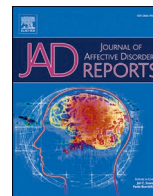




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Research Paper

Mental health of medical students during the COVID19: Impact of studies years



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ABSTRACT

Background: The COVID-19 pandemic had led to severe education disruption in many countries, including for medical students (MS). We aimed to evaluate MS mental health in France and search for a difference depending on studies' years and clinical activities.

Methods: In a cross-sectional, survey-based study during the first confinement, 668 (8.35%) MS were compared to 7 336 non-medical students (non-MS) (91.65%). The PHQ-9 (≥ 10), the GAD-7 (≥ 8), and the IES-R (≥ 26) were collected to assess depressive, anxiety, and distress symptoms. Multivariable logistic regression analyses were performed.

Results: MS reported significant psychological distress (depressive symptoms: 38.17%, anxiety: 38.77% and distress: 36.83%). Compared to non-MS, they reported less significant depressive (OR, 0.80; 95% CI, 0.67–0.91; $P = .007$) and distress symptoms (OR, 0.73; 95% CI, 0.62–0.87; $P < .001$), after taking into account potential confounding variables including COVID-19 diagnosis. First year-MS reported higher rates of significant psychological distress than MS with clinical activities. Moreover, depressive symptoms' rates were higher among MS with COVID-19 diagnosis (OR, 2.61; 95% CI, 1.21–6.13; $P = .016$).

Conclusions: Special attention should be offered to first year-MS and MS with COVID-19 diagnosis. Systematic companionship could be implemented for first year MS, and systematic psychiatric/psychological consultations for students with COVID-19 diagnosis.

1. Introduction

The coronavirus (COVID-19) has spread rapidly around the world infecting more than 305 million people and resulting currently almost 5 million deaths. It had led to confinement in many countries in order to constrain its spread, including education disruption. In France, the population was confined a first time, from March 17, 2020, during a period of 55 days. All students were instructed to stay at home, including medical students (MS). Consequently, all students were confronted with an unusual situation due to the COVID-19.

In this context, an increased risk of mental disorders has been reported for the general population (Brooks et al., 2020; Ettman et al.,

2020; Lei et al., 2020; Xie et al., 2020; Wang et al., 2020b) and students (Essadek and Rabeyron, 2020; Kaparounaki et al., 2020; Wang et al., 2020a; Wathélet et al., 2020).

In addition, MS have been previously described to be at higher risk of anxiety and depressive symptoms compared to general population and other students (Dyrbye et al., 2006; Quek et al., 2019). High rates of MS psychological distress have also been reported during previous pandemics, in particular Ebola and MERS-Cov (Loh et al., 2005; Wong et al., 2007). Several studies evaluated the impact of COVID-19 and confinement on mental health status in MS (Aebischer et al., 2020; Cao et al., 2020; Lin et al., 2020; Liu et al., 2020; Meo et al., 2020; Nakhostin-Ansari et al., 2020; Saddik et al., 2020; Sartorao-Filho et al., 2020;

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Xiao et al., 2020; Ye et al., 2020) reporting high rates of symptoms.

However, a recent meta-analysis on MS suggested that, whereas the degree of anxiety has increased in the general population (Salari et al., 2020), the overall level of anxiety in MS had not changed during the COVID-19 pandemic (Lasheras et al., 2020). One of the limitations of these studies is that a possible COVID-19 diagnosis was not considered. In addition, MS have been shown to have psychological symptoms, related to the fear of contracting and transmitting COVID-19 (Ferreira et al., 2021). Moreover, the few studies that have considered the impact of studies' years or clinical activities (Arima et al., 2020; Chang et al., 2020; Essangri et al., 2021; Kalok et al., 2020; Liu et al., 2020; Nguyen et al., 2020; Saddik et al., 2020; Saraswathi et al., 2020; Wang et al., 2020) reported conflicting results.

In France, medical school includes clinical placements time in the hospital beginning after the first year (pre-clinical year) that increases with years of study. In addition, medical students (second year and above) helped during the lockdown by doing phone counselling and monitoring (especially the youngest ones) and/or direct care (face-to-face care) of COVID-19 patients. So, French medical students have been exposed to the management of individuals with COVID-19 disease, which could lead to a different psychological impact compared to other students.

Thus, the current study aims to assess MS mental health in the era of COVID-19, compare it to non-MS, and search for differences based on studies' years/clinical activities.

