



Evolution of the Risk of Problematic Alcohol Use in University Students: A Longitudinal Study Based on the uniHcos Cohort Data

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Abstract

This study aims to analyse the evolution of problematic alcohol use among Spanish university students. A longitudinal analysis was performed on data from the uniHcos cohort ($n = 1181$; 76.7% female). Participants were assessed at university entry (T1) and after 2–3 years (T2). The overall alcohol consumption prevalence remained high and stable (past 30-days alcohol use 76.2% at T1; 76.4% at T2). Binge drinking practice in the past 30 days was also consistent (44.0% at T1; 44.3% at T2). Regarding the risk of problematic alcohol (measured with AUDIT), the prevalence rates remained stable over time (28.2% in T1 to 30.3% in T2). However, a high persistence rate was observed during university (61% of cases), and 18% of new incident cases were detected during follow-up. Factors associated with an increased risk of problematic alcohol included cohabitation with peers, psychological distress, smoking, and drug experimentation. No sex differences were identified. These findings highlight the need for targeted prevention strategies to address increasing risky alcohol use among university students and mitigate its long-term effects.

Keywords Alcohol drinking · Alcoholism · Binge drinking · University students · AUDIT · Longitudinal

The start of the university period is challenging for students, as many are almost adolescents and must face a new environment full of uncertainty. In this context, there are positive feelings such as greater independence, especially for those leaving home, a sense of adulthood, and a desire to make the most of their youth. However, they are also confronted with negative emotions such as academic pressure, financial stress, and socialising with new people to fit in (Adams et al., 2021; Cheung et al., 2020; Stallman, 2010). These

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changes could lead to an increase in substance experimentation, both in terms of sensation-seeking and coping with the new environment (McAlaney et al., 2021).

Regarding the specific substances used during this period, the most prevalent is alcohol (Busse et al., 2021; Ham & Hope, 2003). According to the WHO, younger people are disproportionately affected by alcohol consumption, with the highest proportion (13%) of alcohol-attributable deaths occurring within the 20–39 age group in 2019 (World Health Organization, 2024a). Based on the latest survey on alcohol and other drugs in Spain (EDADES) (OEDA, 2023a), in the 15–24 age group, the lifetime prevalence of alcohol consumption was 85.3%, and the prevalence in the past 30-days was 62.7%, with higher prevalence in men than in women. In addition, in the 20–24 years age group, 32.3% of men and 25.8% of women, reported binge drinking in the past 30 days.

Among Spanish adolescents (14–18 years), the average age drinking onset is 13.9 years (OEDA, 2023b). In the first year of university, around 90% of students report having already tried alcohol (Bewick et al., 2008; Lázaro-Pérez et al., 2020). Thus, due to the great change and impact on youths' lives, the entry into university is a key point for the establishment of the alcohol use pattern (Gambles et al., 2022; Graupensperger et al., 2021; Niland et al., 2017). Furthermore, several studies indicate that these students could have higher consumption rates than their non-university peers (Caravaca-Sánchez et al., 2021; Wicki et al., 2010).

The phenomenon of alcohol use during university is complex and is mediated by different interrelated factors. One of them is the young adults' motivations for drinking. In this population, the main drinking motives are enhancement, pleasure, and sensation-seeking. Although alcohol is an intoxicant, the intoxication itself has a pleasure value for drinkers as it provides an immediate pleasant reward (King et al., 2023; Nicholls & Hunt, 2025). Alcohol also has a disinhibitory effect, which promotes socialisation and the construction of experiences in the new environment (Kuo et al., 2003). Another mediator is the multitude of advertising and marketing strategies employed to promote alcohol consumption among university students, where alcohol use is usually presented as the sole option of social engagement (Giesbrecht et al., 2024; Ross-Houle & Quigg, 2019). These factors, combined with pressure to drink alcohol from older peers, might create the perception that drinking is the norm (Gambles et al., 2022; Graupensperger et al., 2021; Niland et al., 2017). This environment can lead to low perceived risk of drinking and an increase in binge drinking episodes (Tarrant et al., 2019), usually during the weekend and followed by a period of abstinence during the first days of the week (Hultgren et al., 2019).

Alcohol use patterns during university can lead to problematic alcohol use and future Alcohol Use Disorder (AUD), specially when interacting with risk factors. One is the co-use with other substances (Mekonen et al., 2017; Wadsworth et al., 2004). In the university population, co-use (especially with tobacco) is frequent, creating a bidirectional relationship that promotes the consumption of both substances (Delgado-Lobete et al., 2020).

