Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Journal of Affective Disorders Reports 10 (2022) 100404

Contents lists available at ScienceDirect

Journal of Affective Disorders Reports

journal homepage: www.sciencedirect.com/journal/journal-of-affective-disorders-reports

Research Paper

Mental health in medical, dental and pharmacy students: A cross-sectional study

Ariel Frajerman [a,b,g,*], Boris Chaumette [a,c,d,g], Marie-Odile Krebs [a,c,g], Yannick Morvan [e,f,g]

[a] INSERM U1266, Institute of Psychiatry and Neuroscience of Paris, Université Paris Cité, 102-108 Rue de la Santé, Paris F-75014, France
[b] Service de Psychiatrie, Hôpital de Bicêtre, DMU 11 Psychiatrie, Santé Mentale, Addictologie et Nutrition, Équipe MOODS, Inserm U1178, CESP (Centre de Recherche en Epidémiologie et Santé des Populations), Université Paris-Saclay, AP-HP, Le Kremlin-Bicêtre, France
[c] GHU Paris Psychiatrie et Neurosciences, Paris F-75014, France
[d] Department of Psychiatry, McGill University, Montréal, QC H3A 0G4, Canada
[e] UFR SPSE, laboratoire CLIPSYD, Université Paris Nanterre, EA4430, Nanterre, France
[f] Inserm U1018, CESP, Épistémologie et Méthodes de la Recherche en Pédopsychiatrie et Santé Mentale Des Enfants et Des Adolescents, Paris, France
[g] CNRS GDR 3557, Institut de Psychiatrie, France

ARTICLE INFO

Keywords:
Depression
Anxiety
Burnout
Suicidal ideation
Students

ABSTRACT

Background: The mental health of health students is considered a public health issue which increased dramatically with the COVID 19's pandemic. Few studies have assessed the prevalence of depression in medical, pharmacy, and dental students. Our goal was to assess mental health in health students from the same university and identify the associated factors.

Methods: An online survey was sent to the health students of the University of Paris in 3 specialties (medicine, pharmacy, and dentistry). We used the Hospitalization Anxiety and Depression scale, the Composite International Diagnostic Interview-Short Form and the Maslach Burnout Inventory (with 2 versions: the Human Services Survey for clinical students and residents and the Student survey for the others). The presence of suicidal ideation, humiliation, sexual harassment, and sexual aggression over twelve-months was also measured. We performed multivariable logistic regression analyses to identify the associated factors of Major Depressive Episodes (MDE).

Findings: 1925 students answered the survey. The overall prevalence of 7-day anxiety and depressive symptoms, MDE, suicidal ideation, humiliation, sexual harassment, and sexual aggression were 55%, 23%, 26%, 19%, 19%, 22%, and 5.5%, respectively. Burnout was present in 42% of nonclinical students and 65% of clinical students and residents. Multivariable logistic regression identified several associated factors of MDE: moderate (OR = 1.49,CI95[1.17-1.90]) or major (OR = 2.32,CI95[1.68-3.20]) subjective financial difficulties, humiliation (OR = 1.71,CI95[1.28-2.28]), sexual abuse (OR = 1.65,CI95[1.04-2.60]), and sexual harassment (OR = 1.60,CI95[1.19-2.16]).

Interpretation: This is one of the largest studies comparing dental, pharmacy and medical students from the same university. We found elevated prevalences of psychiatric symptoms with variation depending on specialty.

1. Introduction

Students' mental health is a public health issue. Long before the COVID 19 pandemic, a meta-analysis found a prevalence of depressive symptoms in 30.6% of students (Ibrahim et al., 2013). A meta-analysis focusing only on medical students found a prevalence of depression or depressive symptoms and suicidal thoughts in 27% and 11% of the students, respectively (Rotenstein et al., 2016), while another, on residents only, showed a prevalence of depressive symptoms in 29% (Mata et al., 2015). In dental students, depressive symptoms also concerned 29% of the students, according to a recent meta-analysis (Muniz et al., 2021). There are fewer studies on pharmacy students. Only a few studies compared these 3 populations and found more frequent depressive symptoms in dental students than in medical and pharmacy students (Bacchi and Licinio, 2015; Hamasha et al., 2019). Burnout syndrome is also frequently studied and is usually defined by the

* Corresponding author at: INSERM U1266, Institute of Psychiatry and Neuroscience of Paris, Université Paris Cité, 102-108 Rue de la Santé, Paris F-75014, France.
E-mail address: ariel.frajerman@inserm.fr (A. Frajerman).

https://doi.org/10.1016/j.jadr.2022.100404
Received 13 June 2022; Received in revised form 12 July 2022; Accepted 14 August 2022
Available online 16 August 2022

combination of three categories of symptoms: Emotional Exhaustion (EE), Depersonalization (DP), and Personal Accomplishment (PA) (Maslach and Jackson, 1981). According to a meta-analysis, in medical students before residency, burnout concerned 44% of the students (Frajerman et al., 2019).

Before the COVID 19 pandemic in France, few national studies had been dedicated to measuring mental health in health students.: Students' medical associations decided to launch a national survey on medical students and young doctors in 2017 and found that 66% had anxiety symptoms and 28% had depressive symptoms, using the Hospitalization Anxiety and depression scale (HAD) as a measurement tool with a cut-off of 7. The survey also questioned the presence of suicidal thoughts and found a lifetime prevalence of 24% (Fuhrman, 2017). The Patient Health Questionnaire 9 (PHQ9) was used for dental students in 2018 (but without specifying a precise time window to consider the presence of symptoms). Using a cut-off at 10, 25% of students had depressive syndrome ("Enquête Union Nationale des Etudiants en Chirurgie Dentaire, 2018). For pharmacy students in 2019, with the same tool and the same cut-off, (but with the preceding month period to consider the presence of symptoms) the survey found 28% of students had depressive syndrome ("Résultats de l'enquête de l'ANEPF sur le bien-être des étudiants en pharmacie (Communiqué) – Toute La Veille Acteurs de Santé, le hub de l'info du secteur santé, 2022).