2. Methods

An online survey was fulfilled by 8 004 students at the University of Lorraine, using the Lime Survey software, for 4 days in April 2020 (April 27- April 30). This survey has already been described in a previous publication (Essadek and Rabeyron, 2020). Socio-demographic data have been collected about: age, gender, financial situation (precarious or not), housing (alone or with other people) and work. Data about COVID-19 exposure have also been assessed: contact with COVID-19 positive people, COVID-19 symptoms and COVID-19 diagnosis (by an MD or by a PCR).

Students also fulfilled three mental health scales, validated in French, to measure levels of depression (*Patient Health Questionnaire*, PHQ-9; range 0–27) (Kroenke et al., 2001), anxiety (Generalized Anxiety Disorder, GAD-7; range 0–21) (Spitzer et al., 2006) and subjective distress (Impact of Event Scale- Revised, IES-R; range 0–88) (Chiasson et al., 2018). The PHQ-9 and GAD-7 scales were chosen because they are the most widely used in primary care and symptom detection (Johnson et al., 2019; Levis et al., 2019; Spitzer et al., 1999). The most classical cut-off was determined for depression scores (10) (Manea et al., 2012), anxiety (8) (Plummer et al., 2016) and subjective distress (26) (Lai et al., 2020). The IES-R is a self-administered questionnaire that is frequently used to assess subjective distress caused by traumatic events (Wathelet et al., 2021). The questionnaires were anonymous to ensure confidentiality and reliability of the data. This study has been approved by the University of Lorraine and is registered with the number 2020–115.

The students were classified in two groups: medical students (MS) vs others (non-MS). The medical students were also classified depending on their years of study and the period of clinical practicum: 1st year (no time at hospital; the students must pass the *numerus clausus* in June 2020 to access to the 2nd year), 2nd and 3rd year (once or twice a week at the hospital), 4th, 5th and 6th year (half-time at the hospital), and 7th and above (full-time at the hospital). The non-MS were classified in 4 groups depending on their years of study (1, 2–3; 4–5 and Ph.D students) based on the French university system.

2.1. Statistical analysis

First, a descriptive analysis was performed. Quantitative variables were described by mean and standard deviation (SD) and categorical

variables by percentages. Second, bivariate analyses were performed to compare MS to non-MS considering demographic, COVID-19 and mental health data using Student's T-test and Chi2 tests. Then, we used logistic regressions, giving odds ratios (aOR) and confidence intervals (95%CI), to explore the associations between mental health and MS compared to non-MS (reference group). The dependent variables used in the logistic regression used the PHQ-9, GAD-7 and IES thresholds (noted earlier in the method section) to divide students into symptomatic vs below threshold groups. All factors associated ($p < .20$) in bivariate analyses were included.

Finally, bivariate analyses were performed to compare MS with and without symptoms of depression, anxiety and distress. We performed multivariate logistic regressions in MS only, in order to determine potential risk factors for symptoms of depression, anxiety and distress. All associated factors ($p < .20$) in the bivariate analyses were included, including years of study, COVID-19 diagnosis, precarious situation, job. Only age was not included because of its collinearity with the years of study.

The data analyses were performed by using R software (version 4.0.2). All tests were two-tailed. The significant level was set at <0.05 .

3. Results

On the 8004 students who fulfilled the survey, 668 (8.35%) were MS and 7336 (91.65%) were from other disciplines (non-MS). 15.49% of MS students completed the questionnaires and 13.36% of non-MS students. The mean (SD) scores on the age of MS and for non-MS for all respondents were 21.11 (3.65) and 21.61 (4.25). Of the 668 MS, 74.89% were women, 30.29% were in a precarious financial situation and only 12.28% lived alone. Considering the years of study, 49.85% were in their 1st year; 19.31% in their 2nd and 3rd year, 24.70% in 4th, 5th and 6th year; and 6.14% in 7th year and above. For non-MS, 66.79% were women, 41.78% were in a precarious financial situation and only 14.19% lived alone 28.29%. Considering the years of study, were in their 1st year; 42.05% in their 2nd and 3rd year, 29.03% in 4th and 5th; and 0.63% were PhD students. More detailed socio-demographic data are reported in Table 1. Concerning psychological distress, 255 (38.17%) of the MS had symptoms of depression, 259 (38.77%) had symptoms of anxiety and 246 (36.83%) had symptoms of distress. For non-MS, 3187 (43.44%) had depressive symptoms, 2878 (39.23%) had anxiety symptoms and 3191 (43.50%) had distress symptoms.

In bivariate analyses (Table 1), MS reported less psychological suffering than non-MS considering depression and distress. In terms of anxiety, no significant difference between the two groups has been found. Also, MS were significantly more exposed to have a COVID19 diagnosis than non-MS.