Other of the main predictors of this risky consumption is the family environment and support. There is strong evidence that students who live away from home during university have a higher risk of problematic alcohol use (Boot et al., 2010; Moure-Rodriguez et al., 2018; van Hooijdonk et al., 2022; Wicki et al., 2010). Coming from a dysfunctional family and having a family member with a history of AUD are also risk factors. This is because a family history of AUD predisposes both genetically (Kendler et al., 2015; Powers et al., 2017; Verhulst et al., 2014) and behaviorally (in terms of how alcohol consumption has been perceived in the family and how the child has been educated about consumption) (Paxton et al., 2007; Smith & D'Aniello, 2021; Trujillo et al., 2016) to an increased risk. Thus, poor mental health and psychological distress have also been linked to an increased

risk of problematic use, as drinking may be used as a coping strategy (Lechner et al., 2020; Rodriguez et al., 2020).

Continuing with associated factors early onset of alcohol consumption, and especially the performance of binge drinking, can lead also to a higher risk of problematic alcohol use and AUDs as well as other morbidities such as neuropsychological effects (Stephens & Duka, 2008), mental disorders, fatty liver, and damage to third parts (Carvalho et al., 2019; Ning et al., 2020).

Alcohol use patterns have been extensively studied in first-year university students, and there is a consensus in considering them a vulnerable and high-risk population (Benjet et al., 2022). However, although little some studies (Bewick et al., 2008; Hultgren et al., 2019; Tarrant et al., 2019) have conclude that first year of university is the key point for the establishment of there is still no solid evidence about the evolution that alcohol consumption may have throughout the university period, i.e. about the overall prevalence of alcohol consumption, the evolution of the risk of problematic alcohol use, and the profiles of possible problematic users.

Thus, the study of alcohol use patterns over this period offers a window of opportunity for the prevention of problematic alcohol use and its consequences. To our knowledge, there are a few similar studies worldwide analysing the evolution of and problematic drinking at the university with a longitudinal design (Bewick et al., 2008; Hultgren et al., 2019; Tarrant et al., 2019), and there is only one similar in Spain (Moure-Rodriguez et al., 2018).

In this framework, this study aimed to describe the prevalence, incidence, and persistence of problematic alcohol use among university students in Spain; their evolution over the university period; and to determine the possible factors associated with problematic alcohol use. The insights gained from the data can serve as a foundation for future interventions, aimed at reducing problematic alcohol use in this at-risk population.

Methods

Study Design, Participants, and Data Collection

A longitudinal study based on data from the uniHcos cohort was carried out. uniHcos is a dynamic (new participants are enrolled each year) and prospective cohort whose purpose is to evaluate the evolution of university students lifestyle. The cohort started to recruit participants in December 2011, being the longest Spanish university students cohort, focusing not only in a specific outcome but also on the overall evolution of the health habits of university students and how the different factors interrelate with each other.

The target sample of uniHcos is first-year university students from eleven Spanish universities which participate in the project (Universities of Alicante, Cantabria, Castilla—La Mancha, Granada, Huelva, Jaén, León, Salamanca, Valencia, Valladolid, and Vigo). The uniHcos cohort collects self-administered data based on the questionnaire used for the National Health Surveys of Spain and other valid and reliable questionnaires (Fernández-Villa et al., 2013). Its current version includes 315 items about different health-related aspects, habits, and lifestyles, such as diet, physical activity, substance use, and mental health. At the beginning of each academic year, all the institutional emails from the students who meet the inclusion criteria are retrieved (eligible sample, Fig. 1), and an invitation with relevant information for participating in the study is sent to them. This email includes a welcome message, the main aims of the study, a statement about the data use,

