

MESTRADO INTEGRADO EM MEDICINA

Mental health in Portuguese medical students - a comparative and root cause analysis between pre and post SarsCov2 pandemic

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2023



Dissertação de conclusão do Mestrado Integrado em Medicina, submetida ao Instituto de Ciências Biomédicas Abel Salazar, Universidade do Porto.

- Artigo Original

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Sara Inês Sabim dos Santos

A handwritten signature in black ink that reads "Sara Sabim". The letters are cursive and fluid, with the first 'S' being particularly large and looping.

Idalina Maria Almeida Brandão de Melo Beirão

A highly stylized handwritten signature in black ink. It begins with a large, bold letter that appears to be 'B' or 'I', followed by several loops and a long, sweeping tail that ends in a sharp point.

Isabel Maria Lourinho dos Santos Gonçalves Peixoto

A handwritten signature in black ink that reads "Isabel Lourinho Peixoto". The script is cursive and somewhat informal, with the first name being more prominent.

Milton Severo Barros da Silva

A handwritten signature in black ink that reads "Milton Barros". The letters are cursive and fluid, with the first name being more prominent.

Porto, 29 de maio de 2023

“Agir, eis a inteligência verdadeira. Serei o que quiser. Mas tenho que querer o que for. O êxito está em ter êxito, e não em ter condições de êxito. Condições de palácio tem qualquer terra larga, mas onde estará o palácio se não o fizerem ali?”

Fernando Pessoa

Livro do Desassossego

AGRADECIMENTOS

À Professora Idalina Beirão, por toda a disponibilidade e prontidão em cada etapa do desenvolver deste projeto. Pelo voto de confiança na tarefa de contribuir para o crescimento da Educação Médica na nossa escola e pelo exemplo de ser e fazer sempre mais e melhor.

À Doutora Isabel Lourinho, pelo cuidado acompanhamento e por ter sido a voz de uma visão diferente e enriquecedora no nosso trabalho.

Ao Professor Milton Severo, pela metódica e indispensável análise dos resultados e esclarecimento das tantas dúvidas em relação à sua interpretação.

A todos aqueles que enriqueceram o meu percurso académico e pessoal, que incutiram em mim valores humanos e profissionais, em especial à minha família, amigos e ao Tiago, agradeço o carinho e paciência.

DEDICATÓRIA

À equipa E do departamento de Cirurgia Geral do Songklanagarind Hospital, por me ter ensinado que a palavra “curar/tratar” (รักษา) nasce da palavra “amor” (รัก).

À minha família, em especial ao meu avô, por me ter proporcionado um crescimento envolto nessa tão pura forma de amor.

RESUMO

Com o emergir da pandemia de SarsCov2, inúmeras alterações foram impostas nos quatro cantos do globo. Assim, este estudo tem como objetivo avaliar e compreender o impacto da pandemia na saúde mental dos estudantes de medicina portugueses. Adicionalmente, pretendemos compreender o paradigma global atual no que diz respeito à saúde mental dos estudantes universitários, de modo a aferir se existem diferenças entre os resultados dos estudantes de medicina e de outros estudantes inseridos no mesmo ambiente académico.

Materiais e métodos: Foram realizados dois estudos transversais baseados em inquéritos (2019 e 2021), que recolheram dados sociodemográficos e académicos, assim como o "Maslach Burnout Inventory - Students Survey" (MBI-SS) e a "Hospital Anxiety and Depression Scale" (HADS), entre os estudantes de medicina do Instituto de Ciências Biomédicas da Universidade do Porto (ICBAS). Adicionalmente, um terceiro estudo, com a mesma metodologia dos anteriores, foi realizado entre estudantes de medicina, medicina veterinária e ciências do meio aquático, da mesma instituição.

Resultados e conclusão: Em 2021, 208 estudantes submeteram o inquérito. 33,1% apresentaram burnout, 47,1% sintomas ansiosos moderados a graves (MS-AS) e 13,2% sintomas depressivos moderados a graves (MS-DS). Estes dados foram comparados com uma análise pré-pandémica (2019) de 231 estudantes de medicina da mesma escola. Registou-se um aumento nos MS-DS (8,7 vs. 13,2%, $p=0,021$) e no burnout (35,5 vs. 52,3%, $p<0,001$), demonstrando que o contexto pandémico influenciou a saúde mental dos estudantes de medicina portugueses. Quanto à comparação entre estudantes de medicina, veterinária e ciências do meio aquático, não foram encontradas diferenças estatisticamente significativas, sugerindo que esta deterioração é transversal, enfatizando a necessidade de estimular mecanismos de coping saudáveis e investir em novas abordagens para a saúde mental entre todos os estudantes universitários.

Palavras-chave: Estudantes de medicina; SarsCov2; Saúde mental; Estudantes do ICBAS.

ABSTRACT

The SarsCov2 pandemic led to countless changes in daily life of all families across the globe and medical students were not any different. Therefore, this study aims to assess and understand the impact of the pandemic on mental health of Portuguese medical students. Additionally, we intent to understand the actual global paradigm regarding university students' mental health, in order to ascertain if there are any significant differences between medical students' results and other students from the same academical environment.

Materials and methods: Two cross-sectional survey-based studies (2019 and 2021) collected sociodemographic and academic data as well as the "Maslach Burnout Inventory – Students Survey" (MBI-SS) and "Hospital Anxiety and Depression Scale" (HADS) among School of Medicine and Biomedical Sciences of University of Porto (ICBAS)' medical students. Additionally, a third survey-based study was performed among medical, veterinary and aquatic sciences' students from the same institution.

Results and conclusions: In 2021, 208 students submitted the survey, among which 33.1% presented burnout, 47.1% had moderate to severe anxious symptoms (MS-AS) and 13.2% had moderate to severe depressive symptoms (MS-DS). These data were compared with a previous analysis performed in pre-pandemic times (2019), among 231 Portuguese medical students from the same medical school. An increase in MS-DS rate (8.7 vs. 13.2%, $p=0.021$) and in burnout rate (35.5 vs. 52.3%, $p<0.001$) were observed showing that the pandemic context influenced the Portuguese medical students' mental health. Regarding the comparison between medical, veterinary and aquatic sciences' students, no statistically significant differences were found, suggesting that this deterioration is a transversal problem, emphasizing the necessity of stimulating toward healthy coping mechanisms and investing in new approaches for mental health among all university students.