Previous national studies on health students did not ask about sexual violence (harassment or abuse) but a study before the pandemic on medical students and young physicians found sexual harassment was reported by 15.7% of the participants and associated with impaired mental health (Duba et al., 2020).

Since the COVID 19 pandemic began, more studies have been conducted on students' mental health. A recent meta-analysis found a prevalence of depressive and anxiety symptoms in 34% and 32% of students, respectively. However, the authors decided to exclude studies on medical and nursing students "to prevent possible overestimations of the overall prevalence" (Deng et al., 2021). Health students (medicine, dental, pharmacist) have a special place because they are students and yet caregivers. With the pandemic, they are particularly at risk of mental health issues (Chandratre, 2020).

Thus, there was a lack of data on health students' mental health. Comparisons between health students are rare and French surveys used different questionnaires and cut-offs (Morvan and Frajerman, 2021). Our objective was to assess the mental health of medical, dental, and pharmacy students, using the same tools, in a single large university in France one year after the pandemic's beginning. The aim was to assess the differences in psychiatric disorders between the different specialties to help the university meet the needs of each in an appropriate way.

2. Methods

2.1. Survey

The study was conducted between 2021 May 11 and June 13 for dental and pharmacy students using the Qualtrics© platform. The university sent an invitation to an anonymous online questionnaire to the academic email addresses of all the students. A reminder email was sent to all the students once a week for three weeks (4 emails in total). An URL link for the questionnaire was also available on social media (Twitter, Facebook, Instagram) on the pages of medical student associations and dental and pharmacy student representatives 2 weeks after the first email. Medical data came from the national survey conducted between May 27 and June 27, 2021, for medical students using the same procedure.

2.2. Questionnaire

The questionnaire from a national survey on medical students was adapted for dental and pharmacy students. The questionnaire was structured in 4 specific sections. Participants could not progress in the survey if they did not complete a question ("*I don't know*" or "*refuse to answer*" were considered as an answer*)*. The first section dealt with socio-demographic details (age, gender, familial situation, and precarious financial situation). The second section concerned the curriculum (year of study, work conditions) adapted to each speciality (dental, pharmacy, and medicine). The third section concerned mental health. The hospitalisation and Depression scale (HAD) was used to assess anxiety and depressive symptoms in the last 7 days. The Maslach Burnout Inventory (MBI) was used to measure burnout. Two different versions of MBI were proposed: the MBI Student Survey "SS" (Schaufeli et al., 2002) for medical students in the pre-clinical stage (years 2 and 3), pharmacy and dental students, and the MBI Human Service Survey "HSS" (Maslach et al., 1997) for clinical students (years 4, 5, and 6) or residents (years 7 and more). There is no consensus on a clear cut-off for HAD or MBI scales (Rotenstein et al., 2018, 2016) as they were primarily designed as dimensional measurement tools. HAD is commonly used with 2 subscales: (i) for depression (HAD-D) and (ii) for anxiety (HAD-A) measures. We chose to use the same cut-off (>10) as used in the national survey as thresholds to delineate cases between normality and psychopathological state (Santé Publique France, 2021). Burnout was measured with the MBI that is composed of 3 dimensions: Emotional Exhaustion (EE); Depersonalization (DP), also called Cynicism (CY); and Personal Accomplishment (PA). Specific thresholds are often used in the literature to delineate cases between normality and psychopathology with MBI. For MBI HSS burnout is defined as subscale scores EE> 26 and DP > 9 (Rotenstein et al., 2018). For MBI SS burnout is defined as subscale scores EE >14 and CY>6 and professional/academic efficacy (the equivalent of PA) <23 (Boni et al., 2018; Kajjimu et al., 2021). The Composite International Diagnostic Interview – Short Form (CIDI-SF) questionnaire (Kessler et al., 1998) was used to assess the presence of a major depressive episode (MDE) in the last 12 months. Suicidal thoughts in the previous 12 months and 12 months' use of services or treatments for emotional, psychological, or substance use problems were also measured with the same items as the National French *Observatoire de la Vie Etudiante*. CIDI-SF is rather commonly used as a diagnostic instrument to detect the presence of depression according to ICD criteria (Kessler et al., 1998). To ensure national comparisons with the French general population survey, a similar algorithm was used to detect the presence of an MDE case within 12 months. Suicidal thoughts were assessed by asking students: "In the past 12 months, have you thought about committing suicide?". The fourth section concerned questions about humiliation, sexual harassment, and aggression during the whole curriculum (Yes/no question, see supplementary methods). Finally, students could write a free comment. Material, code and synthetic data based on original data are available at https://osf.io/rnpvf/.

2.3. Population

The target population was medical students with preclinical (years 2 and 3, $n = 1788$); clinical (years 4, 5, and 6, $n = 2476$); and residents (years 7 and more, number unknown (when asked faculty admission was unable to provide exact numbers)); pharmacy students ($n == 1581$); and dental students ($n == 1600$), from the University Paris Cité. The Faculty of Health of the Université Paris Cité is the largest faculty of health in Paris as it is the result of the merge of 2 faculties of medicine, 2 faculties of dentistry and 1 faculty of pharmacy. We did not include first-year students because, in the French system, fewer than 30% of them will pursue their studies after the final competitive exam.

2.4. Statistics analysis

Missing responses on MDE, Burnout, suicidal thoughts, humiliation, sexual harassment, and abuse outcome were included in the analysis by recoding them as zero. Missing data were mainly due to participants in the panel who did not fully complete the survey. Considering CIDI-SF is

a skip structure questionnaire (if screening question criteria are not met, further questions on secondary symptoms are not asked), all panel members were considered with no condition before applying the CIDI-SF algorithm. For predictor variables, the answers *I don't know, refuse to answer,* or *missing* were included as an unknown response category.

Data analysis was performed using R4.0 software. We used Chi-square to compare the gender proportions between students from the study to all the students from the university. Lastly, univariate and multivariate logistic regressions were performed with 12-month MDE as the dependent variable and gender, age, family status, level of study, financial issues, humiliation, sexual harassment, and sexual aggression as explicative variables. All these variables have been associated with depression in previous studies.

