



Screening of substance use and mental health problems among Spanish medical students: A multicenter study

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ABSTRACT

Background: This study aimed to determine the prevalence of substance consumption and mental health problems among Spanish medical students, and their association with sociodemographic factors.

Methods: A multicentre cross-sectional study was conducted. Self-reported data on sociodemographic and clinical characteristics were collected, including BDI-II, PHQ-9, brief STAI, and single-item academic burnout (IUBA).

Results: Overall, 1265 students (74.2% female) completed the survey. Of them, 37.4% scored positive for depressive symptoms, as measured by the BDI-II, and more than half (53%) by the PHQ-9. Suicidal ideation was reported by about 12% whilst high levels of state and trait anxiety were informed by 28.8% and 29.4% of the students. The prevalence of burnout was 40.2%. Female and pre-clinical students reported significantly ($p < 0.01$) higher rates of depressive, anxiety, and burnout symptoms. Alcohol, energy drinks, and tobacco were the most frequently used substances. Total scores of self-reported mental health problems negatively correlated ($p < 0.001$) with objective academic results and positively correlated ($p < 0.02$) with the number of substances consumed in the last 30 days.

Limitations: Research-based on self-reported data could favour information bias due to the social desirability effect and memory error.

Conclusions: A high prevalence of substance consumption and several mental health problems was found among medical students, especially females. The relevant influence of academic-related factors on students' well-being may be a call for medical schools to implement initiatives aimed to improve students' ability to detect, address, and seek help for their mental health issues.

1. Introduction

The mental health of university students is an important global concern (Kaur Kang et al., 2021). This issue has garnered attention from organizations such as the World Health Organization, which developed the World Mental Health International College Student Initiative in collaboration with the American Psychological Association to examine the prevalence of mental health disorders among college students (Auerbach et al., 2016, 2018). Transition to university is a critical period for the development of the individual due to various factors, such as increased responsibility and autonomy. Growing evidence supports that university years are a risk onset period for several mental disorders, particularly anxiety disorders, mood disorders, and substance use

disorders (Hunt and Eisenberg, 2010; Ibrahim et al., 2013; Pedrelli et al., 2015). Likewise, early-onset mental disorders might negatively impact on academic performance (Auerbach et al., 2016), whereas early detection and intervention may arrest the evolution to chronicity (Eaton et al., 2008; Patel et al., 2007; Prince et al., 2007).

Recent studies estimated a prevalence of a third of the college students reporting severe levels of psychological distress in the previous month (Porru et al., 2021) and a 12-month prevalence of 31% in any common mental disorder (Auerbach et al., 2018). A higher prevalence of psychological distress was found in college students reporting higher effort-reward imbalance and higher overcommitment, as well as in females (Duffy et al., 2019; Porru et al., 2021).

Regarding medical students, recent meta-analyses estimated

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prevalence as high as 27.2% (Rotenstein et al., 2016) and 28.0% (Puthran et al., 2016) for depressive symptoms, 33.8% for anxiety (Quek et al., 2019), and 11.1% for suicidal ideation (Rotenstein et al., 2016) among medical students worldwide. However, very little research has been conducted on the causes or consequences of these mental health problems (Hope and Henderson, 2014; Tempiski et al., 2012). It could be hypothesized that medical students face several additional stressors such as long hours of study, high workload, and insecurities concerning the medical profession.

Several factors, such as year of study, gender, personal and family-related issues, changes in lifestyle, and health status have been associated with depressive symptoms among medical students (Giner-Murillo et al., 2021; Mirza et al., 2021; Tam et al., 2019). As in the general population, female medical students are more likely to report depressive and anxiety symptoms than males (Brenneisen Mayer et al., 2016; Mirza et al., 2021; Pacheco et al., 2019).