Keywords: Medical students; SarsCov2 pandemic; Mental health; ICBAS' students.

LIST OF ABBREVIATIONS

BDD MBI-SS: Bi-dimensional definition of MBI-SS.

EUSUHM: European Union for School and University Health and Medicine.

HADS: Hospital Anxiety and Depression Scale.

ICBAS: School of Medicine and Biomedical Sciences of University of Porto.

MBI-SS: Maslach Burnout Inventory – Students Survey.

MS-AS: Moderate to severe anxious symptoms.

MS-DS: Moderate to severe depressive symptoms.

TDD MBI-SS: Three-dimensional definition of MBI-SS.

WHO: World Health Organization.

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INTRODUCTION

Long before the SarsCov2 pandemic, mental health of university students was already an issue of global concern. Back in 2007, the European Union for School and University Health and Medicine (EUSUHM), assembled a congress entitled “From Challenge to Chance – Working for the Health of Young People”. From that congress arose “The Tampere Declaration on Student Health Care in Europe”, which mentions the changes in society and its role in the emergence of new health problems in young ages, such as the increasing prevalence of mental disorders. EUSUHM appealed to the governments and health service leaders to keep up with the rapidly changing health needs, claiming that “Early intervention in mental health is an important preventive activity: students are prospective mothers and fathers for the next generation, and their increased mental wellbeing is an important investment for the future of the nation” ¹.

One decade later, in 2018, the World Health Organization (WHO) developed the “WHO World Mental Health Surveys International College Student Project” in collaboration with the American Psychological Association, in which approximately one third of the participants reported a history of one or more mental disorders ². Furthermore, mental health problems were associated with lower academic success and non-treated students, with depression and anxiety diagnoses, presented significantly lower grade averages ³.

Like other university education sectors, medical education has its specificities and challenges, from curriculum issues to student-related topics, such as mental health ^{4,5}. Literature states that medical students have higher rates of mental health problems, particularly generalized anxiety disorder, depression and burnout ⁶. Academic, psychosocial and environmental stressors were studied, among which the vastness of the academic curriculum, fear of failure or poor performance, lack of recreation, loneliness, family problems and accommodation away from hometown were highlighted ⁷.

In 2019, Carla Cruz evaluated the Portuguese scenario regarding medical students' mental health through her master thesis. Burnout was assessed by the threedimensional definition of Maslach Burnout Inventory – Students Survey (MBI-SS) and a prevalence of 25.9% was reported, with emotional exhaustion being the most impactful dimension. According to the Hospital Anxiety and Depression Scale (HADS), moderate to severe anxiety was found in 42.9% of the students and moderate to severe depression in 8.7% ⁸.

From December 2019 onwards, an unprecedented public health crisis in the 21st century took place. Since the beginning of the SarsCov2 pandemic, more than 650 million people were infected and over 6.6 million have died worldwide. The pandemic had a huge impact, leading to countless changes in daily life of all families across the globe ⁹.

As in previous public health crises, such as the 2009 H1N1 pandemic and the 2014 EVD epidemic, healthcare professionals played a crucial role on the frontlines ¹⁰. Therefore, a particularly relevant impact on these workers was recorded, with an increase in mental health problems, such as depression, anxiety, work-related stress, burnout and somatization, leading to potentially serious consequences, especially impaired decision-making capacities ^{11,12}.

Sharing part of this environment and facing all the changes that the pandemic brought not only to daily life, but to hospitals and wards, medical students were also greatly affected, essentially by the shortcomings arising from a deficit in the practical component of training ¹³. In terms of mental health, the impact was equally substantial ^{14,15}. A study with more than one thousand medical students reported an increase of 61% for anxiety and 70% for depression, during the pandemic, when compared to previous studies ¹⁶. A metanalysis performed during this period and regarding 198 000 medical students demonstrated a heavy mental burden worldwide and concluded that the mental problems might persist in the late stage of the pandemic. From the several identified risk factors, low social support, bad family relationship, economic trouble, pre-existing mental or physical illness and COVID-19 infection or exposure are noteworthy. According to that meta-analysis most of these conditions were avoidable,

which enables a preventive approach, with the creation of tools and the design of interventions that minimize the detrimental effects in mental health during highly stressful events, such as public health crisis ^{17,18}.

With this study we aim to assess the impact of the pandemic in mental health of Portuguese medical students and understand the associations between burnout, depression, anxiety and sociodemographic and academic variables.

Additionally, we intent to understand the actual global paradigm regarding university students' mental health to ascertain if there are differences between medical students' and other students from different courses within the same academical environment.

MATERIALS AND METHODS

To assess the impact of the SarsCov2 pandemic in ICBAS' students we designed two cross-sectional studies, with data collected from September to December 2019 and September to December 2021, and a comparative analysis between this two time-points. Sociodemographic and academic data, MBI-SS and HADS results were collected from medical students from the 1st, 3rd and 6th grades of ICBAS. The instruments/scales used were MBI-SS and HADS verified Portuguese versions ^{19,20}.

The data collected in 2019, previously discussed in a master thesis, were reused for the comparative analysis with the data collected in 2021, representing a pre- and post-pandemic time-points ⁸.

The students were invited to answer a Google Forms survey. Participation was voluntary and anonymous, informed consent was requested prior to initiating the survey and participants were able to quit at any time. Our Ethical Committee has approved both studies and permission to reuse data from the previous study was obtained from the author.

Complementary, a third cross-sectional study was performed to compare the mental health of medical students with other university students from the same academic environment. The target population were ICBAS students from the 1st, 3rd and 6th year of medicine, 1st, 3rd and 5th year of veterinary medicine and 1st and 3rd year of aquatic sciences. The approach to participate in the study was the same as for medical students and the timeline of the study was the same as the second, from September to December 2021.

Study measures

For this study, we collected sociodemographic data (sex, age, marital status, cohabitants), academic data (year of study, no approval in one or more years, first or subsequent course, positive COVID-19 test, psychological/psychiatric assistance), MBI-SS and HADS.

MBI-SS measures three sub-dimensions of burnout, through fifteen questions: five for emotional exhaustion, four for depersonalization and six for sense of personal accomplishment. Each item is quantified by its frequency, on a Likert-type scale, ranging from 0 (never) to 6 (every day). Emotional exhaustion is featured in low (0-9), moderate (10-14) and high (>14); depersonalization in low (0-1), moderate (2-6) and high (>6); and sense of personal accomplishment in reduced (<23), moderate (23-27) and high (>27). Therefore, according to the three-dimensional definition of MBI-SS (TDD MBISS), a student is considered to be in burnout when simultaneously presenting high values of emotional exhaustion (>14) and depersonalization (>6) and reduced sense of personal accomplishment (<23). Another method to assess burnout is the bidimensional definition (BDD MBI-SS), which only considers emotional exhaustion and depersonalization, using the same cut-offs. In this study we evaluate burnout by both methods.