2.5. Ethics

This study ensures patient information and informed consent regarding the different approved studies through a transparency portal under the European Regulation on data protection (GDPR)("(GDPR) – Official Legal Text 2018). We used the Qualtrics© platform for the survey. For the medical questions, the project was approved by the University Paris Saclay's ethics committee (CER Paris Saclay, 2020): CER-Paris-Saclay-2021-022. For the pharmacy and dental students survey, the project was approved by the University of Paris' ethics committee (IRB 00012021-10): No. 2021-10-FRAJERMAN-KREBS.

3. Results

3.1. Population

Among the students, 2,340 opened the survey, but only 1,925 completed the HAD and were included. Response rates for dental, pharmacy, and medical pre-clinical and clinical students were 5.9%, 14.7%, 30.2% and 32.8%, respectively (Fig. 1). The number of residents registered at the faculty was not available, thereby compromising the estimation of response rates for this category.

The sample of health students was mainly composed of women (72%), with no difference regarding speciality. There was an over-representation of women among the respondents except for dental students (supplementary table 1). There were differences regarding the age of the responders in each speciality, which was related to the duration of the study. Pharmacy and dental students were mainly in the first five years of their studies, while 29% of the medical students were residents. Pharmacy students declared bigger financial issues than the other students. The workload was considerable: 20% of dental students and students at pre-clinical levels, 30% for pharmacists, 60% for clinical students, and 80% for residents declaring they worked more than 50 hours per week (Table 1). Most of the students (94%) answered the questionnaire via the email link rather than a social media link.

3.2. Prevalence of psychiatric symptoms and mistreatments

The students showed high levels of 7-day anxiety (55%) and depressive symptoms (23%), the 12-month prevalence of MDE (26%), and suicidal thoughts (19%). Burnout was present in 42% of dental/pharmacy/pre-clinical students and 65% of clinical students/residents. Mistreatment during the curriculum was highly prevalent: humiliation (19%), sexual harassment (22%), and sexual abuse (5.5%). In the population of medical students, the prevalences of sexual harassment and violence increased with the level of training and were more frequent than in the population of pharmacy and dental students. Residents showed less anxiety and depressive symptoms and less MDE than the other students ($p < .001$). Pharmacy students showed more anxiety and depressive symptoms and more burnout than dental or preclinic medical students ($p < .001$). As we used 2 different scales for burnout, we could not compare between pharmacy, dental and preclinic medical students and clinical students and residents (Table 1).

3.3. Associative factors of 12-month MDE

Univariate analysis identified several variables associated with MDE: marital status, subjective financial difficulties, evaluation, curriculum, humiliation, sexual harassment, and abuse. Multivariate logistic regression found the same variables except marital status as associated with MDE. Compared to preclinical students, dental students (OR = 0.43, CI95 [0.23–0.77]), clinical students (OR = 0.53, CI95 [0.37–0.74]) and residents (OR = 0.29, CI95 [0.19–0.46]), presented less MDE prevalence. Humiliation (OR = 1.71, CI95 [1.28–2.28]), sexual harassment (OR = 1.60, CI95 [1.19–2.16]), sexual abuse (OR = 1.65, CI95 [1.04–2.60])) and moderate (OR = 1.49, CI95 [1.17–1.90]) or serious (OR = 2.32, CI95 [1.68-3.20]) subjective financial difficulties were associated with higher odds of having MDE (Table 2).

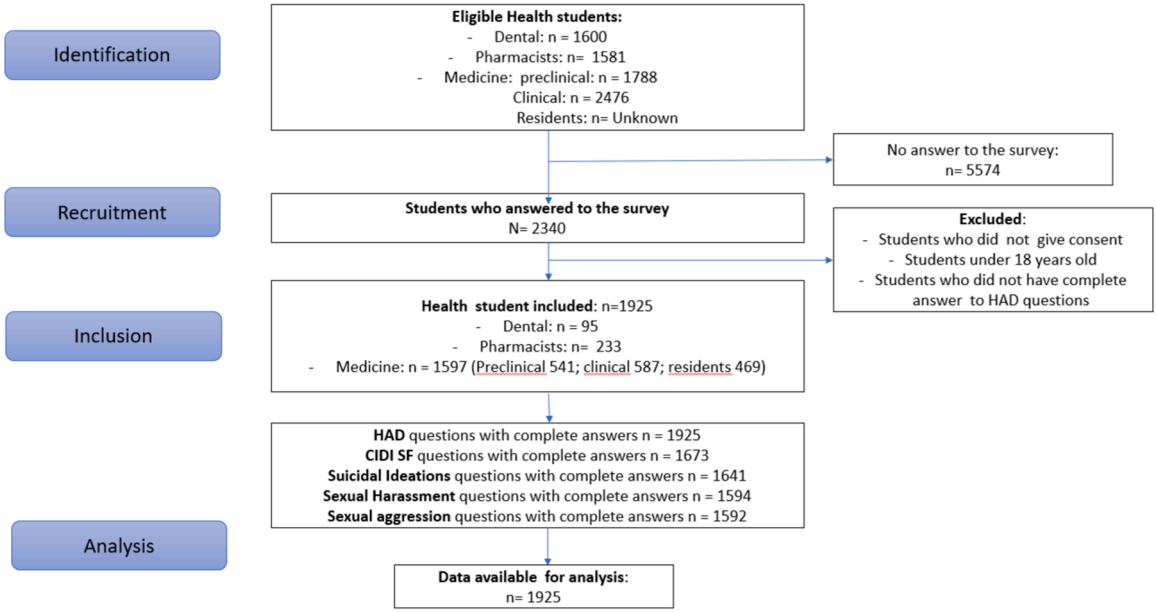

Fig. 1. Flow chart.