Although various studies report that suicide in physicians is more frequent at later ages (Irigoyen-Otiñano et al., 2022; Petersen and Burnett, 2008; Rose and Rosow, 1973), it also occurs among medical students. In a recent study with 4840 medical students, 8.94% had made a suicide attempt. Factors associated with a suicide attempt included being female, daily tobacco consumption, and having a severe risk of alcohol abuse, among others (Marcon et al., 2020). Even though a suicide attempt differs from suicide, in the field of medicine some peculiarities require greater attention. Although the transition between suicidal ideation and attempted suicide is not fully understood, (Diekstra and Garnefski, 1995) medical students and physicians may be more aware of these characteristics than the general population (Aasland et al., 2011) and therefore suicidal thoughts should be taken with extreme attention. In addition, it is known that they present little active help-seeking regardless of the severity of the emotional symptoms they may be presenting (Cai et al., 2020) since they are less likely to ask for help and seek treatment since they consider it a stigma for the profession (Wallace, 2012).

Despite literacy about their potential harms, tobacco smoking, as well as alcohol and illicit substances misuse represent another prevalent health problem in this population (Bourbon et al., 2019; Roncero et al., 2015). Cannabis is the most common illicit substance used among medical students. According to a recent meta-analysis, its lifetime prevalence was 31.4% and the past month's prevalence was 13.4% in Europe (Papazisis et al., 2018). Energy drinks and other psychoactive substances used for cognitive enhancement are also a growing concern (Plumber et al., 2021). Except for hypnotics and sedative drugs, substance use is more frequent among male students (Roncero et al., 2015). Anyway recent research showed that variations are strongly influenced by cultural factors, among medical students in twelve countries (Molodnynski et al., 2020).

Burnout among medical students is a growing area of research, showing the high level of distress due to the stressors related to academic activities. A recent meta-analysis estimated a global prevalence of burnout as high as 44.2% (Frajerman et al., 2019a). Family support during undergraduate medical education was associated with both lower burnout levels and higher academic efficacy (Gradiski et al., 2022). Moreover, in a study conducted in Spain, burnout symptoms increased with the number of years studying medicine (Gil-Calderón et al., 2021) and burnout symptoms were estimated in 37.5% of sixth-year medical students (Galán et al., 2011).

Research conducted on medical students in Spain has tended to focus on psychological distress and burnout rather than on common mental health problems, such as depression and anxiety symptoms, and suicide ideation (Atienza-Carbonell and Balanzá-Martínez, 2020). On the other hand, few multicentre studies have had a large enough sample (Brenneisen Mayer et al., 2016).

Therefore, determining the prevalence rates of different mental health issues and substance consumption in medical students from multicentre studies will allow us to better estimate the magnitude of the

problem. Additionally, identifying which variables are associated with mental health problems will be useful to guide appropriate mental health promotion and early intervention in this population group.

The main objective of this study was to determine the prevalence of depressive and anxiety symptoms, burnout, substance use, and suicidal ideation in medical students from two public Spanish universities. The secondary objective was to determine the relationship between those prevalence rates and several variables of interest, including gender, year of undergraduate study, objective academic results, and satisfaction with the grades of the previous semester.

2. Methodology

This is an observational, cross-sectional, and multicentre study with a survey sample. The population of interest was all students enrolled in the Degree in Medicine of two public universities in Spain, the University of Valencia (UV) and the University of the Basque Country (UPV/EHU) in the academic year 2019–2020. The Degree in Medicine enrolls about 320 new students every year in the UV and 200 in the UPV/EHU. All students ($n = 2035$) were invited to complete an ad hoc socio-demographic survey with the following variables: gender; age; year of study; parents' educational level; type of accommodation during the academic year; objective academic results of the previous year (range from 0 to 10); if participants had ever consulted a health professional about a mental health problem and if in the past semester they had perceived the need for psychological support for recent mental health problems. Regarding the year of study, participants were aggregated into pre-clinical (1st to 3rd) and clinical (4th to 6th) years.

Lifetime and last 30 days' prevalence of tobacco, alcohol, and several substances (see Table 2) were measured, with answer options being "Yes" or "No".

Satisfaction with the grades achieved during the previous semester was measured with a Likert-type scale, with answer options being "Very satisfied", "Satisfied", "Unsatisfied", "Very unsatisfied". The response options were aggregated into Very satisfied/Satisfied and Unsatisfied/Very unsatisfied.

Both universities offer a free counselling service on psychological, sexual, and psycho-pedagogical issues for their students, and participants were asked about awareness of the existence of that service.