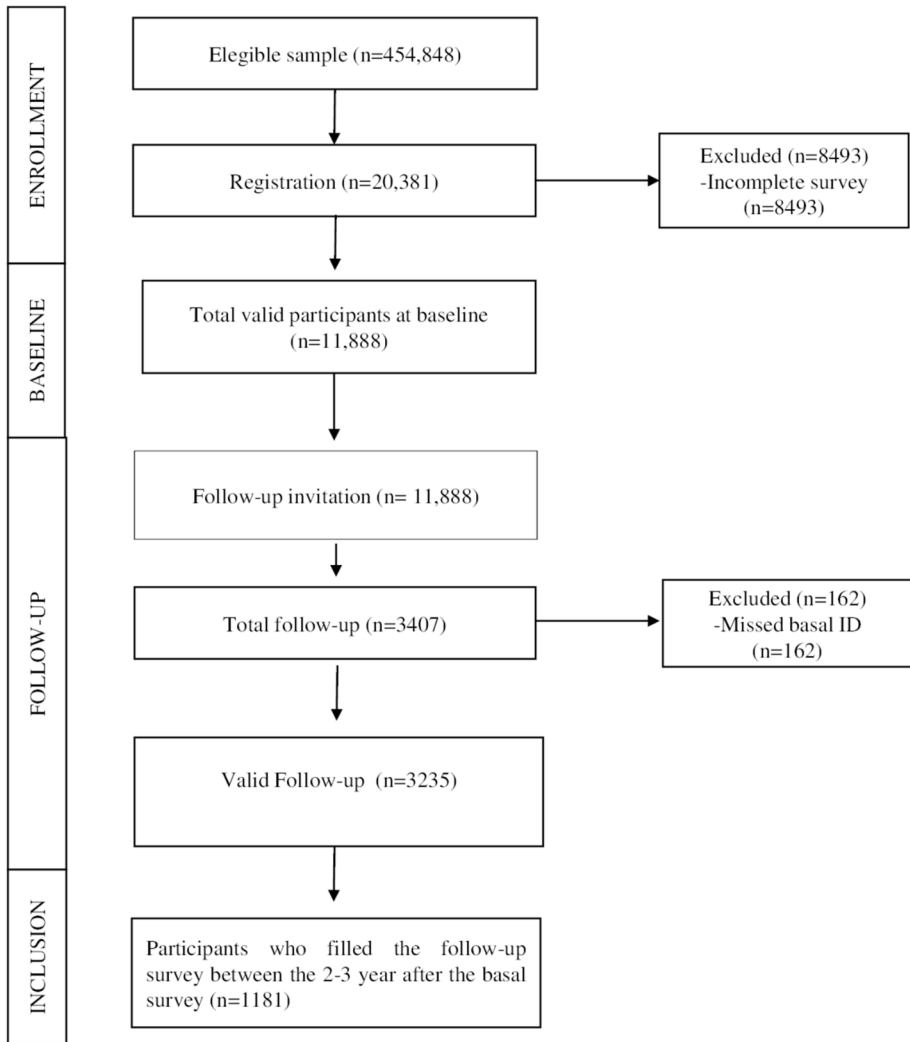


Fig. 1 Flow chart of the recruitment and inclusion of study participants in a sample of university students of Spain

and a link to access the uniHcos questionnaire. The questionnaire is filled by the students using the SphinxOnline® platform (v. 4.29, Le Sphinx Developpement, Chavanod, France), a software which guarantees the anonymity and data protection of participants, and the data is stored in a private server located at the University of León. This platform maintained strict confidentiality of data and adhered to Spanish Law 3/2018 on Data Protection (Ley Orgánica 3/2018, 2018). The data collection system is designed to minimise possible missing data as answering all the questions is required for the submission of the questionnaire.

For those who filled the baseline survey each year, another invitation is sent to the institutional email of students fill in the survey again (follow-up survey). The estimated completion time for the questionnaire ranged between 30 and 45 min. For this study, baseline data

(2012–2021) (T1) and follow-up data (2014–2023) (T2) were used. Follow-up analyses were conducted with participants who completed the follow-up survey between years 2 and 3 since completing baseline (1 year of time). This selection was motivated to ensure greater homogeneity in the follow-up sample, opting for a consistent time window. Figure 1 shows the sample identification and inclusion of participants. A total of 1181 participants who filled out the follow-up survey between 2 and 3 years after the baseline survey were included in the study.

Study Variables

The sociodemographic variables included were age (restricted to 17–24 years at baseline; so initial baseline of 17–24 years were 10883 students; Table 5, Supplementary material), sex, co-habiting status, and field of knowledge. The prevalence of alcohol consumption (ever, past 12 months, and past 30 days) as well as the practice of binge drinking in the past 30 days (defined as consuming 5 or more drinks, for men, and 4 or more drinks for women in approximately 2 h (OEDA, 2023a) was evaluated in T1 and in T2. The *Alcohol Use Disorder Identification Test* (AUDIT) was employed for the analysis of problematic alcohol use. The measure was developed by Babor et al. (WHO et al., 2001) and Kokotailo et al. (Kokotailo et al., 2004) validated it for its use in college students. The AUDIT is a self-reported measure consisting of 10 Likert-type items about different dimensions of alcohol use with a response scale from 0 to 4. The total score is computed by adding the scores for each of the items and ranges from 0 to 40 points. According to the current literature on the application of this test in Spanish university students (García-Carretero et al., 2016), in its online format (Ballester et al., 2021) and considering the general consensus on establishing different cut-off points by sex, the cut-off points used for this study were ≥ 8 points for males and ≥ 6 points for females for the determination of moderate risk of problematic alcohol use (Ballester et al., 2021; García-Carretero et al., 2016; Kokotailo et al., 2004; OEDA, 2022; Reinert & Allen, 2007).

Other covariates considered were psychological distress assessed using the 12-item version of the *General Health Questionnaire* (GHQ-12) computed using a 2-point scoring method, assigning 0 points to answers 0 and 1, and 1 point to answers 2 and 3; dysfunctionality of familial environment assessed using *the Adaptability, Partnership, Growth, Affection, and Resolve* (APGAR), categorised as follows: 7–10 points, normal support; 3–6 points, slightly dysfunctional; and 0–2 points, severely dysfunctional; the presence of a relative with an alcohol use disorder (AUD) (Yes/No); current tobacco smoker (Yes/No), and having tried any other substance use in lifetime.