Table 1
Socio-demographic and clinical characteristics of the population

Variables	Dental students $N = 95$ (5%)	Pharmacy students $N = 233$ (12%)	preclinical students $N = 541$ (28%)	clinical students, $N = 587$ (30%)	Residents $N = 469$ (25%)	p value	Overall, $N = 1925$ (100%)
Gender						0.8	
Women	71 (76%)	167 (72%)	391 (73%)	426 (73%)	328 (71%)		1,383 (72%)
Men	22 (24%)	65 (28%)	145 (27%)	159 (27%)	137 (29%)		528 (28%)
Unknown	2	1	5	2	4		14
Age (year)						**<0.001**	
18–20	20 (21%)	45 (19%)	306 (57%)	9 (1.5%)	0 (0%)		380 (20%)
21–23	51 (54%)	132 (57%)	196 (36%)	317 (54%)	6 (1.3%)		702 (36%)
24 and more	24 (25%)	56 (24%)	39 (7.2%)	261 (44%)	463 (99%)		843 (44%)
Familial Status						**<0.001**	
Single	54 (58%)	157 (68%)	350 (65%)	308 (53%)	162 (35%)		1,031 (54%)
Couple	39 (42%)	75 (32%)	185 (35%)	271 (47%)	300 (65%)		870 (46%)
Unknown	2	1	6	8	7		24
Subjective financial difficulties						**<0.001**	
Not at all important	40 (43%)	85 (38%)	290 (55%)	308 (53%)	280 (60%)		1,003 (53%)
Low	35 (38%)	76 (34%)	189 (36%)	194 (33%)	139 (30%)		633 (34%)
Important	17 (18%)	60 (27%)	48 (9.1%)	79 (14%)	45 (9.7%)		249 (13%)
Unknown	3	12	14	6	5		40
Weekly workload *						**<0.001**	
Less than 50 hours	72 (77%)	152 (66%)	421 (78%)	220 (39%)	73 (16%)		943 (49%)
More than 50 hours	21 (23%)	77 (34%)	120 (22%)	367 (61%)	396 (84%)		981(51%)
Anxiety symptoms (HAD > 10)	55 (58%)	155 (67%)	322 (60%)	336 (57%)	186 (40%)	**<0.001**	1054 (55 %)
Depressive symptoms (HAD > 10)	31 (33%)	91 (39%)	114 (21%)	143 (24%)	64 (14%)	**<0.001**	443(23%)
Major depressive episode (12 months)	18 (19%)	77 (33%)	165 (30%)	150 (26%)	85 (18%)	**<0.001**	495 (26%)
Suicidal thoughts (12 months)	12 (13%)	38 (16%)	115 (21%)	118 (20%)	81 (17%)	0.15	364 (19%)
Burnout (MBI-SS)	37 (39%	115 (49%)	214 (40%)	NA	NA		366 (42%)**
Burnout (MBI-HSS)	NA	NA	NA	393 (67%)	289 (62%)		682 (65%)***
Humiliation	8 (8.4%)	23 (9.9%)	48 (8.9%)	161 (27%)	123 (26%)	**<0.001**	357(19%)
Sexual Harassment	10 (11%)	22 (9.4%)	52 (9.6%)	174 (30%)	166 (35%)	**<0.001**	424(22%)
Sexual aggression	2 (2.1%)	11 (4.7%)	24 (4.4%)	37 (6.3%)	32 (6.8%)	0.2	106 (5.5%)

* Workload includes time in hospital and study time. The measure was adapted to each situation
** Percentage of all students except residents and clinical medical students.
*** Percentage of clinical medical students.

Table 2
Logistic regression with socio-demographic variables with major depressive episode as a dependent variable

Dependent: Major depressive episode (12 months)		No	Yes	OR (univariable)	OR (multivariable)
Gender	Women	1021 (73.7)	364 (26.3)	-	-
	Men	403 (76.3)	125 (23.7)	0.87 (0.69–1.10, $p = 0.243$)	0.88 (0.68–1.14, $p = 0.340$)
Age (year)	18-20	278 (73.2)	102 (26.8)	-	-
	21-23	515 (73.4)	187 (26.6)	0.99 (0.75–1.31, $p = 0.942$)	1.08 (0.77–1.52, $p = 0.653$)
	24 and more	638 (75.5)	207 (24.5)	0.88 (0.67–1.17, $p = 0.383$)	1.44 (0.96–2.18, $p = 0.081$)
Familial status	Single	745 (72.2)	287 (27.8)	-	-
	In a relationship	668 (76.7)	203 (23.3)	**0.79 (0.64–0.97, $p = 0.026$)**	0.85 (0.67–1.06, $p = 0.152$)
Subjective financial difficulties	Very low	800 (79.6)	205 (20.4)	-	-
	Moderate	451 (71.2)	182 (28.8)	**1.57 (1.25–1.98, p <0.001)**	**1.49 (1.17-1.90, p=0.001)**
	Serious	150 (60.2)	99 (39.8)	**2.58 (1.91–3.46, p <0.001)**	**2.32 (1.68-3.20, p <0.001)**
Cursus	Medical Preclinic	376 (69.5)	165 (30.5)	-	-
	Medical Clinic	437 (74.4)	150 (25.6)	0.78 (0.60–1.02, $p = 0.065$)	**0.53 (0.37-0.74, p <0.001)**
	Medical resident	384 (81.9)	85 (18.1)	**0.50 (0.37–0.68, p <0.001)**	**0.29 (0.19–0.46, p <0.001)**
	Dental	77 (81.1)	18 (18.9)	**0.53 (0.30–0.90, $p = 0.024$)**	**0.43 (0.23–0.77, $p = 0.006$)**
	Pharmacy	156 (67.0)	77 (33.0)	1.12 (0.81–1.56, $p = 0.484$)	0.86 (0.59–1.25, $p = 0.438$)
Humiliation	No	1197 (76.6)	366 (23.4)	-	-
	Yes	234 (64.3)	130 (35.7)	**1.82 (1.42–2.32, p <0.001)**	**1.71 (1.28–2.28, p <0.001)**
Sexual Harassment	No	1152 (76.7)	350 (23.3)	-	-
	Yes	279 (65.6)	146 (34.4)	**1.72 (1.36–2.17, p <0.001)**	**1.60 (1.19–2.16, $p = 0.002$)**
Sexual aggression	No	1371 (75.3)	450 (24.7)	-	-
	Yes	60 (56.6)	46 (43.4)	**2.34 (1.56–3.47, p <0.001)**	1.65 (1.04–2.60, $p = 0.032$)