Participants were invited to complete the following questionnaires:

- **Beck Depression Inventory (BDI-II)**. It is a self-administered questionnaire composed of 21 items, it is validated in the Spanish university population and has adequate psychometric properties, including good internal consistency (Sanz et al., 2005). The criteria and cut-off scores by Sanz et al. (Sanz et al., 2014) were used to interpret the scores on the BDI-II. Suicidal ideation was evaluated through item 9 of the BDI-II (Green et al., 2015).
- **Patient Health Questionnaire-9 (PHQ-9)**. The PHQ-9 is a self-reported nine-item depression screening instrument (Diez-Quevedo et al., 2001a; Kroenke et al., 2001). The criteria and cut-off scores by Diez-Quevedo et al. (Diez-Quevedo et al., 2001b) were used to interpret the scores. Screening for suicidal ideation/suicide risk was performed with item 9 of the PHQ-9.
- **State and Trait Anxiety Inventory (STAI) brief version**. The STAI is a self-reported questionnaire widely used in the literature for the assessment of state and trait anxiety in both general and clinical populations (van Knippenberg et al., 1990). The brief Spanish adaptation (Buela-Casal and Guillén-Riquelme, 2017) was used.
- **Single-item academic burnout (IUBA)**. The IUBA is a self-reported single item screening instrument with 5 options of response (1–5), derived from the single item burnout (Merino-Soto and Fernández-Arata, 2017). The cut-off score used for burnout symptoms was ≥ 3 .

The self-report instruments chosen in the present study are among the most commonly used questionnaires to assess mental health issues in

studies of medical students. Specifically, the PHQ-9 and the BDI-II are widely used, according to meta-analyses of studies of depressive symptoms among medical students across the globe (Jin et al., 2021; Rotenstein et al., 2016; Tam et al., 2019). Although these questionnaires may overlap, they have been shown to differ in categorizing the severity of depression (Titov et al., 2011). In this regard, the BDI-II, but not the PHQ-9, measures the direction of sleep and appetite change, or relevant aspects of depression, such as punishment feelings, irritability, indecisiveness, and libido. Moreover, the PHQ-9 is among the instruments used to assess suicide ideation in that population (Rotenstein et al., 2016). Similarly, the STAI is one of the instruments used to assess anxiety symptoms (Quek et al., 2019). Of note, screening for suicide and burnout does not correspond to evaluating suicide or burnout.

2.1. Procedure

During two weeks of February 2020, medical students from both universities were invited to complete a self-administered, online survey. Participation was kept voluntary and students could withdraw from the survey at any point before sending the questionnaire. Responses were anonymized. Participation was conducted from an online survey platform which guaranteed the anonymity of the data collected. The data was saved in an offline database for statistical analysis.

The Ethics Committee of each university approved the study (124,977 in the UV and M10_2019_286 in the UPV/EHU). The study was conducted following the ethical principles of clinical research involving humans (WMA, Declaration of Helsinki).

2.2. Statistical analysis

To describe the distribution of the socio-demographic and clinical characteristics of the sample, measures of central tendency (mean) and dispersion (standard deviation) were used for the quantitative variables, as well as absolute (n) and relative (%) frequencies for the qualitative variables. In both cases, a two-tailed 95% confidence interval was used.

Continuous variables were compared using the Student's *t*-test for two independent groups (e.g. gender; satisfaction with the grades achieved during the previous semester) or analysis of variance (ANOVA) when there were three or more independent groups (e.g. year of study; parents' educational level; type of accommodation during the academic year; language of studies; perceived need for psychological support for recent mental health problems). For comparisons of parametric variables between more than two groups, if the main effect was significant, pairwise comparisons were performed using post hoc tests. To test the associations between variables, Pearson's chi-square test (χ^2) or Fisher's exact test where necessary, was used for categorical variables and correlation analysis for continuous variables.

The latest available version of the SPSS program (SPSS Inc., Chicago, USA) was used for statistical analysis. In all cases, the level of statistical significance was established at a value of $p < 0.05$.