Data Analysis

The prevalence rates of alcohol use in different frequencies, binge drinking, tobacco, and other substance use were estimated in T1 and T2, as binary variables. McNemar's test for paired data and Pearson's chi-square test for independent data were performed to evaluate possible significant differences in the measures between periods. Regarding problematic alcohol use, we first analysed its overall prevalence at T1 and T2 using a binary variable (i.e. positive AUDIT screening at either T1 or T2).

Additionally, we created a categorical variable to explore incidence and persistence. Incident cases were defined as participants with positive AUDIT in T2 among those with negative AUDIT in T1; persistence was defined as participants with positive AUDIT in T2 among those with also positive AUDIT in T1. As previously mentioned, a positive AUDIT screening was defined as a score of ≥ 6 for females and ≥ 8 for males.

To assess the relationship of the different covariates, the outcomes of the study multivariate logistic regression models were used. From these models, adjusted Odds Ratios (aORs) and their 95% Confidence Intervals (95% CIs) were obtained. Multivariable models were adjusted using a theory-driven approach based on the evidence about potential risk factors, considering our available variables. As described in the introduction section, some of potential predictor factors were co-habitation, other substance use, psychological distress, family history of AUD, and family dysfunctionality, so we performed adjusted models for the study of the association of these variables with the three phenomena studied (prevalence of problematic alcohol use in T2, incidence and persistence).

Due to possible differences in the specificity of the measures used derived from the use of the cut-off points selected for the AUDIT, sensitivity analyses using the same cut-off point for males and females were carried out. This has also the purpose to try to contribute to the scientific literature on the possible controversy still existing on the results obtained using the same or different cut-off points for males and females so all the analyses we performed in this study were replicated for the classical same cut-off point for both sexes (AUDIT score ≥ 8) and are available in the Supplementary material. Statistical significance was established at ≤ 0.05 , and all analyses were carried out using STATA v. 17 M.P. software.

Ethical Considerations

Students participated voluntarily and without any form of compensation, and they were fully informed about the study's objectives and all relevant information through informed consent. The protocol of the study was approved by the ethics committee of the University of León (ETICA-ULE-066-2024).

Results

Participants

Table 1 shows the sociodemographic characteristics of the sample. Most of the participants were female (76.7%), lived with their parents or family (47.1%), and were students from social sciences (35.9%) and health sciences (30.8%). To compare the possible differences between those participants who only responded to the baseline survey and those who responded to both the baseline and the follow-up survey, Table 5 in the Supplementary material shows the descriptive results of the socio-demographic characteristics of both populations, concluding that although there are statistically significant differences between the two samples, they could be enough representative in terms of proportions in each category.

Alcohol and Other Substance Use Frequencies

Table 2 shows that the prevalence rates of alcohol use in T1 and T2 were similar and high across all frequencies of alcohol use. The lifetime prevalence of alcohol use was higher in T2 (92.3% to 94.3%), as well as the past 12-month prevalence. However, the prevalence of alcohol use in the past 30 days and binge drinking in the past 30 days was almost identical. Regarding tobacco use, an increase in the prevalence of smokers was observed (22.7% to 25.2%), which was statistically significant.

Table 1 Sample characteristics at baseline (T1). Data from a longitudinal analysis of a sample of Spanish university students

	<i>n</i> (<i>N</i> = 1181)	%	95%CI
Sociodemographics (T1)			
Age (mean/SD)	18.8 (1.5)	-	-
Sex			
Male	275	23.3	20.9–25.8
Female	906	76.7	74.2–79.0
Co-habitants			
Parents/family	556	47.1	44.2–49.9
Roommates/friends	491	41.6	38.8–44.4
Alone	105	6.9	7.4–10.7
Partner	29	2.5	1.7–3.5
Field of knowledge			
Social sciences	424	35.9	33.2–36.7
Health sciences	364	30.8	28.2–33.5
Science	161	13.6	11.8–15.7
Engineering and architecture	118	9.9	8.4–11.8
Art and humanities	114	9.6	8.1–11.5

Abbreviations: CI confidence interval, T1 baseline data, SD standard deviation

Prevalence Incidence and Persistence of Risk of Problematic Alcohol Use by Sex

According to Table 3, during the university period, the prevalence of the risk of problematic alcohol use remained similar, with a slight increase in T2 (28.2% to 30.3%). However, 155 incident cases were identified. Also, a high persistence rate (61.0%) was found. These measures, using the same AUDIT cut-off point for males and females are available in Supplementary Material Table 6.