HADS allows the tracking of anxious and depressive symptoms experienced in the days prior to its application. It is divided into two parts, one for the assessment of anxious symptoms and other for the assessment of depressive symptoms. Each part is composed of seven questions, quantified on a Likert-type scale, from 0 to 3. Through this method each individual rates from 0 to 21 for anxiety and 0 to 21 for depression, separately. Regarding the symptomatology, a score is described as 'normal' (0-7), mild (8-10), 'moderated' (11-14) and 'severe' (15-21) ²⁰.

Statistical analysis

The Chi-squared test was used to compare the proportions and the t-test for two independent samples was used to compare the means between the two time-points.

The estimated adjusted odds ratio (aOR) and the respective 95% confidence intervals (95%CI) were used to assess the magnitude of the association between the several mental health outcomes and the two times-points.

The unconditional logistic regression model was used to calculate the aOR and 95CI%.

All the models for each mental health outcome included, time-point, sex, positive test for Covid-19 and the type of household, specifically for the MBI-SS' outcomes the HADS outcomes were also included in the model.

The sensitivity analysis was conducted to examine the relationship between pre- and post- pandemic changes according to the multiple exposures (interactions) and the results showed that there was no statistically significant interaction. This means that the pre- and post- pandemic changes in mental health outcomes did not vary based on specific exposure (data not shown).

RESULTS

Sample description: sociodemographic and academic data

Regarding medical students, surveys were delivered to the target population, yielding a maximum of 541 potential participants. Of these, 208 students (38.4%) completed and submitted the survey. These results were compared to the data collected in 2019, performed among 231 medical students and corresponding to a response rate of 46.2%. No statistically significant differences were found regarding sociodemographic and academic data between the population studied in 2019 vs 2021 with exception of curricular year and age. The sociodemographic and academic characteristics of both populations are summarized in table 1.

Concerning aquatic sciences, 22 of the 76 students answer de survey, corresponding to a submission rate of 28.9%, and from the 194 veterinary medicine students, 50 submitted de survey, representing a response rate of 25.8%. No statistically significant differences were found regarding sociodemographic and academic data between aquatic sciences, medicine and veterinary medicine students, with exception of curricular year and age. The sociodemographic and academic characteristics of the populations are summarized in table 2.

Mental health outcomes in medical students

According to TDD MBI-SS, students in 2021 presented similar burnout when compared to 2019, 33.1% and 25.9% respectively ($p=0.113$). Considered the BDD MBI-SS, this value increased significantly, from 35,5% in 2019 to 52.3% in 2021 ($p<0.001$) (table 3).

Regarding HADS' results, in 2021, 47.1% students have shown moderate to severe anxious symptoms (MS-AS) and 13.2% moderate to severe depressive symptoms (MS-DS). When compared to the data collected in 2019, the students have shown a similar prevalence of MS-AS (42.9%; $p=0.655$) but a higher prevalence of MS-DS (8.6%; $p=0.021$) (table 3).

Table 3 shows the anxious and depressive symptomatology, BDD MBI-SS, TDD MBI-SS and MBI-SS dimensions, in 2019 and 2021. Regarding MBI-SS dimensions, the mean scores increased significantly from 2019 to 2021 for emotional exhaustion (16.4 vs. 18.8, $p<0.001$) and depersonalization (6.52 vs. 8.91, $p<0.001$).

The BDD MBI-SS ($aOR=2.03$, $p=0.001$) and MS-DS ($aOR=1.91$, $p=0.007$) prevalence increased on the students' cohort of 2021 compared to 2019, after adjusting for confounders sex, curricular year, COVID-19, cohabitants (family), anxious symptomatology, depressive symptomatology (table 4).

A statistically significant relationship between the curricular year and burnout was observed, according to dimension BDD MBI-SS ($OR = 1.11$; $p=0.040$) and to TDD MBI-SS ($OR= 1.13$; $p=0.025$). Regarding MS-AS, a statistically significant relationship with sex was shown, with a higher prevalence among females ($OR=1.98$; $p=0.007$). Lastly, a statistically significant relationship between burnout and MS-AS and MS-DS was found. The BDD MBI-SS, TDD MBI-SS, MS-DS and MS-AS prevalences by curricular year are shown in figure 1 and the effect adjusted for socio-academic data in BDD MBI-SS, TDD MBI-SS, MS-DS and MS-AS are shown in table 4. No other statistically significant differences were found.

After adjusting for the confounders sex, curricular year, COVID-19, cohabitants (family), anxious symptomatology, depressive symptomatology, no differences were found concerning the dimensions evaluated by MBI-SS, with no differences regarding the sense of personal accomplishment ($aOR=0.98$; $p=0.919$) and a statistically significant increase in emotional exhaustion ($aOR=1.85$; $p=0.047$) and depersonalization ($aOR=2.09$; $p=0.003$), independently of the possible confounders (table 5).

Living in a shared apartment / residence was proven to be protective of the emotional exhaustion dimension, when compared to living with family (aOR=0.44; p=0.001). The impact of the socioeconomic and academic variables on MBI-SS dimensions are shown in table 5.

Mental health outcomes in ICBAS' students

According to the TDD MBI-SS, 6 (35.3%) aquatic sciences, 59 (33.1%) medical and 17 (36.2%) veterinary students have presented burnout (p=0.92). Considered the BDD MBISS, this value increases to 10 (58.8%) aquatic sciences, 92 (52.3%) medical and 32 (68.1%) veterinary students have presented burnout (p=0.92) (table 6)

Concerning HADS, 7 (41.2%) aquatic sciences, 80 (47.1%) medical and 26 (56.5%) veterinary students have shown MS-AS (p=0.64) and 0 (0.0%) aquatic sciences, 22 (13.2%) medical and 10 (22.2%) veterinary students have shown MS-DS (p=0.08).

Table 6 shows the anxious and depressive symptomatology, BDD MBI-SS, TDD MBI-SS and MBI-SS dimensions for the populations.