3. Results

3.1. Sample description

The study sample consisted of 1265 medical students, comprising 793 from UV and 472 from UPV/EHU. The response rates were 41.3% and 39.3%, respectively.

The sociodemographic characteristics of the whole sample are shown in Table 1. The mean age was 21.40 (\pm 3.31) years and women were predominant (74.2%). Students from all academic years participated, although those in their third year predominated (21.3%). Most of the sample (67.8%) were satisfied or very satisfied with their academic results of the previous semester.

More than one-third of the sample (34.7%) reported having ever consulted a professional for a mental health problem and 26.5% of

Table 1
Sample description: sociodemographic characteristics.

Variables/categories		Mean	SD
Age		21.40	3.31
		n	%
University	UV	793	62.7
	UPV/EHU	472	37.3
Sex	Female	939	74.2
	Male	320	25.3
	Non-binary	6	0.5
Academic year	First	201	15.9
	Second	228	18
	Third	270	21.3
	Fourth	234	18.5
	Fifth	201	15.9
	Sixth	131	10.4
Language of studies	Spanish	653	51.6
	Euskera	246	19.5
	Valencian	199	15.7
	English	167	13.2
Mother's educational level	University	190	15
	Medium	279	22.1
	Low	796	62.9
Father's educational level	University	218	17.2
	Medium	321	25.4
	Low	726	57.4
Type of accommodation during the academic year	With the family	727	57.5
	Shared apartment	428	33.8
	Student residency	27	2.1
	On my own	83	6.6
Satisfaction with the academic results of the previous semester	Very satisfied	237	18.7
	Satisfied	621	49.1
	Not that satisfied	288	22.8
	Not satisfied at all	119	9.4
Ever consulted a health professional about a mental health problem	Yes	439	34.7
During undergraduate education consulted a health professional about a mental health problem	Yes	335	26.5
Perceived need for psychological support for recent mental health problems	Yes	395	31.2
	No	585	46.3
	I am not sure	285	22.5
Know the existence of the free counselling service on psychological, sex and psycho-pedagogical issues of the UV or UPV/EHU	Yes	480	37.9

UV = University of Valencia; UPV/EHU = University of the Basque Country.

participants had done so during undergraduate education. Moreover, the perceived need for psychological support for recent mental health problems was 31.2%.

Table 2 depicts the characteristics of substance consumption. Alcohol was the substance most frequently used by students during their lifetime and during the last 30 days, followed by energy drinks and tobacco. More than one-third of the students (36.8%) had ever used cannabinoids, although only 6.6% did so in the last 30 days.

3.2. Prevalence of mental health issues

The prevalence of depressive symptoms and suicidal ideation, state and trait anxiety, and burnout symptoms appear in Table 3.

More than a third of the sample (37.4%) positively screened for depression symptoms according to the BDI-II and more than half (56.2%) using the PHQ-9. Specifically, 16.1% reported mild, 12.4% moderate, and 8.9% severe depression symptoms as measured by the BDI-II. For the PHQ-9 categories, 43.8% reported no to minimal, 34.7% mild, 13.1% moderate, 5.2% moderately severe, and 3.2% severe depression symptoms (Table 3).

Suicidal ideation was reported by 12.7% of the medical students as

Table 2
Prevalence of substance consumption.

Substance	Consumption			
	Lifetime		Last 30 days	
	n	%	n	%
Alcohol	1167	92.3	913	72.2
Tobacco	545	43.1	164	13.0
Energetic drinks	632	50.0	165	13.0
Benzodiazepines	261	20.6	64	5.1
Antidepressants	105	8.3	50	4.0
Cannabinoids	466	36.8	84	6.6
Synthetic cannabinoids (e.g. Spice)	6	0.5	1	0.1
Ectasis (e.g. MDMA)	32	2.5	3	0.2
Amphetamines (e.g. Speed)	26	2.1	4	0.3
Psilocybin (e.g. hallucinogenic mushrooms)	24	1.9	1	0.1
Cocaine	24	1.9	3	0.2
LSD	12	0.9	1	0.1
Inhalant (e.g. Popper, ether)	30	2.4	3	0.2
Opiate (e.g. heroine, morphine)	7	0.6	1	0.1
Other design drugs (e.g. Nexus, 3cb)	3	0.2	1	0.1
Other hallucinogenic drugs (e.g. ayahuasca, peyote, DMT)	4	0.3	0	0

MDMA: 3,4 methylenedioxyamphetamine; DMT: dimethyltryptamine.

defined by item 9 of the BDI-II and 11.7% as defined by item 9 of the PHQ-9.

