Heavy episodic drinking and alcohol-related injuries: An open cohort study among college students

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ABSTRACT

Aim: The objective of this study is to assess the effects of Heavy Episodic Drinking (HED) on the incidence of alcohol-related injuries among university students in Spain, taking sex into consideration.
Methods: We carried out an open cohort study among college students in Spain (992 women and 371 men). HED and alcohol-related injuries were measured by question 3rd and 9th of Alcohol Use Disorders Identification Test to every participant at the ages of 18, 20, 22, 24 and 27. For data analysis we used a Multilevel Logistic Regression for repeated measures adjusting for alcohol and cannabis use.
Results: The incidence rate of alcohol-related injuries was $0.028\,year^{-1}$ for females and $0.036\,year^{-1}$ for males. The multivariate analysis showed that among females a high frequency of HED and use of cannabis are risk factors for alcohol-related injuries (Odds Ratio [OR] = 2.64 and OR = 3.68), while being more than 23 is a protective factor (OR = 0.34). For males, bivariate analysis also showed HED like risk factor (OR = 4.69 and OR = 2.51). Finally, the population attributable fraction for HED among females was 37.12%.
Conclusions: HED leads to an increase of alcohol-related injuries in both sexes and being over 23 years old acts as a protective factor among women. Our results suggest that about one third of alcohol-related injuries among women could be avoided by removing HED.

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1. Introduction

Risk behavior, including substance use, is common among youth (Pickett et al., 2002). Specifically, rates of heavy episodic drinking (HED) behavior are increasing among young people around the world (Jernigan, 2001). This alcohol consumption pattern is characterized by the intake of large amounts of alcohol in a short period of time, reaching blood alcohol concentrations of 0.8 g/l or greater (National Institute on Alcohol Abuse and Alcoholism, 2016). Reich's research found that about 58% of youth between 22 and 23 years old practice HED. This proportion decreased after 5 years, among the same participants, to 42% (Reich et al., 2015). Spain is no exception, with high rates of HED. The prevalence of HED in Spain among youth from 14 to 18 years old is 41.8% (Delegación del Gobierno para el Plan Nacional sobre Drogas, 2013).

During the college years people acquire behavior patterns and life styles that they maintain through adulthood (Schulenberg et al., 1996). Excessive alcohol consumption during youth is also associated with an increased risk of dependence and alcohol-related problems in adulthood (Grant et al., 2006). Importantly, cerebral maturity, specifically in frontal and temporal regions, continue to develop during adolescence and youth. These regions are also particularly susceptible to the effects of alcohol (Guerri and Pascual, 2010). Other consequences that have been associated with HED are lower academic achievement (Mota et al., 2010; Powell et al., 2004), unsafe sex (Cooper, 2002; Moure-Rodríguez et al., 2016a,b) and car accidents (Valencia-Martín et al., 2008; Wechsler et al., 2003).

Previous studies have also shown a higher risk of alcohol-related injuries among individuals that present with HED, compared to those who do not show this pattern of consumption (Rehm et al., 2002; Watt et al., 2004). Mundt et al. found a 43% occurrence of alcohol-related injuries among Heavy Episodic Drinkers compared with 10% among non-HED, and McLeod has found three times the risk of these injuries among subjects who practice HED (Mcleod et al., 1999; Mundt et al., 2009). Finally, previous studies have also shown the prevalence of HED is different among both female and

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male college students (Moure-Rodríguez et al., 2016a,b; Wicki et al., 2010) and HED is also significantly different from the ages of 18–27 years old (Moure-Rodríguez et al., 2016a,b). Not to mention, HED's consequences could be different as well (Caamaño-Isorna et al., 2016; Kypri et al., 2009; Wiersma and Fischer, 2014).

Furthermore, it has been observed the consequences of alcohol use vary considerably in different countries (Graham et al., 2011). Despite our previous results of this cohort (Moure-Rodríguez et al., 2014), we are not aware of any similar longitudinal studies in European countries with traditional alcohol use.

The objective of this study is to assess the effects of HED on the incidence of alcohol-related injuries among university students in Spain, taking sex into consideration.

2. Methods

2.1. Design, population and sample

An open cohort analysis was conducted within the framework of a cohort study designed to assess neurocognitive and social consequences of alcohol use. The study was carried out between November 2005 and February 2015 college students from a large public university at the north west of Spain. We performed a cluster sampling. From each one of the 33 university schools, at least one of the freshman year classes was randomly selected (a total of 53 classes). The number of classes selected on each university school was proportional to its number of students. All students present in the class on the day of the survey were invited to participate in the study (n = 1382). Abstinent subjects and subjects who were not born in 1987 were excluded from the study. The study follows the principles of the Declaration of Helsinki and was approved by the university ethics committee (October 2004).