4. Discussion

4.1. Prevalence of depression, suicidal ideation, and burnout among University of Paris' health students

This study found high prevalences of MDE and suicidal thoughts in the health students of the University Paris Cité. They showed a higher prevalence of MDE and suicidal thoughts than medical students elsewhere in France, especially in the pre-clinical stage (35% vs 26% and 24% versus 17%, respectively) (Rolland et al., 2022). Contrary to our report, previous studies showed that dental students have fewer psychiatric symptoms than medical or pharmacy students who had the highest levels (Bacchi and Licinio, 2015; Hamasha et al., 2019). The very high level of symptoms in pre-clinical medical students might be

partially related to an administrative reorganisation (the recent merger of the 2 previous medical faculties into one), which was associated with increased workload and computer issues (registration issues, teaching issues, etc.) (Le quotidien du médecin, 2021). Financial difficulties were associated with an increased risk of major depressive episodes, in line with previous data (Rajapuram et al., 2020). The higher cost of living in Paris may explain the higher psychological distress at the University Paris Cité compared to other French regions.

In contrast with usual epidemiological results on mental health (Kuehner, 2017), being a woman was not associated with a higher prevalence of depression in our study. As our health student sample was composed mainly of women (70%), gender differences may have been more difficult to identify. Using the CIDI-SF allowed us to compare our observed 26% of MDE and 19% of suicidal thoughts with the prevalence of 2 other studies: the 2016 national student survey from the National Observatory of Student Life and the 2017 national general population survey from *Santé Publique France.* The 2016 student survey included 2, 414 medical students. Prevalence of MDE and suicidal thoughts were 15% and 9% respectively in 2016 for the national student sample and 14% and 7 % respectively for medical students, excluding those in their first year (Frajerman et al., 2020). For the general population in France in 2017, the prevalence of MDE was 10% and 5% for suicidal thoughts (Léon et al., 2019) Our result showed that the prevalence in health students was twice as high (Frajerman et al., 2020).

The use of HAD can be used to compare our data with the national French monitoring study on mental health in the general population (CoviPrev). The 18-24 age class showed a prevalence of depressive symptoms (cut-off >10) of 26.1% (May 2021) and 22.6% (June 2021), which was similar to health students (23%) (Santé Publique France, 2021). The twelve-month prevalence of suicidal thoughts was 15.7% in May 2021 and 20.1% in June 2021; the prevalence in health students in our study was similar(19%) (Santé Publique France, 2021). A meta-analysis found an increase in the prevalence of depression among non-medical and non-nursing students (Deng et al., 2021).

Burnout, assessed with the MBI student version (MBI-SS), impacted 40% of the pre-clinical medical students, in line with a previous French study (Breton et al., 2019) for pre-clinical students. There is a lack of data for pharmacy and dental students. For clinical students and residents, burnout, assessed with the caregiver MBI version (MBI-SS), concerned 67% of clinical students and 62% of residents. For residents, this is in line with a French study conducted during the COVID-19 pandemic (Azoulay et al., 2021). It is important to understand that the workload is not the same depending on the speciality and the level of training. For pharmacy and pre-clinical students, it is mainly theoretical courses and exams with a competition at the end of the course for pharmacy students, which will determine their future speciality and the city where they will finish their studies. For dental and clinical students, there are internships in the hospital, so directly exposed as medical staff to the care system stress and reorganisation, in addition to the theoretical courses and exams, and to the competition at the end of the course, which will determine their future speciality and the city where they will finish their studies. For residents, they are full-time in the hospital.

For clinical students, the prevalence was much higher than the mean prevalence (44%) reported in our meta-analysis. But our meta-analysis was performed before the pandemic, so it may have increased the burnout symptoms, and there was no French study included (Frajerman et al., 2019). Studies suggested that burnout has a negative impact on patient outcomes (Welp et al., 2014), increased dropout thoughts in students (Dyrbye et al., 2010) and a high cost to society (Han et al., 2019).

All health students' specialities had a high prevalence of psychiatric symptoms, but sexual harassment and humiliation were much higher among clinical students and residents. This study did not search for risk factors specific to each speciality.

4.2. Improving students' mental health

In France, the Ministry of Health received an official report in 2018 dedicated to the mental health situation of heath students (Rapport du Dr Donata Marra sur la Qualité de vie des étudiants en santé, 2018). This report led to the creation of a national structure: *Centre national d'aide (CNA)*("CNA Santé, 2022), which was dedicated to developing psychological support structures for health students. There are many ways of improving mental health in French medical students: reducing workload, improving the screening of student psychiatric disorders, and setting up support actions (Frajerman, 2020). In Canada, a "National Standard for Mental Health and Well-Being for Post-Secondary Students" ("National Standard for Mental Health and Well-Being for Post-Secondary Students | Mental Health Commission of Canada," n.d.) has been established. A systematic review found 10 studies on student support systems for undergraduate medical students during the COVID-19 pandemic (Ardekani et al., 2021). Furthermore, there are preventable risk factors: financial difficulties but also misconduct (especially humiliation, sexual harassment, and sexual abuse) which are very frequent in our study. At the national level, more efforts should be made against these types of behaviour: information for students on their rights, a unit to fight against abuse such as the one created at the University of Paris-Cité, withdrawal of students from problematic services, an end to the impunity of harassing doctors by integrating student representatives in the disciplinary bodies. Furthermore, the victims should receive more support and preventive measures for later psychiatric symptoms should be considered.

Fewer studies are available on pharmacy and dental students than on medical students, but these two specialities also exhibited a high prevalence of psychiatric disorders. Preventive actions and psychological support should concern all students, regardless of their speciality.