Taking percentile ≥ 75 as a cut-off score (total score = 10 in both categories) (Martínez-Otero Pérez, 2012), 28.8% and 29.4% of the students reported high state and high trait anxiety, respectively (Table 3).

The prevalence of burnout symptoms as evaluated by the IUBA was 40.2%. (Table 3).

3.3. Relationship of mental health outcomes with other variables of interest

Females reported significantly higher total scores on the BDI-II ($p < 0.001$), the PHQ-9 ($p < 0.001$), and the brief STAI ($p < 0.001$), as well as higher rates of high state anxiety ($p = 0.004$) and trait anxiety ($p <$

Table 3
Total scores and prevalence of psychopathological symptoms.

Variables		Total (n = 1259)		Women (n = 939)		Men (n = 320)		T	p
		Mean	SD	Mean	SD	Mean	SD		
Total BDI-II score		12.21	9.94	12.88	10.14	10.18	9.08	4.228	<0.001
Total PHQ-9 score		6.47	5.12	6.74	5.22	5.67	4.71	3.242	<0.001
STAI State anxiety		7.96	2.75	8.16	2.75	7.37	2.70	5.245	<0.001
STAI Trait anxiety		7.63	3.44	7.91	3.45	6.76	3.29	4.456	<0.001
Categories		Total		Women		Men		X ²	p
		n	%	n	%	n	%		
BDI-II	No depression	788	62.6	552	58.8	236	73.8	25.115	<0.001
	Mild depression symptoms	203	16.1	173	18.4	30	9.4		
	Moderate depression symptoms	156	12.4	122	13.0	34	10.6		
	Severe depression symptoms	112	8.9	92	9.8	20	6.3		
PHQ-9	No to minimal	552	43.8	387	41.2	165	51.6	12.037	0.017
	Mild	437	34.7	337	35.9	100	31.3		
	Moderate	165	13.1	128	13.6	37	11.6		
Brief STAI	Moderately severe	65	5.2	53	5.6	12	3.8	8.385	0.004
	Severe	40	3.2	34	3.6	6	1.9		
	High state anxiety	363	28.8	291	31.0	72	22.5		
IUBA	High trait anxiety	370	29.4	308	32.8	62	19.4	20.731	<0.001
	I enjoy my studies. I have no symptoms of burnout	124	9.8	88	9.4	36	11.3		
	Occasionally I am under stress, I don't always have as much energy as I once did, but I don't feel burned out	628	49.9	448	47.7	180	56.3		
IUBA	I am definitely burning out and have one or more symptoms of burnout, such as physical and emotional exhaustion	345	27.4	269	28.6	76	23.8	13.743	0.008
	The symptoms of burnout that I'm experiencing won't go away.	101	8.0	87	9.3	14	4.4		
	I feel completely burned out.	61	4.8	47	5.0	14	4.4		

BDI-II: Beck Depression Inventory II; PHQ-9: General Health Questionnaire-9; Brief STAI: State and Trait Anxiety Inventory brief version; IUBA: Single-item academic burnout.

0.001) than males (Table 3). Moreover, females presented higher percentages in the three categories of clinical severity of depressive symptoms of the BDI-II ($p < 0.001$) and the five categories of the PHQ-9 ($p = 0.017$). Similarly, a higher proportion of women reported symptoms of burnout ($p < 0.008$). No significant differences were found in suicidal thoughts regarding gender as measured by the BDI-II and the PHQ-9 ($p = 0.948$ and $p = 0.540$, respectively).

Medical students who reported being unsatisfied/very unsatisfied with their grades showed higher total scores on the PHQ-9 and the BDI-II, as well as higher burnout symptoms ($p < 0.001$, in all cases).