Multivariable logistic regression analysis showed that (Table 2) MS reported less anxiety (OR, 0.80; 95% CI, 0.67–0.91; $P = .007$) and distress (OR, 0.75; 95% CI, 0.73–0.87; $P = .001$) compared to non-MS, taking into account all the previous potential confounding variables including COVID-19 contact or diagnosis (Table 2).

Bivariate analyses on MS with and without symptoms of depression, anxiety and distress are presented in supplementary material S1.

In the corresponding logistic regressions (Table 3), first-year MS reported more symptoms of depression, anxiety and distress than MS in higher grades. MS with a COVID-19 diagnosis were significantly more likely to experience symptoms of depression (OR, 2.61; 95% CI, 1.21–6.13; $P = .016$). MS in precarious situations were significantly more associated with symptoms of distress (OR, 1.6; 95% CI, 1.12–2.27; $P = .005$).

4. Discussion

The aim of this study was to analyze the impact of the COVID-19 pandemic on mental health symptoms of Medical Students. In this regard, it appeared that more than a third of MS reported significant

Table 1
Demographic characteristics and outcome of respondents' mental health scales.

Characteristic	MS N = 668 n [%] or Mean (SD)	No-MS N = 7336 n [%] or Mean (SD)	Statistics	P Value
Age	21.11 (3.65)	21.61 (4.25)	$t = 2.9$	< .003
Gender Female	500 [74.89]	4900 [66.79]	Chi2 = 18.10	< .001
Live alone Yes	82 [12.28]	1041 [14.19]	Chi2 = 51.32	< .001
Precarious situation Yes	203 [30.39]	3065 [41.78]	Chi2 = 51.32	< .001
Job Yes	142 [21.26]	1189 [16.21]	Chi2 = 10.9	< .001
Study years				
1st year	334 [49.85]	2075 [28.29]	Chi2 = 206.05	< .001
Once a week/ 2nd & 3rd	128 [19.31]	3085 [42.05]		
Half time hospital/ 4th&5th year	165 [24.70]	2130 [29.03]		
Full time hospital/ PhD student	41 [6.14]	46 [0.63]		
COVID19 contact	237 [35.48]	1694 [23.09]	Chi2 = 51.324	< .001
COVID19				
No symptoms	548 [82.04]	6194 [84.43]	Chi2 = 15.859	.001
COVID19 symptoms	90 [13.47]	941 [12.83]		
COVID19 diagnosis	30 [4.49]	201 [2.74]		
Psychiatric symptoms				
PHQ-9	9.34 (6.05)	9.39 (6.06)	$t = 2.37$.018
GAD-7	6.94 (5.58)	6.94 (5.59)	$t = -0.07$.94
IES-R	25.14 (17.39)	25.32 (17.35)	$t = 2.95$.003
Cut-off				
PHQ-9 ≥ 10	255 [38.17]	3187 [43.44]	Chi2 = 6.7	.009
GAD-7 ≥ 7	259 [38.77]	2878 [39.23]	Chi2 = 0.036	.85
IES-R ≥ 26	246 [36.83]	3191 [43.50]	Chi2 = 10.85	< .001

Legend: MS, Medical students; PHQ-9, 9-item Patient Health Questionnaire; GAD-7, 7-item Generalized Anxiety Disorder; IES-R, 22-item Impact of Event Scale-Revised.

Table 2
Comparison of mental health risks to medical students Vs others to the multi-variable logistic regression analysis.

Variable	Adjusted OR (95%CI) ^a	P value
PHQ-9	0.80 (0.67–0.91)	.007
GAD7	0.95 (0.81–1.13)	.63
IES-R	0.73 (0.62–0.87)	< .001

Legend: PHQ-9, 9-item Patient Health Questionnaire; GAD-7, 7-item Generalized Anxiety Disorder; IES-R, 22-item Impact of Event Scale-Revised.

^a Adjusted for Age, Gender, Live alone, Precarious situation, Job, COVID19 (contact, symptoms, diagnosis).