4.3. Limitations and strengths

The response rate for dental and pharmacy students was very low and included very few residents. As the response rate of the medical students was higher, we subgrouped them according to their study level. The difference in response rate might be related to the absence of support from the national dental and pharmacy student associations. However, in 2020, two national reports on students from all fields had a lower response rate: 4.3% and 1.4% (Wathelet et al., 2021, 2020). Our better response rate from medical students may reflect the support of national medical student associations or the better awareness of this topic in this population. A low response rate always raises the question of response bias: are the subjects who respond more likely to be those who are well or those who are more concerned by the survey topic. We used both emails and social networks to reduce bias linked to one-way and improved the response rate, but it was still on line and: "individuals with existing or severe mental illness are less likely to participate online than those without such conditions "(Pierce et al., 2020).

Second, including missing data and recoding them at zero could underestimate prevalence.

Third, there was an overrepresentation of women in our sample as in the majority of health studies. Consequently, these results cannot be extrapolated to all students from the university.

Burnout assessment was performed with two different scales. This was helpful to adjust the level of study and growing involvement in clinical care but limits comparability between groups. Similarly, the workload estimation included two different aspects, such as time spent at the hospital and time allocated to study.

Due to organisation constraints, there was a two-week gap between the dental and pharmacy students' survey and the medical student survey. Thus, the comparison of the last week level of depression on HAD should be treated with caution. The CIDI-SF allowed a 12-month prevalence measure of MDE, which is more reliable and may improve the reproducibility and comparability of future studies. Finally, we did

not assess other psychiatric disorders such as bipolar disorders, psychotic disorders or eating disorders. Lastly, to avoid the Table 2 fallacy (Westreich et al., 2021; Westreich and Greenland, 2013) (e.g. suggesting implicitly that all of the risk factor estimates can be interpreted similarly), it's important to consider factors identified in this study only as factors associated with medical student mental health that we suppose are involved in a broader complex system

5. Conclusion

To our knowledge, this is the largest study comparing the mental health of dental, pharmacy, and medical students. We found high levels of depression and suicidal thoughts in University Paris Cité's health students. The study highlights their need for psychological support. Furthermore, the high frequency of misconduct (i.e., humiliation, sexual harassment, and aggression) requires action. The methodology of our survey ensures reproducibility and will be useful to measure the effects of prevention and intervention on this population.

Contributors

Ariel Frajerman conducted the statistical analyses with YM and wrote the draft of the manuscript with YM. He is the study's promoter with MOK. He was one of the promoters of the national survey on the mental health of medical students from which the data on medical students at the University of Paris used in this article were derived

Boris Chaumette helped to improve the entire manuscript and acted as an advisor.

Marie-Odile Krebs is the study's promoter with AF. She helped to improve the entire manuscript and acted as an advisor.

Yannick Morvan conducted the statistical analyses with AF and wrote the draft of the manuscript with AF. He provided the access to Qualtrics© platform. He was one of the authors of the national survey on the mental health of medical students from which the data on medical students at the University of Paris used in this article were derived.

Role of the funding source

No financial support was involved in the preparation of this manuscript.

Declaration of Competing Interest

Ariel Frajerman: none. Boris Chaumette: has received speaking fees from Janssen Cilag, Lundbeck and Eisai outside the submitted work. Marie-Odile Krebs: received financial support for scientific dissemination from Otsuka Lundbeck, Jansen, Eisai Yannick Morvan: has received funding from the University of Paris Nanterre, Inserm, GHU Sainte-Anne, Fondation de France, Fondation Pierre Deniker. Yannick Morvan is or has been a member of various professional and scientific organisations of or involving psychologists (AEPU, AFTCC, AFRC, APA, APS, IdPsy, IEPA, FFPP, SFP). He is also a member of the scientific college of the Observatoire National de la Vie Etudiante (OVE)

Acknowledgments

Ariel Frajerman: was funded by Agence Nationale de la Recherche (ANR-17-CE37-003-01EPI young)) and by the Agence Régionale de Santé (ARS contrat 2020-10-37- FRAJERMAN) Ile de France

Boris Chaumette received a grant from the Fondation Bettencourt Schueller.

The authors would like to thank the students who answered the survey and the Faculty of Health of Université Paris Cité, in particular the staff of the school admission services, the deans of the Faculty of Health, Medicine, Pharmacy and Odontology, the president of the research commission and the vice-dean for students.

The authors would like to thank national associations of medical students : *Association Nationale des Etudiants en Médecine de France* (ANEMF), *InterSyndicale Nationale Autonome Représentative des Internes de Médecine Générale* (ISNAR-IMG) and *InterSyndicale Nationale des Internes* (ISNI). Data for medical students came from the national survey conducted with these associations.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jadr.2022.100404.

References

Ardekani, A., Hosseini, S.A., Tabari, P., Rahimian, Z., Feili, A., Amini, M., Mani, A., 2021. Student support systems for undergraduate medical students during the COVID-19 pandemic: a systematic narrative review of the literature. BMC Med. Educ. 21, 352. https://doi.org/10.1186/s12909-021-02791-9.

Azoulay, E., Cariou, A., Bruneel, F., Demoule, A., Kouatchet, A., Reuter, D., Klouche, K., Argaud, L., Barbier, F., Jourdain, M., Reignier, J., Papazian, L., Resche-Rigon, M., Guisset, O., Labbé, V., Van Der Meersch, G., Guitton, C., 2021. Symptoms of mental health disorders in critical care clinicians facing the COVID-19 second wave: a cross-sectional study. Chest. https://doi.org/10.1016/j.chest.2021.05.023.

Bacchi, S., Licinio, J., 2015. Qualitative literature review of the prevalence of depression in medical students compared to students in non-medical degrees. Acad. Psychiatry 39, 293–299. https://doi.org/10.1007/s40596-014-0241-5.

Boni, R.A.D.S., Paiva, C.E., de Oliveira, M.A., Lucchetti, G., Fregnani, J.H.T.G., Paiva, B. S.R., 2018. Burnout among medical students during the first years of undergraduate school: Prevalence and associated factors. PLoS One 13, e0191746. https://doi.org/10.1371/journal.pone.0191746.