After adjusting for the confounders sex, curricular year, COVID-19, cohabitants (family), anxious symptomatology, depressive symptomatology, the results were similar.

DISCUSSION

Mental health of medical students

After reviewing the literature produced during this period, we concluded that our results are consistent with many other studies from all around the globe. A systematic review and meta-analysis with 17 431 medical students highlighted a burnout rate between 33.4% and 55.0%. Similar values were also found regarding anxiety and depression, with a 49.4% anxiety prevalence found in a study performed among fourteen United Kingdom Medical Schools and a depression prevalence between 11.3% and 17.3% found in a crosssectional study at the University of Michigan Medical School ^{21, 22}.

Regarding the interaction between sociodemographic and academic variables with these mental health problems, we found a statistically significant relationship between burnout and the year of study, with a higher prevalence of burnout in the 3rd year, by BDD MBISS and, through the TDD MBI-SS, increasing along the course, with a higher prevalence in the 6th year.

Literature suggests that burnout progressively increases during medical education and is a phenomenon that develops cumulatively ²⁶. At ICBAS, the first contact with the clinical reality occurs in the 3rd year, representing a very hard-working period. Exhaustion can be related to study demands and workload, which can explain the high burnout rate observed in the 3rd year. On the other hand, the third dimension evaluated in TDD MBI-SS is the sense of personal accomplishment. The beginning of clinical practice and contact with the hospital reality is a very important and longed-for moment for a medical student, this fact may help to explain the higher sense of personal accomplishment found in the 3rd year, causing a burnout prevalence, by TDD-MBI, lower than through the BDD-MBI. In Portugal, the 6th year is a professionalizing year, in which students have a tutor and are on the ward. According to the literature, during this final clinical training, students often spend considerable time without

assigned tasks and waiting for the tutor to teach and supervise, which might be a source of frustration and lead to a decrease in personal accomplishment ²⁷. Besides the internships, 6th year students must write their master's thesis, which can be a complex and time-consuming process, as well as study for the final exam. All this background may help to explain the higher burnout rate, by TDD-MBI, found in this year.

Regarding MS-DS and MS-AS, our findings are also consistent with literature that states a rise in depression scores and their persistence during medical school and reports that women scored higher on anxiety tests ^{38,29}.

A strong relationship between anxiety, depression and burnout was found. Therefore, we can suggest that students with anxiety and depression have a much higher propensity to develop burnout.

Recent studies also state a strong relationship between depression, anxiety and emotional exhaustion, the most impactful dimension recorded among burned-out medical students, according to MBI-SS. Additionally, findings support that burnout is related to depression and anxiety and could explain the high prevalence of these symptoms among medical students ^{30,31}.

In the comparison between the data obtained in 2019 and our data, we found an increase in BDD MBI-SS and MS-DS.

Literature reports a similar deterioration in mental health regarding before and after the beginning of the SarsCov2 pandemic ³³. A growing body of literature suggests that the pandemic has had a transversal impact on university students' mental health, leading to increased levels of stress, anxiety, depression, and other mental health problems ^{44,45}. One of the main factors contributing to this impact was the sudden change of the learning environment. The abrupt closure of universities and the switch to online classes, that left many students feeling isolated and disconnected from their peers and instructors. The lack of face-to-face interaction and the challenges of adapting to this new reality have contributed to increased stress and anxiety levels among students ⁴⁶.

The pandemic has also created economic instability, with many students facing financial difficulties due to job losses or reduced work hours. These economic stressors can exacerbate pre-existing mental health conditions or lead to the development of new ones. Another factor contributing to the impact of the pandemic was the disruption of daily routines and social support networks. The closure of campus facilities and restrictions on social gatherings have made it difficult for students to maintain their usual social connections and engage in activities that promote mental wellbeing, such as exercise and hobbies. The increased uncertainty about the future, with many students unsure about their academic and career prospects, lead to feelings of hopelessness, helplessness and despair, which can contribute to the development of mental health problems ⁴⁶⁻⁴⁹.

Moreover, the CONFINS study reported that, during the SarsCov2 pandemic, university students were at higher risk of mental health disturbances than non-students, and suffered a greater deterioration in mental health indexes, compared to young people of the same age ⁴³. Therefore, all this background emphasizes the need for intervention.

Concerning the three dimensions evaluated by MBI-SS, we observed an increase regarding emotional exhaustion and depersonalization, without interfering with the third dimension, the sense of personal accomplishment.

Although social media has constantly updated about the SarsCov2 pandemic, disinformation was very frequent and fed unfounded fears among the population. This confused people and was harmful to their mental health, with many citizens expressing negative feelings, such as fear, worry, nervousness and anxiety on social media ³⁴. Concerning medical students, a study states that they had extensive knowledge regarding COVID-19 and expressed a positive attitude towards the pandemic, which was useful in combating the misinformation and, since it allowed to put the acquired knowledge into practice, it had a good impact in the sense of personal accomplishment, the third dimension evaluated by MBI-SS, helping to explain the deterioration found in all dimensions evaluated by MBI-SS, with the exception of the sense of personal accomplishment ³⁵.

Thus, our results suggest that the pandemic has been shown to further exacerbate the mental burden among medical students.

Mental health of ICBAS' students

In our evaluation we found no statistically significant differences among ICBAS students' mental health outcomes. According to TDD MBI-SS, 35.3% aquatic sciences, 33.1% medical and 36.2% veterinary students have presented burnout. 41.2% aquatic sciences, 47.1% medical and 56.5% veterinary students have shown MS-AS and 0% aquatic sciences, 13.2% medical and 22.2% veterinary students have shown MS-DS.

Concerning the differences between medical and non-medical students' mental health, literature is not in agreement. As some studies report medical students as particularly exposed to higher levels of distress and consequently having more mental health problems ³⁶⁻³⁸; others claim that this distress may be a phenomenon that transversally affects university students ³⁹⁻⁴¹. Some explanations can justify these disparities, among which, the fact that medical students, due to their training, more easily identify mental health related symptoms and complain of these problems significantly more, although their prevalence is not higher in comparison to other students ^{39,40,42,43}.

CONCLUSION

With our study, we proved that the SarsCov2 pandemic has been shown to further exacerbate the mental burden among medical students. And furthermore, we found that anxiety and depression have a synergistic impact on burnout, cumulatively worsening this mental health burden.

Additionally, our data also suggest that a mental health deterioration is cross-cutting to all our three students' populations, without any statistically significant difference, reinforcing that universities should invest in preventive approaches such as self-aware, self-care and healthy coping mechanisms.