psychological distress (significant depressive symptoms: 38.17%, anxiety: 38.77% and distress: 36.83%). These results are consistent with the recent meta-analysis of *Lasheras et al. (2020)*. In addition, in our study, MS reported significantly less significant depressive and distress symptoms than other students when taking into account confounding factors including COVID-19 contact and diagnosis, those despite studies reporting these as increasing psychological distress in MS (*Ferreira et al., 2021*). These results are consistent with previous studies reporting less mental health symptoms for MS in comparison to non-MS during the COVID-19 pandemic. In this regard, MS were found to report lower anxiety in comparison to dental medicine students (*Saddik et al., 2020*), and to experience lower levels of depression, anxiety and distress in

comparison to non-MS (*Chang et al., 2020; Xie et al., 2020*). One of the possible protective effects against psychological distress is a better medical knowledge (*Wang et al., 2020b*). For example, *Saddik et al. (2020)* reported a higher median score for knowledge of COVID-19 in MS than non-MS and it has also been pointed out that a better knowledge of the disease could reduce mental health symptoms (*Wang et al., 2020b*). Moreover, the urgency to act during the pandemic at the hospital may have reduced the possibility of rehashing, which can also decrease the scores of anxiety and depression. In this sense, in the period of pandemic, medical training could protect MS compared to others. Interestingly, a previous systematic meta-analysis (published in 2016) reported no significant difference in prevalences of depression between medical and non-medical students (*Puthran et al., 2016*).

Another aim of this study was to determine whether mental health differed with study's year and the frequency of clinical practice. First-year MS were significantly at higher risk for depression, anxiety and distress compared to other MS. This result is in line with previous studies (*Essangri et al., 2021; Kalok et al., 2020; Nguyen et al., 2020; Saraswathi et al., 2020; Wang et al., 2020*) that reported higher psychological distress among undergraduate clinical students compared to more senior students during the COVID-19 pandemic.

A recent study (*Saraswathi et al., 2020*) comparing mental health of undergraduate MS also reported increased of anxiety and distress during the COVID-19 compared to the pre-pandemic situation. Nevertheless, *Liu et al. (2020)* and *Arima et al. (2020)* did not find any significant differences depending on study's year, but all students were confined at home, including final-year students, in these two studies.

Conversely, two other studies have reported higher levels of psychological distress when clinical activities increase (*Saddik et al., 2020; Wang et al., 2020a*). However, *Saddik et al. (2020)* reported higher levels of anxiety in MS who had rotations in high-risk wards or who had been in contact with COVID-19 patients, suggesting that high-risk perception of COVID-19 may contribute to higher levels of anxiety and Wang et al. (2020) also pointed out the academic pressure that usually increases further as one advances in study years.

In France, the situation of MS is specific because it is the first year that induces the highest academic pressure as it ends with a very competitive examination with only a 10% success rate. The pandemic has probably increased the uncertainty level of these first-year MS concerning their ability to succeed to their exam, which has probably induced high rates of mental health symptoms. They were also highly isolated, and a decrease of motivation has been reported among students (*Guse et al., 2020*). In addition, clinical practice, which is implemented in France by the second year, maybe a protective factor against mental health symptoms for several reasons. The clinical practice allows the MS to continue their usual activities and work has been reported as a protective factor for students during the pandemic (*Essadek and Rabeyron, 2020*). In addition, working in the hospital during this health crisis may also have led to a feeling of usefulness especially since the MS seems to demonstrate an adequate level of knowledge about COVID-19 and to implement appropriate strategies to prevent its spread (*Magklara et al., 2021*). We recommend more than ever a special attention to the mental health of first-year MS. The establishment of a companionship that would be carried out by other years' MS could be implemented. It could help to better detect psychological difficulties in first-year MS, in order to direct them as quickly as possible, in conjunction with the faculty, to an adequate mental health care system (*Tabari and Amini, 2021*). This mentoring system could also be offered for other disciplines.

However, other categories of MS might be at risk of poorer mental health: MS with a COVID-19 diagnosis reported higher significant depression scores than MS without the diagnosis. This is particularly important as MS are significantly more likely to be affected by COVID-19 than non-MS.

Special attention is needed for students with a COVID-19 diagnosis. The development of teleconsultations during the pandemic offers the possibility of rapid psychiatric evaluations.

Table 3
Multivariable logistic regression analysis of risk factor for mental health in medicals students.