2.2. Data collection procedures

Participants were evaluated via a self-administered questionnaire in the classroom in November 2005 and again in November 2007. Students that provided their phone number were further evaluated by phone at 4.5- 6.5-, and 9.0- year follow-up. On all five occasions, alcohol consumption and alcohol-related injuries were measured using the Galician validated version of the Alcohol Use Disorder Identification Test (AUDIT) (Saunders et al., 1993; Varela et al., 2005). At baseline and at the 2-year follow-up, participants responded to additional questions about age of onset of alcohol consumption and about cannabis consumption.

2.3. Definition of variables

In order to characterize the samples, several variables were considered: sex, place of residence (parental home/away from the parental home), university entrance grade (5 –<7 points; 7 –<9 points; and 9–10 points); and maternal educational level (primary school/high school/university). The subjects were also asked about the age of onset of use of alcohol using the following question: "At what age did you start drinking alcohol?**" Four categories were defined for age of onset of use (after 16 years old, at 16, at 15, before the age of 15).

2.3.1. Independent variables
2.3.1.1. Heavy episodic drinking (HED) at 18, 20, 22, and 24 years old.
Question 3 of the AUDIT: "How often do you have 6 or more alcoholic drinks on a single occasion? Never; less than once a month; at least once a month; at least once a week; daily or almost daily". The categories at least once a month; at least once a week; and daily or almost daily were recategorized to More frequently. In Spain, a

standard drink corresponds to 10 g of alcohol, therefore the consumption of 6 alcoholic beverages in 2 h results in blood alcohol concentration levels of 0.8 g/l.

2.3.1.2. Frequency of alcohol consumption at 18, 20, 22 and 24 years old.
Question 1 of the AUDIT: "How often do you have a drink containing alcohol? Never; monthly or less; two to four times a month; two to three times a week; four or more times a week".

2.3.1.3. Number of alcoholic drinks on a typical day at 18, 20, 22 and 24 years old.
Question 2 of the AUDIT: "How many alcoholic drinks do you have on a typical day when you are drinking? 1 or 2; 3 or 4; 5 or 6; 7–9; 10 or more".

2.3.1.4. Cannabis consumption at 18, and 20 years old.
This variable was measured with the question "Do you consume cannabis when you go out? Never; sometimes; most of the times; always". The categories "most of the times" and "always" were recategorized to Usually.

2.3.2. Dependent variable
2.3.2.1. Alcohol-related injuries at 20, 22, 24 and 27 years old..
Question 9 of the AUDIT: "Have you or someone else been injured as a result of your drinking? No; yes, but not during the last year; yes, during the last year".

2.4. Statistical analysis

The follow-up was structured in 4 periods: 11/2005- 11/2007 (2 years); 11/2007–05/2010 (2.5 years); 05/2010–05/2012 (2 years); and 05/2012–02/2015 (2.5 years). Because of the open cohort design of the study, the conditions of subjects may have changed during follow-up. While the 9th AUDIT question refers to alcohol related injuries suffered in the past, the independent variables about alcohol consumption and cannabis consumption were referred about the present. Therefore, the variable "alcohol-related injuries" measured in 11/2007, 05/2010, 05/2012 and 02/2015 was considered as the effect of both the number of alcoholic drinks on a typical day (Question 2 of the AUDIT) and the HED (Question 3 of the AUDIT) having occurred in 11/2005, 11/2007, 05/2010, and 05/2012 respectively. Since we have only two measures of cannabis use (11/2005 and 11/2007), we considered the alcohol-related injuries in 11/2007 as the effect of the cannabis use in 11/2005, and alcohol related injuries for the rest of the periods as the effect of cannabis use at 11/2007. At each stage of the study the subjects than answered "Never" to the first question of the AUDIT were excluded.

We used multilevel logistic regression for repeated measures to obtain adjusted Odds Ratios for Alcohol-related injuries. Cannabis consumption and number of alcoholic drinks on a typical day (Question 2 of the AUDIT) were also considered as independent variables, because it is known that both variables can result in a lower risk perception and decreased attention, which may consequently lead to injury. Adjusting by both variables, we can therefore identify the specific effect associated to HED. Frequency of alcohol consumption (Question 1 of the AUDIT) was also considered in order to remove the abstinent subjects. The university school and the class were considered as randomized variables. The follow-up time was included as an offset term. Data were analyzed using Generalized Linear Mixed Models from the SPSS 20.0.

Finally, in order to calculate the population impact measures, we considered the following formulas (Llorca et al., 2001). (1) To calculate the proportion of alcohol related injuries in exposed subjects attributable to HED $1 - (1/OR)$; and (2) To calculate the population attributable fraction $pc - (pc/OR)$, being pc the prevalence of