Proposals to counteract this mental health deterioration

Therefore, in view of the proven deterioration of mental health burden among university students, a clear need for intervention arises. To that end, some proposals have been made to counteract this problem.

The frequency of socialization has been proven a good predictor of both emotional and academic outcomes, and peer mentoring and support groups showed a positive impact on acute and long-term stressors ⁵⁰. Some extracurricular activities were also associated with better mental health outcomes. Music-related activities were proven protective from burnout and physical exercise from stress, with regular exercise associated with lower levels of neuroticism, anxiety, and depression ⁵¹.

The supervisors' type of leadership also plays a critical role in the wellbeing of the students ⁵². For that matter it is important not only to train the teachers and leaders for healthy leadership, teaching and management but also for recognizing

psychological and psychiatric symptoms⁵³. Additionally, evidence suggests that some specific interventions in the learning environment were associated with significant improvements in emotional well-being, among which programs of mindbody skills, wellness, advising and multicomponent program reforms are to be noticed⁵⁴.

Other effective measures described in literature include resilience training, good social support and self-care activities such as mindfulness, nutrition, exercise, good sleep and fulfilling interpersonal relationships⁵⁵⁻⁵⁷.

Particularly for medical students, at Saint Louis University School of Medicine, a multipronged strategy successfully decreased the levels of depression and anxiety, through the application of some strategies, among which, a three-hour resilience and mindfulness curriculum and a confidential option for tracking depression and anxiety were implemented, with a later contact from a mental health provider⁵⁸.

APPENDIX 1 – RESULTS

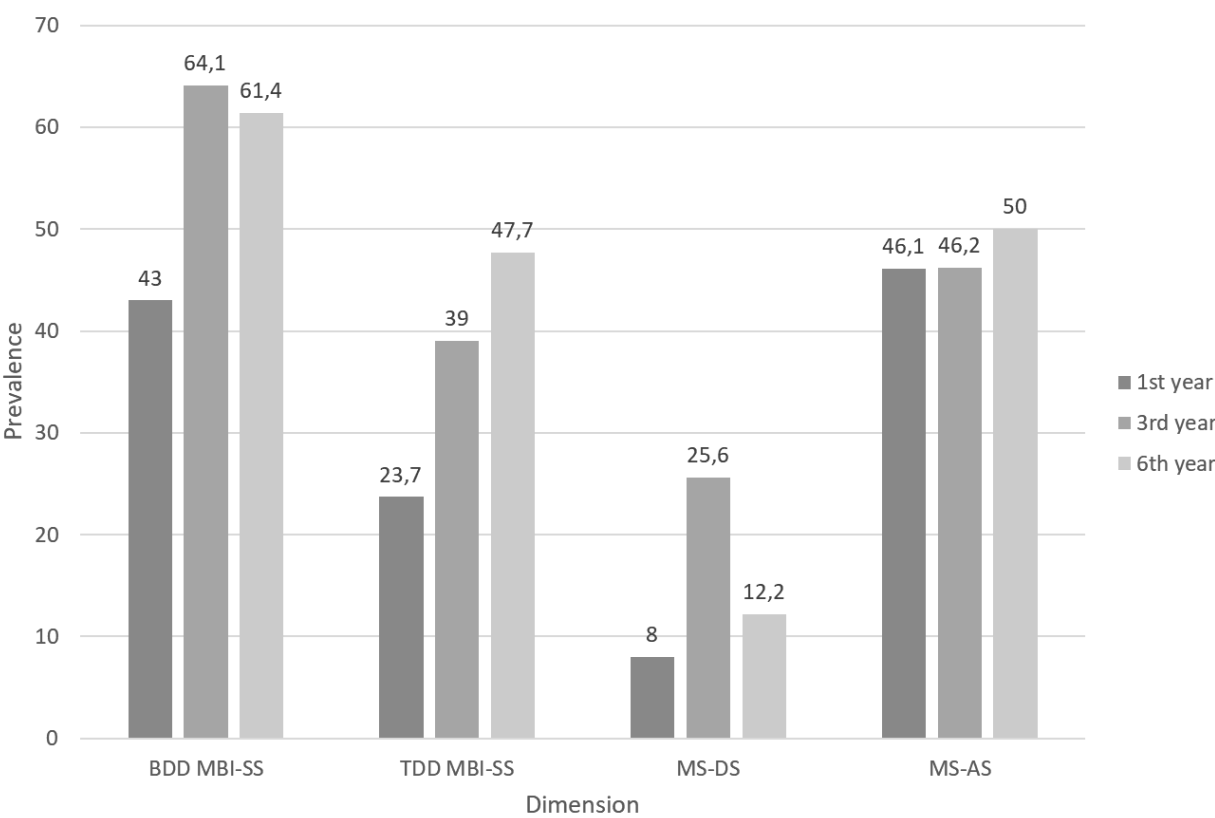


Figure 1 – BDD MBI-SS, TDD MBI-SS, MS-AS and MS-DS by year of study among ICBAS’ medical students.

Table 1 - Sociodemographic and academic characterization of ICBAS' medical students in 2019 and 2021.

	2019	2021	p
TOTAL	231	208	
Year of study - N (%)			<0.001
1 st	98 (62.8)	119 (57.2)	
3 rd	84 (46.4)	43 (20.7)	
6 th	49 (30.1)	46 (22.1)	
Sex - N (%)			0.609
Female	174 (75.3)	161 (77.4)	
Male	57 (24.7)	47 (22.6)	
Age			<0.001
Average ($\pm$ SD)	23.9	20.1 ($\pm$ 3.2)	
Marital Status - N (%)			0.195
Single	230 (99.6)	204 (98.1)	
Other	1 (0.4)	4 (1.9)	
Cohabitants - N (%)			0.069
Family	161 (69.7)	123 (59.2)	
Shared apartment / residence	53 (22.9)	64 (30.8)	
Alone	17 (7.4)	21 (10.1)	
Have you ever failed a year? - N (%)			0.457
Yes	6 (2.6)	8 (3.8)	
No	225 (97.4)	200 (96.2)	
Is this your first degree? - N (%)			0.215
Yes	191 (82.7)	180 (87.0)	
No	40 (17.3)	27 (13.0)	
COVID-19 infeccion - N (%)			
Yes	—	33 (15.9)	
No	—	175 (84.1)	
Search for a mental health professional - N (%)			
Psychological help	—	85 (41.3)	
Psychiatric help	—	35 (16.8)	

Table 2 - Sociodemographic and academic characterization of ICBAS' aquatic sciences, medicine and veterinary medicine students.