Figure 2 shows that the prevalence of risk of problematic alcohol use by sex was higher in females in T1 than in males, whereas at T2, the prevalence was similar for both sexes, incidence was similar for both sexes, while prevalence was higher among males. However, no statistically significant differences by sex were identified in any phenomenon. By carrying out this figure but using the same cut-off point for males and females (AUDIT \geq 8), statistically significant differences were observed for prevalence (T2) and persistence, with higher values in males for the four measures analysed (Supplementary Material, Fig. 3).

Possible Risk Factors Associated with Prevalence, Incidence, and Persistence of Problematic Alcohol Use at 2–3 Years of Follow-Up

Table 4 shows the results from the multivariable logistic regression models assessing the possible risk factors under study in relation to problematic alcohol use. It shows that cohabitating with roommates or friends instead of family was a strong predictor of the three phenomena under study (prevalence T2, aOR = 1.96; incidence; aOR = 1.76; persistence aOR = 2.44). A positive screening for GHQ-12 test was associated with prevalence

Table 2 Prevalence of alcohol use, binge drinking practice, and other substance use in the baseline (T1) and follow-up (T2) sample

	<i>n</i> (<i>N</i> = 1181)	%	95%CI	<i>p</i> -value ^(b)
Prevalence				
Alcohol use				
Lifetime (T1)	1090	92.3	90.6–93.7	< 0.001
Lifetime (T2)	1114	94.3	92.9–95.5	
Past 12 months (T1)	1051	89.0	87.1–90.7	0.007
Past 12 months (T2)	1076	91.1	89.3–92.6	
Past 30 days (T1)	900	76.2	73.7–78.6	
Past 30 days (T2)	902	76.4	73.9–78.7	0.898
Binge drinking practice (past 30 days)				
Binge drinking (T1)	519	44.0	41.1–36.7	0.831
Binge drinking (T2)	523	44.3	41.5–47.1	
Tobacco smokers				
Smoker (T1)	268	22.7	20.4–25.2	0.001
Smoker (T2)	297	25.2	22.8–27.7	
Number of other substances tried in lifetime^(a)				
1 (T1)	431	36.5	33.8–39.3	< 0.001
≥ 2 (T1)	27	2.3	1.6–3.31	
1 (T2)	439	37.2	34.5–39.9	
≥ 2 (T2)	172	14.6	12.7–16.7	

^(a)Number of substances other than tobacco and alcohol tried ever in lifetime. ^(b)*p*-value data for McNemar's test for paired data. *Abbreviations*: CI confidence interval, T1 baseline data, T2 follow-up data

in T2 (aOR = 1.35) and persistence (aOR = 1.65) but it was not statistically significant for incidence. Regarding other substance use in T1, being a binge drinker and tobacco smoker and having tried any other substance ever in lifetime were associated with the three phenomena. However, we found no association between a dysfunctional family or having a relative with AUD and an increased risk of prevalence, incidence or persistence.

Besides, the results from the multivariable analyses show that being a male or a female was not a risk or protective factor for problematic alcohol use. However, when the same cut-off point is employed for both sexes (score ≥ 8 points; Supplementary Material, Table 7), being a male become a significant risk factor for prevalence in T2 (aOR = 2.02 (95%CI 1.47–2.78)) and persistence (aOR = 2.35 (95% 1.54–3.59)).

Discussion

The results of our study, one of the few studies that address the issue of the evolution of problematic alcohol use during university, demonstrate that during this period, problematic alcohol use is prevalent, incident, and persistent. These results could be considered a milestone for future research and could inform the development of preventive and public health measures aimed at reducing the impact and burden of problematic alcohol use in a population group particularly affected by it: university students. According to our results, the prevalence

Table 3 Prevalence in the baseline (T1) and follow-up (T2), incidence, and persistence of the moderate-high risk of problematic alcohol use among a sample of Spanish university students

Moderate-high risk of problematic alcohol use (AUDIT)					
	<i>n</i>	Reference group (<i>n</i>)	%	95%CI	<i>p</i> -value ^(a)
Prevalence					
Baseline (T1)	333	1181	28.2	25.8–30.8	0.139
Follow-up (T2)	358	1181	30.3	27.8–32.9	
Incidence	155	848	18.3	15.8–21.0	-
Persistence	203	333	61.0	55.6–66.1	-

Moderate-high risk of problematic alcohol use was considered if AUDIT score was ≥ 8 points for males and ≥ 6 points for females (positive AUDIT). Prevalence T1: positive AUDIT in T1 among total sample ($n=1181$); Prevalence T2: positive AUDIT in T2 among total sample ($n=1181$); Incidence: positive AUDIT in T2 among those with negative with negative AUDIT in T1 ($n=848$); Persistence: positive AUDIT in T2 among those with positive AUDIT in T1 ($n=333$). ^(a)*p*-value data for McNemar’s test for paired data. *Abbreviations:* AUDIT Alcohol Use Disorder Identification Test, CI confidence interval, T1 baseline data, T2 follow-up data