Breton, P., Morello, R., Chaussarot, P., Delamillieure, P., Le Coutour, X., 2019. Burnout syndrome among third year medical students in Caen: prevalence and associated factors. Rev. Epidemiol. Sante Publique 67, 85–91. https://doi.org/10.1016/j.respe.2019.01.119.

CER Paris Saclay, 2020. Comité d'éthique de la recherche. Université Paris-Saclay. https://www.universite-paris-saclay.fr/recherche/polethis-ethique-et-integrite/comite-dethique-de-la-recherche (accessed 8.6.21).

Chandratre, S., 2020. Medical students and COVID-19: challenges and supportive strategies. J. Med. Educ. Curric. Dev. 7 https://doi.org/10.1177/2382120520935059, 2382120520935059.

Deng, J., Zhou, F., Hou, W., Silver, Z., Wong, C.Y., Chang, O., Drakos, A., Zuo, Q.K., Huang, E., 2021. The prevalence of depressive symptoms, anxiety symptoms and sleep disturbance in higher education students during the COVID-19 pandemic: a systematic review and meta-analysis. Psychiatry Res. 301, 113863 https://doi.org/10.1016/j.psychres.2021.113863.

DICOM_Jocelyne.M, DICOM_Jocelyne.M, 2020. Rapport du Dr Donata Marra sur la Qualité de vie des étudiants en santé. Ministère des Solidarités et de la Santé. https://solidarites-sante.gouv.fr/ministere/documentation-et-publications-officielles/rapports/sante/article/rapport-du-dr-donata-marra-sur-la-qualite-de-vie-des-etudiants-en-sante (accessed 3.12.20).

Duba, A., Messiaen, M., Boulangeat, C., Boucekine, M., Bourbon, A., Viprey, M., Auquier, P., Lançon, C., Boyer, L., Fond, G., 2020. Sexual harassment exposure and impaired mental health in medical students. the MESSIAEN national study. J. Affect. Disord. 274, 276–281. https://doi.org/10.1016/j.jad.2020.05.100.

Dyrbye, L.N., Thomas, M.R., Power, D.V., Durning, S., Moutier, C., Massie, F.S., Harper, W., Eacker, A., Szydlo, D.W., Sloan, J.A., Shanafelt, T.D., 2010. Burnout and serious thoughts of dropping out of medical school: a multi-institutional study. Acad. Med. 85, 94–102. https://doi.org/10.1097/ACM.0b013e3181c46aad.

Enquête "Votre bien-être, parlons en !," n.d. 2022. Union nationale des etudiants en chirurgie dentaire. URL https://www.unecd.com/dossier_presse/enquete-votre-bien-etre-parlons-en/ (accessed 6.28.21).

Frajerman, A., 2020. [Which interventions improve the well-being of medical students? A review of the literature]. Encephale 46, 55–64. https://doi.org/10.1016/j.encep.2019.09.004.

Frajerman, A., Chevance, A., Chaumette, B., Morvan, Y., 2020. Are medical students really more affected by depression than other students? results from a national survey of 18,875 students in france. European Psychiatry. Cambridge Universiy Press, Cambridge, England, p. S138. Edinburgh BLDG, Shaftesbury RD, CB2 8RU.

Frajerman, A., Morvan, Y., Krebs, M.O., Gorwood, P., Chaumette, B., 2019. Burnout in medical students before residency: a systematic review and meta-analysis. Eur. Psychiatry 55, 36–42. https://doi.org/10.1016/j.eurpsy.2018.08.006.

Fuhrman, J., 2017. Enquête santé mentale des jeunes médecins. ANEMF.org, le site officiel des étudiants en médecine. URL https://www.anemf.org/blog/2017/06/13/enquete-sante-mentale-des-jeunes-medecins-2/ (accessed 2.3.20).

General Data Protection Regulation (GDPR) – Official Legal Text [WWW Document], n.d. 2022. General data protection regulation (GDPR). URL https://gdpr-info.eu/ (accessed 3.25.22).

Hamasha, A.A.-H., Kareem, Y.M., Alghamdi, M.S., Algarni, M.S., Alahedib, K.S., Alharbi, F.A., 2019. Risk indicators of depression among medical, dental, nursing, pharmacology, and other medical science students in Saudi Arabia. Int. Rev. Psychiatry 31, 646–652. https://doi.org/10.1080/09540261.2019.1584095.

Han, S., Shanafelt, T.D., Sinsky, C.A., Awad, K.M., Dyrbye, L.N., Fiscus, L.C., Trockel, M., Goh, J., 2019. Estimating the attributable cost of physician burnout in the United States. Ann. Intern. Med. 170, 784–790. https://doi.org/10.7326/M18-1422.

Ibrahim, A.K., Kelly, S.J., Adams, C.E., Glazebrook, C., 2013. A systematic review of studies of depression prevalence in university students. J. Psychiatr. Res. 47, 391–400. https://doi.org/10.1016/j.jpsychires.2012.11.015.

Kajjimu, J., Kaggwa, M.M., Bongomin, F., 2021. Burnout and associated factors among medical students in a public University in Uganda: a cross-sectional study. Adv. Med. Educ. Pract. 12, 63–75. https://doi.org/10.2147/AMEP.S287928.

Kessler, R.C., Andrews, G., Mroczek, D., Ustun, B., Wittchen, H.-U., 1998. The world health organization composite international diagnostic interview short-form (CIDI-SF). Int. J. Methods Psychiatr. Res. 7, 171–185. https://doi.org/10.1002/mpr.47.

Kuehner, C., 2017. Why is depression more common among women than among men? Lancet Psychiatry 4, 146–158. https://doi.org/10.1016/S2215-0366(16)30263-2.

Le quotidien du médecin, 2021. À l'Université de Paris, les partiels de 800 carabins de deuxième année tournent au chaos technique, les étudiants désemparés [WWW Document]. Le Quotidien du Médecin. URL https://www.lequotidiendumedecin.fr/internes/etudes-medicales/luniversite-de-paris-les-partiels-de-800-carabins-de-deuxieme-annee-tournent-au-chaos-technique-les (accessed 3.15.22).