	Aquatic Sciences	Medicine	Veterinary Medicine	p
TOTAL	22	208	50	
Year of study - N (%)				<0.001
1 st	18 (81.8)	119 (57.2)	10 (20.0)	
3 rd	4 (18.2)	43 (20.7)	32 (64.0)	
5 th			8 (16.0)	
6 th		46 (22.1)		
Sex - N (%)				0.58
Female	18 (85.7)	161 (77.4)	40 (81.6)	
Male	3 (14.3)	47 (22.6)	9 (1.4)	
Age				<0.001
Average ($\pm$ SD)	19.3 (3.9)	20.1 ($\pm$ 3.2)	22.5 (5.8)	
Marital Status - N (%)				0.07
Single	20 (95.2)	204 (98.1)	47 (94.0)	
Other	1 (4.8)	4 (1.9)	3 (6.0)	
Cohabitants - N (%)				0.07
Family	15 (68.9)	123 (59.2)	39 (78.0)	
Shared apartment / residence	7 (31.8)	64 (30.8)	10 (20.0)	
Alone	0 (0.0)	21 (10.1)	1 (2.0)	
Have you ever failed a year? - N (%)				0.006
Yes	2 (9.1)	8 (3.8)	8 (16.0)	
No	20 (90.9)	200 (96.2)	42 (84.0)	
Is this your first degree? - N (%)				0.009
Yes	20 (90.9)	180 (87.0)	35 (70.0)	
No	2 (9.1)	27 (13.0)	15 (30.0)	
COVID-19 infection - N (%)				0.92
Yes	4 (18.2)	33 (15.9)	35 (70.0)	
No	18 (81.8)	175 (84.1)	15 (30.0)	
Search for a mental health professional - N (%)				0.71
Psychological help	11 (50.0)	85 (41.3)	20 (40.0)	
Psychiatric help	5 (22.7)	35 (16.8)	9 (18.0)	

Table 3 - Comparison of anxious and depressive symptomatology, BDD MBI-SS, TDD MBI-SS and MBI-SS dimensions, between 2019 and 2021 among ICBAS' medical students.

	2019	2021	p
Anxious symptomatology - N (%)			0.655
Normal	64 (27.7%)	46 (27.1%)	
Mild	68 (29.4%)	44 (25.9%)	
Moderate - Severe	99 (42.9%)	80 (47.1%)	
Depressive symptomatology - N (%)			0.021
Normal	181 (78.4%)	110 (65.9%)	
Mild	30 (13.0%)	25 (21.0%)	
Moderate - Severe	20 (8.7%)	22 (13.2%)	
BDD MBI-SS - N (%)	82 (35.5%)	92 (52.3%)	<0.001
TDD MBI-SS - N (%)	60 (26.0%)	59 (33.1%)	0.113
MBI-SS dimensions – M (±SD)			
Emotional exhaustion	16.4 (±5.8)	18.8 (±7.0)	<0.001
Depersonalization	6.52 (±5.73)	8.91 (±6.27)	<0.001
Sense of personal accomplishment	23.7 (±5.7)	23.2 (±6.4)	0.382

Table 4 – Relationship between sociodemographic and academic data, BDD MBI-SS, TDD MBI-SS, MS-AS and MS-DS among ICBAS' medical students.

	BDD MBI-SS*		TDD MBI-SS*		MS-AS*		MS-DS*	
	aOR (95%CI)	p	aOR	p	aOR	p	aOR	p
Year								
2019	1		1		1		1	
2021	2.03 (1.36-3.06)	0.001	1.37 (0.87-2.17)	0.175	0.94 (0.59-1.51)	0.802	1.91 (1.19-3.07)	0.007
Sex								
Male	1		1		1		1	
female	1.06 (0.66-1.70)	0.817	0.80 (0.49-1.33)	0.391	1.98 (1.20-3.25)	0.007	1.05 (0.62-1.84)	0.848
Curricular year	1.11 (1.01-1.23)	0.040	1.13 (1.02-1.26)	0.025	1.01 (0.90-1.13)	0.908	0.92 (0.54-1.55)	0.764
COVID-19								
Negative	1		1		1		1	
Positive	0.90 (0.39-2.08)	0.802	1.29 (0.52-3.06)	0.565	1.46 (0.53-4.72)	0.489	1.00 (0.37-2.51)	0.998
Cohabitants (family)								
Parents/Family	1		1		1		1	
Shared apartment / residence	1.00 (0.63-1.58)	0.989	1.24 (0.75-2.03)	0.388	1.30 (0.77-2.22)	0.335	0.92 (0.54-1.55)	0.764
Alone	0.76 (0.34-1.62)	0.478	0.67 (0.25-1.55)	0.372	1.80 (0.74-5.08)	0.223	1.29 (0.55-2.86)	0.544
Anxious symptomatology								
Normal	1		1					
Moderate	3.76 (1.96-7.49)	<0.001	4.80 (2.16-11.63)	<0.001				
High	5.43 (2.88-10.66)	<0.001	4.94 (2.28-11.74)	<0.001				
Depressive symptomatology								
Normal	1		1					
Moderate	2.99 (1.61-5.69)	0.001	3.23 (1.73-6.09)	<0.001				
High	8.37 (3.40-23.96)	<0.001	11.53 (5.12-27.88)	<0.001				

*Adjusted for all variables in the table

Table 5 - The impact of the socioeconomic and academic variables on the MBI-SS dimensions among ICBAS' medical students.