Significant differences were found between academic years in state anxiety, PHQ-9, BDI-II, and burnout total scores ($p < 0.05$, in all cases). These prevalence rates were higher during the pre-clinical years of medical studies ($p < 0.002$). Conversely, a significantly higher prevalence of lifetime consumption of benzodiazepines, cannabinoids, and ectasis, and consumption of amphetamines in the last 30 days, was observed during the clinical years of medical studies ($p < 0.05$).

Moreover, a negative correlation was observed between the objective academic results of medical students and total scores on the BDI-II ($r = -0.276$; $p < 0.001$), PHQ-9 ($r = -0.272$; $p < 0.001$), state anxiety ($r = -0.179$; $p < 0.001$), trait anxiety ($r = -0.167$; $p < 0.001$) and burnout ($r = -0.242$; $p < 0.001$). A positive correlation was observed between the number of substances ever consumed and total scores on the BDI-II ($r = 0.202$; $p < 0.001$), PHQ-9 ($r = 0.261$; $p < 0.001$), state anxiety ($r = 0.104$; $p < 0.001$), trait anxiety ($r = 0.055$; $p = 0.049$) and burnout ($r = 0.173$; $p < 0.001$). The number of substances consumed in the last 30 days were also positively correlated with total scores of BDI-II ($r = 0.181$; $p < 0.001$), PHQ-9 ($r = 0.233$; $p < 0.001$); state anxiety ($r = 0.120$; $p < 0.001$); trait anxiety ($r = 0.071$; $p = 0.012$) and burnout ($r = 0.136$; $p < 0.001$).

No other significant associations were found between mental health outcomes and other variables of interest.

4. Discussion

The main objective of this study was to determine the prevalence of substance consumption and several mental health outcomes among

medical students from two public universities in Spain. Overall, the prevalence of symptoms of depression, suicidal ideation, anxiety, burnout, and substance use are relevant and in line with previous research.

More than a third of the participants reported having had depressive symptoms of any severity in the previous two weeks. Moreover, around 12% of the students reported recent suicidal ideation. Additionally, almost a third of the students reported high state and trait anxiety and 40.2% of them reported burnout.

In this study, the prevalence of depressive symptoms was higher than 27.2% and 28.0% found in recent meta-analyses (Puthran et al., 2016; Rotenstein et al., 2016). These discrepancies may be related, at least in part, to the screening instrument of depressive symptoms used. These differences were maintained after comparing our results with the median prevalence of the studies that used the BDI-II with the same cut-off scores of the Rotenstein meta-analysis (29.5% vs 37.4% in our study). Conversely, the median prevalence of studies that used the PHQ-9 and the same cut-off scores was similar to that in our study (53.5% vs 56.2%).

The presence of suicidal ideation in this study (11.7% as measured by item 9 of BDI-II and 12.7% as measured by item 9 of PHQ-9) was higher than that found in the Puthran meta-analysis of medical students (5.8%) (Puthran et al., 2016) and among Spanish university students (9.9%) (Blasco et al., 2019). Nevertheless, the rate of suicidal ideation (11.1%) in another meta-analysis (Rotenstein et al., 2016) was similar to ours. As mentioned before, these differences could be due, at least in part, to the screening instrument of suicidal ideation used in this study, e.g. a single item of the BDI-II and PHQ-9, instead of a more specific instrument.

The global prevalence of anxiety in medical students (33.8%), according to a meta-analysis (Quek et al., 2019), was similar to that of our study. Moreover, our results are in the lower part of the anxiety-state prevalence range (23.7% - 81.7%) of the studies that used the STAI as an assessment instrument in that meta-analysis (Quek et al., 2019).

There is a considerable degree of heterogeneity in the prevalence of burnout symptoms among medical students, which probably results from the use of different instruments and criteria for categorizing burnout (Gil-Calderón et al., 2021). Although in this study burnout was measured with the IUBA (Merino-Soto and Fernández-Arata, 2017), our results (40.2%) concur with the global prevalence estimates for burnout among medical students (44.2%) (Frajerman et al., 2019b), medical students from the United States (35.2%) (Dyrbye et al., 2014) and sixth-year medical students from Spain (37.5%) (Galán et al., 2011).