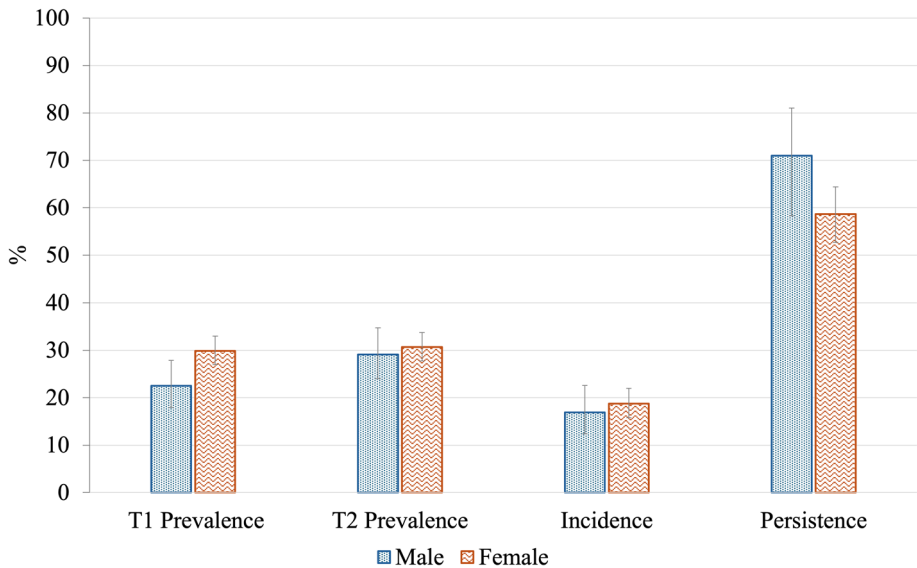


Fig. 2 Prevalence in T1 and T2, incidence, and persistence of risk of problematic alcohol use, by sex (AUDIT score ≥ 8 points for males and ≥ 6 for females) in 1181 Spanish university. T1: baseline data (first year of university), T2: follow-up data (2–3 years after baseline). Prevalence T1: positive AUDIT in T1 among total sample ($n=1181$); Prevalence T2: positive AUDIT in T2 among total sample ($n=1181$); Incidence: positive AUDIT in T2 among those with negative with negative AUDIT in T1 ($n=848$); Persistence: positive AUDIT in T2 among those with positive AUDIT in T1 ($n=333$)

rates of overall alcohol consumption remained stable in the different frequencies studied. A small increase was observed in the lifetime and 12-month frequencies, but no differences were found in the 30-past day prevalence of use and 30-past days of binge drinking practice.

Regarding the risk of problematic alcohol use, our results show that the prevalence rates remained stable over time (28.2% in T1 to 30.3% in T2). These prevalence rates are similar to previous cross-sectional studies carried out in Spain (Guerrero-Agenjo et al., 2023; Zapata et al., 2022), but lower than those from the United States (Sriken et al., 2023) and higher than those from the Netherlands (Verhoog et al., 2019). However, a high persistence rate was observed during university (61% of cases), and 18% of new incident cases were detected during follow-up. Compared to two studies carried out in the UK focused on analysing the evolution of problematic alcohol use during the university period (Bewick et al., 2008; Tarrant et al., 2019), our prevalence rates were similar (half of students were in moderate/high risk of alcohol consumption); nevertheless, our results differ from these studies regarding the evolution of prevalence, as both studies detected a decrease during follow-up, while in our case, prevalence remained stable.

However, our study converges with Bewick et al. (2008) in the conclusion that alcohol use in T1 is the strongest predictor of problematic use in T2, coinciding with our results about high persistence. This finding is also in line with the work of Hultgren et al. (2019), where the authors conclude that the students in higher risk drinking levels were likely to stay in these classes during the university period, suggesting that many students establish high-risk drinking practice in the first year of the university, and then, they maintained it. Also, a small proportion of students moved to less risky levels during this period.

In addition, a longitudinal study carried out in Spain observed that although the prevalence of risky consumption was lower at the end of the follow-up, the high-risk drinkers at the beginning of the university maintained their patterns of excessive drinking during adulthood (Moure-Rodriguez et al., 2018). These results are in line with our study, suggesting that in Spanish university students, despite the frequency of alcohol consumption being similar, the patterns of drinking are not the same, showing an increase and maintenance in the risk of problematic alcohol use during the university stage.

It should be noted that although the first year of university may be a critical period for the implementation of strategies to prevent the establishment of risky drinking patterns, the high prevalence of different drinking frequencies and positive AUDIT screening results indicates that the decisive point for action could be before university entry. A substantial body of research shows that adolescents tend to initiate alcohol consumption at an early age (Jalling et al., 2017; OEDA, 2023b; World Health Organization, 2024b), with significant consequences associated with it (Hingson et al., 2009; Lees et al., 2020; Spear, 2015). Therefore, it is essential to implement interventions from the onset of adolescence (Slade et al., 2021) until the beginning of university.