	Sense of personal accomplishment*		Emotional exhaustion*		Depersonalization*	
	aOR (95%CI)	p	aOR (95%CI)	p	aOR (95%CI)	p
Year						
2019	1		1		1	
2021	0.98 (0.61-1.55)	0.919	1.85 (1.02-3.43)	0.047	2.09 (1.30-3.39)	0.003
Anxious symptomatology						
Normal	1		1		1	
Moderate	2.05 (1.14-3.74)	0.017	6.58 (3.56-12.57)	<0.001	2.32 (1.30-4.17)	0.005
High	1.82 (1.02-3.27)	0.045	17.92 (8.82-38.73)	<0.001	3.57 (2.02-6.43)	<0.001
Depressive symptomatology						
Normal	1		1		1	
Moderate	2.78 (1.53-5.09)	<0.001	4.91 (1.75-17.66)	0.006	2.89 (1.51-5.76)	0.002
High	9.63 (4.16-25.32)	<0.001	4.65 (1.22-30.77)	0.050	7.71 (2.84-27.07)	<0.001
Sex						
Male	1		1		1	
Female	0.83 (0.49-1.39)	0.472	1.11 (0.60-2.05)	0.735	0.72 (0.42-1.22)	0.227
Curricular year	1.00 (0.89-1.12)	0.997	0.90 (0.78-1.04)	0.1447	1.08 (0.97-1.22)	0.164
Cohabitants (family)						
Parents/Family	1		1		1	
Shared	1.18 (0.71-1.94)	0.524	0.44 (0.23-0.82)	0.011	0.82 (0.49-1.38)	0.459
Alone	1.32 (0.58-2.99)	0.510	0.59 (0.21-1.72)	0.315	0.72 (0.30-1.70)	0.454
COVID-19						
Negative	1		1		1	
Positive	1.93 (0.74-5.16)	0.179	0.42 (0.12-1.56)	0.179	0.91 (0.33-2.62)	0.860

*Adjusted for all variables in the table

Table 6 - Comparison of anxious and depressive symptomatology, BDD MBI-SS, TDD MBI-SS and MBI-SS dimensions, between ICBAS' students

	Aquatic Sciences	Medicine	Veterinary Medicine	p
Anxious symptomatology - N (%)				0.64
Normal	5 (29.4)	46 (27.1)	8 (17.4)	
Mild	5 (29.4)	44 (25.9)	12 (26.1)	
Moderate - Severe	7 (41.2)	80 (47.1)	26 (56.5)	
Depressive symptomatology - N (%)				0.08
Normal	10 (58.8)	110 (65.9)	24 (53.3)	
Mild	7 (41.2)	25 (21.0)	11 (24.4)	
Moderate - Severe	0 (0.0)	22 (13.2)	10 (22.2)	
BDD MBI-SS - N (%)	10 (58.8)	92 (52.3)	32 (68.1)	0.15
TDD MBI-SS - N (%)	6 (35.3)	59 (33.1)	17 (36.2)	0.92
MBI-SS dimensions – M (±SD)				
Emotional exhaustion	18.9 (5.1)	18.8 (7.0)	21.4 (6.3)	0.07
Depersonalization	10.5 (6.4)	8.9 (6.3)	11.3 (6.2)	0.05
Sense of personal accomplishment	21.1 (7.5)	23.2 (6.4)	22.3 (7.0)	0.38

APPENDIX 2 - SURVEY

Dados sociodemográficos

Sexo *

- ☐ Feminino
- ☐ Masculino

Idade *

Date

dd/mm/aaaa

Estado civil *

- ☐ Solteiro
- ☐ Casado
- ☐ Divorciado
- ☐ Viúvo

Com quem reside *

- ☐ Pais/Família
- ☐ Sozinho
- ☐ Partilha de casa/Residência universitária
- ☐ Other: _____

Dados acadêmicos

Ano de Curso *

- | | | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1 | 2 | 3 | 4 | 5 | 6 |
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

Alguma vez não transitou de ano na faculdade? *

☐ Sim

☐ Não

Este é o seu primeiro curso? *

☐ Sim

☐ Não

Qual o Curso que frequenta?

CMA ☐

Medicina ☐

Medicina Veterinária ☐

Teve algum teste positivo para COVID-19? S ☐ N ☐

Alguma vez procurou ajuda psicológica? S ☐ N ☐

Se sim,

☐ nos ultimos 3 meses

☐ nos últimos 6 meses

☐ nos ultimos 12 meses

☐ nos ultimos 24 meses

Alguma vez procurou ajuda psiquiquiátrica? S ☐ N ☐

Se sim,

☐ nos ultimos 3 meses

☐ nos últimos 6 meses

☐ nos ultimos 12 meses

☐ nos ultimos 24 meses

Malash Burnout Inventory - Students Survey

As afirmações seguintes são referentes aos sentimentos/emoções de estudantes em contexto escolar. Leia cuidadosamente cada afirmação e decida sobre a frequência com que se sente da forma descrita.

Legenda da escala:

- 0- Nenhuma vez
- 1- Poucas vezes por ano
- 2- Uma vez por mês
- 3- Poucas vezes por mês
- 4- Uma vez por semana
- 5- Poucas vezes por semana
- 6- Sempre

Os meus estudos deixam-se emocionalmente exausto. *

	0	1	2	3	4	5	6	
Nenhuma vez	☐	☐	☐	☐	☐	☐	☐	Sempre

Sinto-me de 'rastros' no final de um dia na universidade. *

	0	1	2	3	4	5	6	
Nenhuma vez	☐	☐	☐	☐	☐	☐	☐	Sempre

Sinto-me cansado quando me levanto de manhã e penso que tenho de enfrentar mais um dia na universidade. *

	0	1	2	3	4	5	6	
Nenhuma vez	☐	☐	☐	☐	☐	☐	☐	Sempre

Estudar ou assistir a uma aula deixam-me tenso. *

	0	1	2	3	4	5	6	
Nenhuma vez	☐	☐	☐	☐	☐	☐	☐	Sempre

Os meus estudos deixam-me completamente esgotado. *

	0	1	2	3	4	5	6	
Nenhuma vez	☐	☐	☐	☐	☐	☐	☐	Sempre

Tenho vindo a desinteressar-me pelos meus estudos desde que entrei na universidade. *

	0	1	2	3	4	5	6	
Nenhuma vez	☐	☐	☐	☐	☐	☐	☐	Sempre

Sinto-me pouco entusiasmado com os meus estudos. *

	0	1	2	3	4	5	6	
Nenhuma vez	☐	☐	☐	☐	☐	☐	☐	Sempre

Sinto-me cada vez mais cínico relativamente à utilidade potencial dos meus estudos. *