The number of substances consumed both lifetime and in the last 30 days correlated positively with depressive, anxiety, and burnout symptoms. In this survey, the most frequently used substances were alcohol, energy drinks, and tobacco. The lifetime prevalence of cannabis use in the present study (36.8%) was similar to 31.4% reported in a recent meta-analysis (Papazisis et al., 2018). Conversely, tobacco use in the last 30 days (13%) was found to be lower than the 18.9% of French medical students identified as current daily tobacco smokers (Bourbon et al., 2019).

More than one-third of medical students (34.7%) in this survey reported to have ever consulted a professional for a mental health problem. Moreover, although the prevalence of individuals who had ever consulted a professional during undergraduate education was around 25% of the sample, the perceived need for psychological support for recent mental health problems remained in nearly 30% of the students. Evidence shows that only a small proportion of 1 out of 7 medical students screening positive for depressive symptoms seek professional help (Puthran et al., 2016; Rotenstein et al., 2016). It has been suggested that due to “self-stigma” (Henderson et al., 2012), medical students might fear being perceived by their peers and faculty members as less able to handle their responsibilities (Schwenk et al., 2010). Growing evidence suggests that senior physicians disclosing histories of personal vulnerability could support destigmatizing mental illness and normalizing help-seeking among medical students (Martin et al., 2020). However,

self-stigma was not assessed in our survey. Subsequent studies should clarify the relationship between self-stigma in the perceived need for psychological support and seek for help in this population.

Optimizing mental health is desirable for medical students, as future healthcare professionals. Literature showed that poor mental health and well-being among doctors and residents were associated with reduced empathy and self-reported suboptimal patient care practices (Gibby and McKimm, 2021; Rosen et al., 2006; Shanafelt et al., 2002). Moreover, interventions earlier in the medical career pathway aiming to the prevention and detection of mental health issues may be beneficial to the physician community (Ranasinghe et al., 2022).

4.1. Relationship of mental health outcomes with other variables of interest

Regarding the secondary aim of our study, female students reported more depressive symptoms and higher rates of high state and trait anxiety than their male counterparts. These gender differences converge with those previously described regarding depression and anxiety in the general population (World Health Organisation, 2017) and depressive and anxiety symptoms among undergraduate students (Asher BlackDeer et al., 2021; Liu et al., 2019; Steptoe et al., 2007). Likewise, significant gender differences in depressive and anxiety symptoms have been described specifically among medical students (Brenneisen Mayer et al., 2016; Mirza et al., 2021; Pacheco et al., 2019). Nevertheless, higher rates of depressive and anxiety symptoms have been found in female medical students, but those differences were not statistically significant (Haldorsen et al., 2014; Puthran et al., 2016; Quek et al., 2019).

Similarly, a higher proportion of women reported burnout symptoms in our study. However, this is a controversial relationship, since similar studies have shown that burnout symptoms are either more frequent in women (Gil-Calderón et al., 2021) or do not differ according to gender (Galán et al., 2011).

It should be noted that in the context of the progressive feminization of the profession and according to statistics from the Spanish Ministry of Universities (Ministry of Universities, 2021), in the academic year of our study (2019/2020) a total of 69.9% of the medical students in Spain were female students. Therefore, we consider our sample (74.2% of female students) was more similar than dissimilar compared to the sex ratio of medical students of our country.

On the other hand, higher rates of state anxiety, depressive symptoms, and burnout were found among pre-clinical students in this study. In a meta-analysis (Puthran et al., 2016), first-year medical students showed the highest rates of depression, and rates significantly and gradually decreased until the last year of medical school. During pre-clinical years, medical students face the stressful effects of changing both their place of residence and social circles, the broadness of the academic pre-clinical syllabus, high expectations of themselves, and little time for hobbies (Coskun et al., 2019; Steiner-Hofbauer and Holzinger, 2020). Future studies should consider these factors.