	DEPRESSION (PHQ-9)			ANXIETY (GAD-7)			DISTRESS (IES-R)		
	Affected No. (%)	Odds-ratio (95% IC) ^a	P-value	Affected No. (%)	Odds-ratio (95% IC) ^a	P-value	Affected No. (%)	Odds-ratio (95% IC) ^a	P-value
Gender									
Male	–	–	–	47 (27.98)	1 [REFERENCE]	NA	43 (25.6)	1 [REFERENCE]	NA
Female	–	–	–	212 (42.4)	1.92 (1.30–2.88)	.001	203 (40.6)	1.98 (1.34–2.99)	< .001
Precarious situation									
No	170 [36.56]	1 [REFERENCE]	NA	167 (35.91)	1 [REFERENCE]	NA	151 (32.47)	1 [REFERENCE]	NA
Yes	85 [41.87]	1.02 (0.71–1.46)	.91	92 (45.32)	1.20 (0.84–1.71)	.31	95 (46.8)	1.6 (1.12–2.27)	.009
Job									
No	214 [40.68]	1 [REFERENCE]	NA	224 (42.58)	1 [REFERENCE]	NA	209 (39.73)	1 [REFERENCE]	NA
Yes	41 [28.87]	0.99 (0.60–1.61)	.96	35 (24.65)	0.61 (0.37–1)	.05	37 (26.06)	0.80 (0.48–1.31)	.39
Study Years Clinical activities									
1st year MS - no clinical activities	171 (51.20)	1 [REFERENCE]	NA	166 (49.70)	1 [REFERENCE]	NA	155 (46.41)	1 [REFERENCE]	NA
MS - one per week	28 (22.05)	0.24 (0.14–0.39)	< .001	30 (23.44)	0.34 (0.21–0.54)	< .001	38 (29.69)	0.54 (0.34–0.84)	.007
MS - half time	47 (28.31)	0.32 (0.18–0.54)	< .001	52 (31.52)	0.55 (0.36–0.83)	.005	41 (24.85)	0.42 (0.27–0.65)	< .001
MS - Full time hospital	9 (21.95)	0.19 (0.06–0.49)	.001	11 (26.83)	0.53 (0.22–1.2)	.13	12 (29.27)	0.60 (0.26–1.35)	.23
COVID19 symptoms									
No symptoms	201 (36.68)	1 [REFERENCE]	NA	–	–	–	–	–	–
COVID19 symptoms	38 (42.22)	1.56 (0.94–2.52)	.07	–	–	–	–	–	–
COVID19 diagnosis	16 (53.33)	2.61 (1.21–6.13)	.016	–	–	–	–	–	–

Legend: PHQ-9, 9-item Patient Health Questionnaire; GAD-7, 7-item Generalized Anxiety Disorder; IES-R, 22-item Impact of Event Scale-Revised.

^a Associated factors ($p < .20$) in the bivariate analyses were included. (See Supplementary material S1).

This study has several limitations. Firstly, despite a large number of students ($n = 8004$), the sample represents only 13.34% of the students. Also, there is an under-representation of MS in 7th grade and above ($n = 41$), which limits the generalization of the conclusions, particularly with regard to the level of study. Secondly, as the mean differences between medical and other students are relatively small, we cannot exclude that the significant differences could only be the product of large sample sizes. Thirdly, the study was conducted over 4 days, during the confinement, and it does not allow for a longitudinal approach, nor does it take into account the post-traumatic effects of the pandemic on MS after the lockdown. Fourthly, there may be a bias in the sample, for example, non-respondents may have been too depressed to participate, and the same is true also for those who were too anxious. Students were also able to respond in ways that improved or reduced the natural scores. For example, MS students may be more likely to modify their answers based on what they would consider as "good" answers and thus not dare to say that they are depressed or anxious. The tools used are self-evaluation tools, hetero-evaluation scales would have allowed for more reliable evaluations.

This study has shown high rates of mental health symptoms in French MS during the first confinement period in March and April 2020. Whereas MS reported lower significant depressive and distress symptoms than non-MS, first-year MS showed the highest risk of anxiety and depression among all students of MS. However, it is important to note that first-year MS are exposed to high exam pressure, which may impact their mental health independent of the COVID crisis and explain the difference with other MS. In contrast, the COVID crisis may have amplified the psychological distress of these first-year MS. It is also important to point out that MS are at greater risk of contracting COVID-19, and in that case, they will report high rates of depression.

These results suggest that the establishment of a systematic psychological assessment would be necessary for MS, in particular for first-year MS and MS affected by COVID-19. Indeed, for these students, medical knowledge could increase depression, while clinical practice is not a protective or a resilient factor.

Screening tools (e.g. mental health questionnaires) might be used to detect potential mental health suffering from MS since their first year (Tabari and Amini, 2021). Moreover, the current development of teleconsultations during the pandemic might offer the possibility of a rapid mental health evaluation. Special attention should be given to first-year

MS and companionship from older students could also be relevant. The telepsychiatry should be made available to MS, as a recent study showed that MS were willing to use it for their personal needs (Lavergne and Kennedy, 2021). Psychological assessment for MS affected by COVID-19 should also be the norm. Further studies might analyze the impact on mental health of MS after the other confinements and evaluate the influence of measures aiming at detecting and taking care of mental health symptoms of MS, especially during the pandemic.

Declaration of Competing Interest

None.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:[10.1016/j.jadr.2022.100318](https://doi.org/10.1016/j.jadr.2022.100318).

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