Furthermore, we explore the possible associated factors contributing to the risk of problematic alcohol use. According to the results, co-habitation with friends or roommates instead of with family was a risk factor for a positive screening in AUDIT. These results are in line with other studies describing that living with peers increases risky behaviours, possibly because of a greater sense of independence and freedom and peer pressure (Moure-Rodriguez et al., 2018; van Hooijdonk et al., 2022; Wicki et al., 2010). Additionally, a positive screening in the GHQ-12 test for the detection of psychological distress in the first year of university was also a risk factor (Arias-De la Torre et al., 2019). Binge drinking practice in T1 was a strong predictor of problematic alcohol use in the follow-up. This has been reported by several studies (Correia et al., 2024; Tavalacci et al., 2016; Vasconcelos et al., 2021). It should be noted that there is a correlation between binge drinking and AUDIT, since question 3 of the AUDIT questionnaire assesses binge drinking, so it is consistent to

Table 4 Multivariable associations of risk factors under study with prevalence, incidence, and persistence of risk of problematic alcohol use at 2–3-year follow-up in Spanish university students

	Prevalence (T2)			Incidence			Persistence		
	aOR	95%CI	p-value	aOR	95%CI	p-value	aOR	95%CI	p-value
T1 variables									
Sex (ref= female)	0.92	0.68–1.25	0.598	0.85	0.56–1.28	0.434	0.78	0.54–1.15	0.216
Age (ref= 17 yo)	0.92	0.85–1.01	0.093	0.86	0.75–0.98	0.026	0.95	0.86–1.07	0.448
Co-habitants (ref= family)	1.96	1.51–2.54	< 0.001	1.76	1.23–2.52	0.002	2.44	1.75–3.41	< 0.001
Positive screening in:									
GHQ12 test	1.35	1.05–1.74	0.020	1.32	0.93–1.88	0.125	1.65	1.19–2.27	0.003
APGAR test									
Slightly dysfunctional	0.92	0.66–1.28	0.639	0.95	0.59–1.52	0.846	0.91	0.59–1.38	0.647
Severe dysfunctional	1.30	0.80–2.11	0.288	1.56	0.83–2.93	0.164	1.13	0.59–2.15	0.702
Relative with AUD	0.95	0.60–1.48	0.792	0.85	0.44–1.62	0.616	0.88	0.50–1.57	0.684
Substance use									
Binge drinking	6.22	4.68–8.25	< 0.001	3.65	2.52–5.29	< 0.001	31.43	18.68–52.37	< 0.001
Smoker	2.56	1.91–3.44	< 0.001	2.17	1.39–3.41	0.001	4.56	3.14–6.62	< 0.001
Number of other substances tried ever in life (ref=0)									
1	3.64	2.77–4.79	< 0.001	3.13	2.15–4.57	< 0.001	6.94	4.80–10.03	< 0.001
≥ 2	10.13	4.33–23.7	< 0.001	3.13	0.59–16.4	0.177	28.66	10.40–78.98	< 0.001

Multivariable models adjusted by: sex, age, university, field of knowledge, and coliving (0, family or 1, roommates/friends/other) (basal variables (T1)). Problematic alcohol use defined as: score ≥ 8 for males and ≥ 6 for females in AUDIT. Prevalence T1: positive AUDIT in T1 among total sample (n = 1181); Prevalence T2: positive AUDIT in T2 among total sample (n = 1181); Incidence: positive AUDIT in T2 among those with negative with negative AUDIT in T1 (n = 848); Persistence: positive AUDIT in T2 among those with positive AUDIT in T1 (n = 333); reference category (0): Prevalence: negative screening in AUDIT T2, Incidence and Persistence: negative both AUDIT T1 and T2. GHQ-12 positive screening was considered as 3 or more points assessed with a 2-point scoring method, assigning 0 points to answers 0 and 1, and 1 point to answers 2 and 3. APGAR was measured as: 7–10 points, normal support; 3–6 points, slightly dysfunctional; and 0–2 points, severely dysfunctional. *Abbreviations: AUD* Alcohol Use Disorder, *AUDIT* Alcohol Use Disorder Identification Test, *GHQ-12* General Health Questionnaire, *APGAR* Adaptability, Partnership, Growth, Affection, and Resolve, *aOR* adjusted Odds Ratio, *T1* baseline data, *T2* follow-up data

