not significantly affect this variable and the interaction between time of drinking onset and family history of problems with alcohol was not significant. Descriptive data for monthly number of drinking days and monthly number of drunkenness episodes can be found in Table 3.

Age at first drinking and tobacco and drug use

Age at drinking initiation was associated with lifetime tobacco ($\chi^2 = 9.53$, *P* ≤ 0.01) and drug ($\chi^2 = 16.59$, *P* ≤ 0.001) use. Specifically, compared with late drinkers, early drinkers were more likely to report lifetime tobacco and drug use. Moreover, significant associations were found between drinking initiation

Table 4. Occurrence of tobacco and drug use as a function of time at drinking onset and family history of alcohol abuse

	EO (<i>n</i> = 171)	LO (<i>n</i> = 189)	U/ χ^2 (DO)	FH+ (<i>n</i> = 81)	FH- (<i>n</i> = 278)	U/ χ^2 (FH)
Tobacco use						
Lifetime	74.3	59.8	$\chi^2 = 9.53^{**}$	65.4	66.9	$\chi^2 = 0.02$ ns
Last month	39.2	28.6	$\chi^2 = 4.41^*$	35.8	33.1	$\chi^2 = 0.28$ ns
Last week	33.3	21.7	$\chi^2 = 6.32^*$	27.2	27.3	$\chi^2 = 0.01$ ns
Drug use						
Lifetime	43.9	23.8	$\chi^2 = 16.59^{***}$	34.6	32.7	$\chi^2 = 0.14$ ns
Last month	22.8	12.2	$\chi^2 = 7.56^{**}$	17.7	17.3	$\chi^2 = 0.01$ ns
Last year DU	23.06 \pm 48.34	11.63 \pm 34.73	$U = 12976.5^{**}$	21.00 \pm 52.52	15.92 \pm 38.61	$U = 10,750$ ns

Data are presented as percentage of subjects that fell into each category. For continuous variables data are presented as means and standard deviation in each category.

EO, early drinking onset; LO, late drinking onset; FH+, positive family history of alcohol abuse; FH-, negative family history of alcohol abuse; Last year DU, mean of number of times with drug use in the last year.

* $P < 0.05$.

** $P < 0.01$.

*** $P < 0.001$.

and last month ($\chi^2 = 4.41$, $P \leq 0.05$) and last week ($\chi^2 = 6.32$, $P \leq 0.05$) tobacco use, and between drinking initiation and last month drug use ($\chi^2 = 7.56$, $P \leq 0.01$). Participants who started to drink at early ages showed greater last month and last week tobacco use, and were more likely to exhibit last month drug use. These results are presented in Table 4. Age at drinking onset was associated with age of tobacco initiation ($\chi^2 = 21.69$, $P \leq 0.001$) but not to age at drug onset ($\chi^2 = 1.82$, $P = 0.18$). Inspection of the contingency table indicated that those students who started to drink before the age of 16 were more likely to show an early onset of tobacco use than those who started to drink at 16 years or older (56.3 vs. 26.5%).

Family history of alcohol abuse and tobacco and drug use

Chi-square tests revealed that family history of alcohol abuse was not significantly associated with drug and tobacco use indicators. These results are presented in Table 4.

In regards with number of drug consumption episodes during the last year, the non-parametric test indicated greater frequency in EO than LO subjects, both in subjects with or without a family history of alcoholism, $U = 495.5$, $P < 0.005$ and $U = 8283$, $P < 0.05$, respectively. There were no differences between FH+ and FH- subjects, neither for subjects that started early to drink nor in subjects featuring a late drinking onset, $U = 2143$, and $U = 2690$, both P 's > 0.05 , respectively. Descriptive data for number of drug consumption episodes during the last year can be found in Table 4.

DISCUSSION

Certain adolescents and youth progress rapidly to alcohol abuse and dependence, whereas others keep controlled drinking despite continuous alcohol exposure (Zucker *et al.*, 2008). Early onset of alcohol drinking (Grant and Dawson, 1997; DeWit *et al.*, 2000) and family history of alcohol problems (Buscemi and Turchi, 2011) rank among the most important factors to differentiate between these populations. The present study was aimed at analyzing, in a sample of Argentinean college students, the independent and potential interactive effects exerted by these factors on alcohol use and alcohol-related problems, and on tobacco and drug use. A novel contribution of the present study is to provide evidence regarding

the prevalence of alcohol and other substances use in a local sample of college students and the effect of age at drinking onset and FH+ on subsequent substance use and alcohol-related problems. To our knowledge, this is the first study aimed at analyzing the interactive effect of these two risk factors in Argentinean college students.