Previous research has analyzed the relationship between psychopathological distress and satisfaction with the current degree program (Mao et al., 2019), academic results (Iorga et al., 2018), and life in general (Aboalshamat et al., 2015). In our study, a lower degree of satisfaction with the grades achieved during the previous semester was associated with higher scores of depressive and burnout symptoms. However, the relationship between objective academic results and psychopathology represents one of the novelties of the present study. In our study, objective academic results correlated negatively with all the psychopathological measures.

According to the literature, the main factors contributing to burnout in medical students include those associated with the curriculum, such as stress related to the competition, the exams or the cost of the studies, as well as hospital conditions, such as the workload, exposure to patients' suffering and death, and style of management (Frajerman, 2019). As indicated above, in our study, burnout was associated with greater

dissatisfaction with the academic results of the previous semester. Evaluating the role of these and other factors on mental health outcomes would be of special interest in future studies.

4.2. Strategies to promote mental health among medical students

All these findings suggest that medical students may face several mental health problems. Different strategies exist to promote mental health and support psychological well-being among medical students. In general, actions concrete in 1) design and implementation of student-oriented support initiatives such as *peer support for student mental health* (Faulkner and Basset, 2012; Gulliver and Byrom, 2014; Ochocka et al., 2006; Suresh et al., 2021), 2) changes in undergraduate medical curriculum aimed to reduce academic stress (Ange et al., 2018; Bloodgood et al., 2009; Reed et al., 2011), and 3) psychotherapeutic interventions based on mindfulness or healthy lifestyle behaviors (Daya and Hearn, 2017; Giner-Murillo et al., 2021; Melnyk et al., 2014; Shiralkar et al., 2014).

Several *limitations* should be considered when interpreting the present results. First, the cross-sectional study design prevents establishing causality. Second, research based on self-reported data could favour information bias due to the social desirability effect and memory error. Third, as previously mentioned, some of the chosen screening instruments could affect the external validity of our data, since suicidal ideation was assessed using single items of the BDI-II and the PHQ-9, and no specific instrument was used. Actual mental health issues are properly determined with hetero-administered instruments, such as structured clinical interviews, whereas self-reported measures allow screening only. Therefore, the screening for suicide and burnout does not correspond to evaluating those mental health issues. Fourth, a key issue in survey-based research is whether respondents differ from non-respondents in some way that is likely to impact systematically the estimated prevalence. The use of convenience samples and self-report instruments are potential limitations of this study. Both issues seem to be the rule rather than the exception in the field, however. Indeed, all but one of the 183 studies included in the meta-analysis by Rotenstein and colleagues (Rotenstein et al., 2016) used self-report instruments. Moreover, multicenter surveys conducted in other European countries also used convenience samples and opportunistic sampling methods (Bert et al., 2020; Fond et al., 2018), like the present study. Additionally, the response rates in this study were near half of the target population. Considering that no academic or financial compensation was offered to the students for participating in the study, the response rate could be regarded as one of the main *strengths* of this study. Nevertheless, to our knowledge, this is the first multicentre study conducted in Spanish medical schools to specifically estimate the prevalence of depressive and anxiety symptoms, suicidal ideation, burnout, and substance consumption among medical students. In addition, the survey was conducted in a period without exams in both universities, to avoid the influence of any academic stressors due to proximity to examinations or carry-over effects shortly after the examination periods.

5. Conclusion

The present findings confirm a high prevalence of substance consumption, depression, anxiety, suicidal ideation, and burnout symptoms among medical students. Our results demonstrate a significant effect of gender and academic-related factors on students' mental health. Importantly, our results may prompt medical schools to implement initiatives to improve students' ability to detect, address, and seek help for their mental health issues.

CRedit authorship contribution statement

Conceptualization and methodology, B.A.-C., V.B.-M., V.G.-C., and M.I.-O.; software, B.A.-C.; formal analysis, B.A.-C., and V.G.-C.;

investigation, B.A.-C., V.B.-M., and V.G.-C.; writing—original draft preparation, B.A.-C., V.B.-M., and V.G.-C.; writing—review and editing, M.I.-O.; supervision, V.B.-M. All authors have read and agreed to the current version of the manuscript.

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Conflict of interest

The authors declare no potential conflicts of interest related to the research, authorship, and publication of this article.

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