Léon, C., Chan-Chee, C., Du Roscoät, E., Andler, R., Cogordan, C., Guignard, R., 2019. Baromètre de Santé publique France 2017: tentatives de suicide et pensées suicidaires chez les 18-75 ans. Bull. Épidémiol. Hebd. 3–4.

Maslach, C., Jackson, S.E., 1981. The measurement of experienced burnout. J. Organiz. Behav. 2, 99–113. https://doi.org/10.1002/job.4030020205.

Maslach, C., Jackson, S.E., Leiter, M.P., 1997. Maslach Burnout Inventory. In: Zalaquett, C.P., Wood, R.J. (Eds.), Evaluating Stress: A Book of Resources, 3rd. Scarecrow Education, pp. 191–218.

Mata, D.A., Ramos, M.A., Bansal, N., Khan, R., Guille, C., Di Angelantonio, E., Sen, S., 2015. Prevalence of depression and depressive symptoms among resident physicians: a systematic review and meta-analysis. JAMA 314, 2373. https://doi.org/10.1001/jama.2015.15845.

Missions, organisation | CNA Santé [WWW Document], n.d. 2022 URL https://cna-sante.fr/missions-organisation (accessed 3.2.21).

Morvan, Y., Frajerman, A., 2021. La santé mentale des étudiants: mieux prendre la mesure et considérer les enjeux. L'Encéphale. https://doi.org/10.1016/j.encep.2020.10.009.

Muniz, F.W.M.G., Maurique, L.S., Toniazzo, M.P., Silva, C.F., Casarin, M., 2021. Self-reported depressive symptoms in dental students: systematic review with meta-analysis. J. Dent. Educ. 85, 135–147. https://doi.org/10.1002/jdd.12408.

National Standard for Mental Health and Well-Being for Post-Secondary Students | Mental Health Commission of Canada [WWW Document], n.d. 2022 URL https://www.mentalhealthcommission.ca/English/studentstandard (accessed 8.24.21).

Pierce, M., McManus, S., Jessop, C., John, A., Hotopf, M., Ford, T., Hatch, S., Wessely, S., Abel, K.M., 2020. Says who? The significance of sampling in mental health surveys during COVID-19. Lancet Psychiatry 7, 567–568. https://doi.org/10.1016/S2215-0366(20)30237-6.

Rajapuram, N., Langness, S., Marshall, M.R., Sammann, A., 2020. Medical students in distress: the impact of gender, race, debt, and disability. PLoS One 15, e0243250. https://doi.org/10.1371/journal.pone.0243250.

Résultats de l'enquête de l'ANEPF sur le bien-être des étudiants en pharmacie (Communiqué) – Toute La Veille Acteurs de Santé, le hub de l'info du secteur santé, n.d. 2022 URL https://toute-la.veille-acteurs-sante.fr/139592/resultats-de-lenquete-bien-etre-des-etudiants-en-pharmacie-communique/ (accessed 8.23.21).

Rolland, F., Hadouiri, N., Haas-Jordache, A., Gouy, E., Mathieu, L., Goulard, A., Morvan, Y., Frajerman, A., 2022. Mental health and working conditions among French medical students: a nationwide study. J. Affect. Disord. 306, 124–130. https://doi.org/10.1016/j.jad.2022.03.001.

Rotenstein, L.S., Ramos, M.A., Torre, M., Segal, J.B., Peluso, M.J., Guille, C., Sen, S., Mata, D.A., 2016. Prevalence of depression, depressive symptoms, and suicidal ideation among medical students: a systematic review and meta-analysis. JAMA 316, 2214–2236. https://doi.org/10.1001/jama.2016.17324.

Rotenstein, L.S., Torre, M., Ramos, M.A., Rosales, R.C., Guille, C., Sen, S., Mata, D.A., 2018. Prevalence of burnout among physicians: a systematic review. JAMA 320, 1131–1150. https://doi.org/10.1001/jama.2018.12777.

Santé Publique France, 2021. CoviPrev : une enquête pour suivre l'évolution des comportements et de la santé mentale pendant l'épidémie de COVID-19 [WWW Document]. URL https://www.santepubliquefrance.fr/etudes-et-enquetes/coviprev-une-enquete-pour-suivre-levolution-des-comportements-et-de-la-sante-mentale-pendant-l-epidemie-de-covid-19 (accessed 8.23.21).

Schaufeli, W.B., Martinez, I.M., Pinto, A.M., Salanova, M., Bakker, A.B., 2002. Burnout and engagement in university students: a cross-national study. J. Cross Cult. Psychol. 33, 464–481.

Wathelet, M., Duhem, S., Vaiva, G., Baubet, T., Habran, E., Veerapa, E., Debien, C., Molenda, S., Horn, M., Grandgenèvre, P., Notredame, C.E., D'Hondt, F., 2020. Factors associated with mental health disorders among university students in france confined during the COVID-19 pandemic. JAMA Netw. Open 3, e2025591. https://doi.org/10.1001/jamanetworkopen.2020.25591.

Wathelet, M., Fovet, T., Jousset, A., Duhem, S., Habran, E., Horn, M., Debien, C., Notredame, C.-E., Baubet, T., Vaiva, G., D'Hondt, F., 2021. Prevalence of and factors associated with post-traumatic stress disorder among French university students 1 month after the COVID-19 lockdown. Transl. Psychiatry 11, 327. https://doi.org/10.1038/s41398-021-01438-z.

Welp, A., Meier, L.L., Manser, T., 2014. Emotional exhaustion and workload predict clinician-rated and objective patient safety. Front. Psychol. 5, 1573. https://doi.org/10.3389/fpsyg.2014.01573.

Westreich, D., Edwards, J.K., van Smeden, M., 2021. Comment on Williamson et al. (OpenSAFELY): the table 2 Fallacy in a study of COVID-19 mortality risk factors. Epidemiology 32. https://doi.org/10.1097/EDE.0000000000001259 e1.

Westreich, D., Greenland, S., 2013. The table 2 fallacy: presenting and interpreting confounder and modifier coefficients. Am. J. Epidemiol. 177, 292–298. https://doi.org/10.1093/aje/kws412.