One important finding was the significant role exerted by early onset of drinking on alcohol and drug use measures. Subjects who began to drink early in life (i.e. ≤ 15 years) exhibited significantly greater number of drug consumption episodes during the last year and significantly more days of alcohol consumption in a given month than counterparts with a late onset of drinking. These effects of early onset of drinking were similar in subjects with or without a positive family history of alcohol problems. Moreover, early onset of drinking, but not family history of alcohol problems, was associated with usual and hazardous drinking and also with lifetime tobacco and drug use. There was also an association between early onset of drinking and early onset of tobacco smoking.

A limitation of the present study is that we did not obtain direct measures of alcohol abuse or dependence. We did measure, however, proxies for these clinical entities, namely frequency of problems with alcohol (i.e. losing control on quantity of alcohol consumption or needing larger amounts of alcohol to feel a significant effect) and monthly number of alcohol intoxication episodes. Another important finding was that early onset of drinking exerted a significant, facilitative effect on these variables, but only in those subjects with a positive history of alcohol problems. These results are similar to those found by Jenkins *et al.* (2011), in that family history of alcohol problems appears to help distinguish between those early drinkers who will transition from alcohol experimentation to abuse from those who will keep a controlled pattern of drinking. In other words, these results suggest a synergistic effect between these factors, in which the risk of exacerbated and problematic alcohol drinking is higher in subjects featuring early onset of drinking and positive family history of alcohol-related problems.

Consistent with previous studies, age at drinking onset was related to greater alcohol use (Warner and White, 2003; Pitkänen *et al.*, 2005; D'Alessio *et al.*, 2006). Those participants who started to drink before the age of 16 showed more frequent and heavier alcohol use and greater number of alcohol-related problems, than those that delayed alcohol

initiation until age 16 or later. Age at drinking onset was also associated with greater occurrence of hazardous drinking, with early drinkers being more likely to report drinking 'until they were not completely conscious of their behavior' and heavy episodic drinking (Warner and White, 2003; Pitkänen *et al.*, 2005).

Timing of alcohol and timing of tobacco onset were associated, indicating that early drinking initiation was likely to occur alongside early tobacco debut. The design of the present study does not allow establishing a causal link between timing of drinking and smoking onset or concluding which initiation precedes the initiation of the other. Alcohol drinking, however, was more prevalent in this sample, and 60% of the sample had started to drink by the age of 15 years, while <30% reported tobacco onset by the same age. Timing of drinking initiation was not associated with age of drug initiation but it was related to lifetime and last month drug use, underscoring the association between these two behaviors.

About 22% of this sample of college students reported a positive family history of alcohol abuse, which falls between the lower (Perkins, 2002; Pulido *et al.*, 2009) and greater (LaBrie *et al.*, 2010) incidence reported in previous studies. Most of first drinking experiences occurred in family settings under parental or adult supervision (Warner and White, 2003; Pilatti *et al.*, 2013b). Warner *et al.* (2007) suggested that this parental decision of allowing children to drink alcohol could be influenced by a family history of alcohol abuse. It has been postulated that early drinking onset is but one of several factors non-causally associated with alcohol problems at adulthood. Early drinking onset, alongside with factors such as sensitivity to stress (Blomeyer *et al.*, 2011), disinhibited behavior and externalizing disorders (Pitkänen *et al.*, 2008), would be mere manifestations or 'early warning signs' of alcohol problems, derived from a common factor of genetic vulnerability. According to this 'marker hypothesis' (Prescott and Kendler, 1999) it could be hypothesized that, in the present study, respondents with a positive family history of alcohol abuse would be more likely to show early drinking onset (Dawson, 2000), greater alcohol use (LaBrie *et al.*, 2010) and greater substance use (Elliott *et al.*, 2012). This expectation was not corroborated. Family history of alcohol abuse was not associated with either early onset of alcohol drinking or consumption of alcohol or other substances.