find this relationship between both variables, with very high ORs being observed in all three phenomena. Regarding other substance use, being smoker and having tried any other drug were related to the prevalence, incidence, and persistence of problematic alcohol use. This coincides with a robust literature (Cance et al., 2017; El Ansari et al., 2020; Herrero-Montes et al., 2019) about the mechanisms of polysubstance use, in which the consumption of one substance enhances the use of other, especially in a problematic way (Delgado-Lobete et al., 2020). However, despite the current evidence on family dysfunctionality (Caravaca-Sánchez et al., 2021; Paxton et al., 2007; Trujillo et al., 2016), or having a family history of AUD (Kendler et al., 2015; Powers et al., 2017) in the influence of alcohol use in youths, we found no association between APGAR test or relative with AUD and an increased risk of any problematic alcohol use phenomena. This could imply that in our sample, other factors have a greater weight on alcohol consumption. So, these findings should be studied more in depth in further university population studies.

On another note, we found no differences between sexes in any phenomenon under study (prevalence, incidence, and persistence of problematic use). Although previous studies show that men have a higher risk of problematic alcohol use than women, in the recent years, consensus is emerging about the similitudes in the patterns of consumption in both sexes (Iwamoto & Mui, 2020; White, 2020), even a greater risk of alcohol consumption among females (Messina et al., 2021), especially in the youths and university students (Slade et al., 2016). Also, the use of a different cut-off of AUDIT could contribute to this narrowing gap as the application of the same cut-off point revealed that being a male was a risk factor in our analysis. Considering these findings, the necessity of standardised methodologies employed in the study of this population is imperative, thereby facilitating interoperability.

Different limitations of the study need to be discussed. First, attrition should be mentioned. This loss to follow-up is mainly attributed to voluntary and anonymised participation, and non-invasive recruitment may make some participants unmotivated to take the follow-up survey. Strategies such as survey forwarding, and social media engagement are being employed to mitigate this problem. Other limitations are the voluntary nature of participation and the length and the characteristics of the self-administered questionnaire. On another note, the fact that the prevalences of alcohol consumption are assessed dichotomously across frequencies, and that the variable of evolution of problematic alcohol consumption has also been categorised, limits information on the full pattern of consumption, with data on quantity consumed per occasion or type of drink not being available. This work also has limitations related to the sample, considering the higher proportion of women in the sample. However, more women are entering university in Spain (56.0%), especially in some fields like health sciences (71.4%) (Ministerio de Universidades, 2022) so it is hoped that this and the disaggregation of data by sex will control for a possible underestimation of men. A self-selection bias is inherently present in the study due to its original design. This may result in the participants who participate the most in both the baseline and follow-up surveys being the most motivated and those with the worst lifestyle habits choosing not to participate in these initiatives. On the other hand, this work has several strengths. Firstly, online data collection offers advantages such as reduced dependence on interviewers, fewer data entry errors, and easier data processing, making the study more efficient and reducing interviewer bias and social desirability bias. Furthermore, the use of validated questionnaires allows for comparison with other samples. And finally, we consider that the main strength is that there are few similar studies in this field, especially focusing on problematic alcohol use with a longitudinal design. The results provided in this article could lead to a better knowledge of this population to design useful preventive and directed interventions.

Conclusions

In conclusion, the results from this study show that the university period is key for students in relation to the establishment of patterns of alcohol consumption that may last into adulthood. Drinking prevalence rates were similar in the first year of university and in the following 2–3 years, and also, the prevalence of risky consumption remained stable. A high persistence of problematic alcohol use was observed (61% of cases), as reported in other studies, while incident cases were 18% in the follow-up. Living away from home, having poor mental health, and being a user of other substances such as tobacco at the beginning of university were risk factors for the development of risk of problem drinking, while no sex differences were observed. To mitigate the risks associated with alcohol consumption is crucial to implement specific prevention programmes during the first years of the university period, or even earlier. These interventions should act not only on the frequency of consumption but also on heavy and problematic drinking patterns, preventing the establishment of alcohol dependence in adulthood and its comorbidities. Therefore, our results could constitute a helpful resource to inform the development of preventive interventions against the development of problematic patterns of alcohol consumption and, consequently, to reduce the burden and impact of alcohol misuse among university students.

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Data Availability The uniHcos dataset is available upon reasonable request to the principal investigator (Tania Fernández-Villa; e-mail: tferv@unileon.es) or the corresponding author (Antonio J Molina; e-mail: ajmolt@unileon.es).

Declarations

Competing Interests The authors declare no competing interests.

Ethics Statement The procedure was carried out following current data protection regulations and following the Code of Ethics of the World Medical Association (Declaration of Helsinki of 1975, as revised in 2000). All ethics committees of the collaborating universities evaluated and approved the project. Informed consent was obtained from all patients for being included in the study. The students participated voluntarily, without

any kind of reward. For each new project carried out, the different approvals have been requested from the ethics committee of the Universidad de León, being the current code approval: ETICA-ULE-066-2024.

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