The lack of association between family history of alcohol abuse and most of the alcohol consumption measures used in the present study was unexpected, although a recent meta-analysis found that college students with positive family history of alcohol problems do not, on average, drink more than FH- students (Elliott *et al.*, 2012). There might be greater dispersion—that is, some who grow up in a family where there is an alcohol problem are especially cautious about drinking or may even decide to avoid it completely. One possible explanation for the absence of a significant effect of FH+ in the present study could be related to how FH+ was measured. Participants were classified as FH+ if one of their relatives had or had had a history of alcohol abuse. Previous studies, however, have employed criteria that are more stringent. For instance, participants have been classified as FH+ after reporting at least one first-degree relative with probable alcoholism (Kareken *et al.*, 2013), or if one or both biological parents experienced one or more serious problems as a consequence or their alcohol drinking (Acheson *et al.*, 2011). The less

severe criteria employed in the present study could have resulted in false-positive FH+. Another possibility is that familiar and social factors are more strongly related to early substance use, while genetic factors become more important influences during young and middle adulthood (Kendler *et al.*, 2008). Notably, more than half of the participants that took part in the present work were still adolescents in their first year of college. Future work should employ a more rigorous criterion for FH+ (i.e. alcohol dependence) to explore the role of this risk factor in a more homogeneous sample in terms of representation of age groups. A surprising finding was that FH+ subjects exhibited significantly less occurrence of intoxication episodes than FH- subjects. One likely explanation is that FH+ subjects have greater tolerance or less sensibility to ethanol-induced intoxication than FH- counterparts. This differential pattern of response would make them less likely of engaging in alcohol intoxication than FH- subjects. Also important is that no significant differences were found between FH+ and FH- in quantity of alcohol consumption per drinking occasion. In summary, FH+ and FH- groups drink similar amounts of alcohol, but this ingestion leads to greater occurrence of drunkenness episodes in FH- subjects. These results suggest lessened sensitivity to alcohol-induced intoxication in FH+ than in FH- subjects. Previous studies have argued that a lower sensitivity to alcohol may represent an endophenotype for alcohol use disorders (Schuckit, 1994; Schuckit *et al.*, 2009; Buscemi and Turchi, 2011). The hypothesis of a low level of response to alcohol as a mediator of genetic vulnerability for AUD is consistent with recent results from a meta-analytic review (Quinn and Fromme, 2011) and an experimental study (Kareken *et al.*, 2013).

Another important result was that close to half of the sample showed heavy episodic drinking, defined as drinking $\geq 4.01/5.01$ drinks in a single drinking occasion (for women and men, respectively). This high occurrence of hazardous drinking is similar to that reported in studies conducted in the USA (Dawson *et al.*, 2004) and some European countries like Italy (D'Alessio *et al.*, 2006) and Sweden (Johnsson *et al.*, 2008).

The present study has some limitations that must be considered. Participants were college students sampled by an incidental procedure; therefore, the generalizability of the results reported here is limited. There was no record of the recruitment rate; however, most of students were willing to participate. Retrospective reports of age at substance onset may be subject to forward telescoping (Golub *et al.*, 2000) especially for older participants (Dawson *et al.*, 2008). Although self-reports of age at substance initiation showed sufficient reliability (Johnson and Mott, 2001), a prospective study that starts prior to any substance initiation is the most appropriate design to analyze the effect of substance debut on subsequent substance behaviors. Additionally, the effect of age at first alcohol-related problems on subsequent prevalence of negative consequences was not analyzed. There is a growing body of evidence concerning the effect of age at first intoxication on subsequent alcohol-related problems (Henry *et al.* 2011; Capaldi *et al.*, 2013). This possibility should be examined in future work, since initial reaction to alcohol may represent a risk factor in the development of alcohol drinking disorders (Warner *et al.*, 2007).

Overall, the most important results of the present study are that early onset of drinking was significantly and independently

associated with several measures of alcohol (including hazardous drinking) and with lifetime tobacco and drug use. Early onset of drinking was also associated with increased frequency of problems with alcohol, although only in subjects with a positive history of alcohol problems. This interactive effect between age at drinking onset and family history of alcohol abuse pinpoints a specific, vulnerable subpopulation that should be the focus of targeted interventions.

Although we cannot know that early onset of taking alcohol is the cause of later heavier use of alcohol (and drugs), it would seem prudent that at least those with a family history of alcohol problems should be aware of this association

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