	0	1	2	3	4	5	6	
Nenhuma vez	☐	☐	☐	☐	☐	☐	☐	Sempre

Sinto-me estimulado quando alcanço os meus objectivos escolares. *

	0	1	2	3	4	5	6	
Nenhuma vez	☐	☐	☐	☐	☐	☐	☐	Sempre

Tenho aprendido muitas matérias interessantes durante o meu curso. *

	0	1	2	3	4	5	6	
Nenhuma vez	☐	☐	☐	☐	☐	☐	☐	Sempre

Durante as aulas, sinto que consigo acompanhar as matérias de forma eficaz. *

	0	1	2	3	4	5	6	
Nenhuma vez	☐	☐	☐	☐	☐	☐	☐	Sempre

Tenho duvidas sobre o significado dos meus estudos. *

	0	1	2	3	4	5	6	
Nenhuma vez	☐	☐	☐	☐	☐	☐	☐	Sempre

Consigo resolver, de forma eficaz, os problemas que resultam dos meus estudos. *

	0	1	2	3	4	5	6	
Nenhuma vez	☐	☐	☐	☐	☐	☐	☐	Sempre

Acredito que participo, de forma positiva, nas aulas a que assisto. *

	0	1	2	3	4	5	6	
Nenhuma vez	☐	☐	☐	☐	☐	☐	☐	Sempre

Sinto que sou um bom aluno. *

	0	1	2	3	4	5	6	
Nenhuma vez	☐	☐	☐	☐	☐	☐	☐	Sempre

Escala Hospitalar de Ansiedade e Depressão

Esta escala pretende saber como se encontra a sua saúde mental no momento presente. Responda de forma espontânea e sincera.

Sinto-me tenso ou contraído: *

	0	1	2	3	
Nunca	☐	☐	☐	☐	A maior parte do tempo

Ainda sinto gosto pelas mesmas coisas de antes: *

	0	1	2	3	
Sim	☐	☐	☐	☐	Já não sinto prazer em nada

Sinto uma espécie de medo, como se alguma coisa má fosse acontecer: *

	0	1	2	3	
Sim, de maneira muito forte	☐	☐	☐	☐	Não sinto nada disso

Divirto-me quando vejo coisas engraçadas: *

	0	1	2	3	
Da mesma forma que antes	☐	☐	☐	☐	Já não consigo

Consigo ficar sentado à vontade e sentir-me relaxado: *

	0	1	2	3	
Sim, quase sempre	☐	☐	☐	☐	Nunca

Estou com a cabeça cheia de preocupações: *

	0	1	2	3	
Raramente	☐	☐	☐	☐	A maior parte do tempo

Sinto-me alegre: *

	0	1	2	3	
A maior parte do tempo	☐	☐	☐	☐	Nunca

Sinto-me lento a pensar e a realizar tarefas: *

	0	1	2	3	
Nunca	☐	☐	☐	☐	Quase sempre

Sinto uma sensação de medo, como um frio na barriga ou um aperto no estômago: *

	0	1	2	3	
Nunca	☐	☐	☐	☐	Quase sempre

Perdi o interesse em cuidar da minha aparência: *

	0	1	2	3	
Cuido da mesma forma que antes	☐	☐	☐	☐	Completamente

Sinto-me inquieto, como se não pudesse ficar parado em nenhum lugar: *

	0	1	2	3	
Não me sinto assim	☐	☐	☐	☐	Sim, demasiado

Espero de forma animada coisas boas que estão por vir: *

	0	1	2	3	
Da mesma forma que antes	☐	☐	☐	☐	Quase nunca

De repente, tenho a sensação de entrar em pânico: *

	0	1	2	3	
Não sinto isso	☐	☐	☐	☐	Quase em todos os momentos

Consigo sentir prazer quando assisto a um bom programa de televisão, de rádio ou quando leio alguma coisa: *

	0	1	2	3	
Quase sempre	☐	☐	☐	☐	Quase nunca

REFERENCES

1. EUSUHM. The Tampere declaration on student health care in Europe. 2007. www.eusuhm.org
2. WHO. WHO World Mental Health Surveys International College Student Project: prevalence and distribution of mental disorders. *Journal of Abnormal Psychology*. 2018;127(7):623–638. doi:10.1037/abn0000362
3. Autumn AB, Patterson Silver Wolf DA, Maguin E, Beeler-Stinn S. Depression and anxiety among college students: Understanding the impact on grade average and differences in gender and ethnicity. *Journal of American College Health*. 2021. doi:10.1080/07448481.2021.1920954
4. WHO. Defining and measuring the social accountability of medical schools. 1995.
5. Parboosing J. Medical schools' social contract: more than just education and research. 2003. www.sworm.on.ca
6. Mousa OY, Mandip S. D, Lander S, Dhamoon AS. The MD Blues: Under-Recognized Depression and Anxiety in Medical Trainees. *PLoS ONE*. 2016;11(6). doi:10.1371/journal.pone.0156554
7. Anuradha R, Dutta R, Dinesh Raja J, Sivaprakasam P, Patil AB. Stress and stressors among medical undergraduate students: A cross-sectional study in a private medical college in Tamil Nadu. *Indian Journal of Community Medicine*. 2017;42(4):222–225. doi:10.4103/ijcm.IJCM_287_16
8. Cruz C. Síndrome de burnout em estudantes de medicina do ICBAS: prevalência, relação com dados sociodemográficos e acadêmicos e relação com ansiedade e depressão. 2020.

9. Wang Y, Wang Z, Wang J, Ming L, Wang S, He X, Zhou C. Evolution and control of the COVID-19 pandemic: A global perspective. *Cities*. 2022;130. doi:10.1016/j.cities.2022.103907
10. Chahley ER, Reel RM, Taylor S. The lived experience of healthcare professionals working frontline during the 2003 SARS epidemic, 2009 H1N1 pandemic, 2012 MERS outbreak, and 2014 EVD epidemic: A qualitative systematic review. *SSM - Qualitative Research in Health*. 2021;1:100026. doi:10.1016/j.ssmqr.2021.100026
11. Lai J, Ma S, Wang Y, Cai Z, Hu J, Wei N, Wu J, Du H, Chen T, Li R, et al. Factors associated with mental health outcomes among health care workers exposed to coronavirus disease 2019. *JAMA Network Open*. 2020;3(3). doi:10.1001/jamanetworkopen.2020.3976
12. Dragioti E, Tsartsalis D, Mentis M, Mantzoukas S, Gouva M. Impact of the COVID-19 pandemic on the mental health of hospital staff: An umbrella review of 44 metaanalyses. *International Journal of Nursing Studies*. 2022;131. doi:10.1016/j.ijnurstu.2022.104272
13. Odintsova TA, Kopchak OO, Bachinskaya NY, Ivniev BB, Pokanevych O v. Pros and cons of remote medical education in Ukraine in terms of COVID-19 pandemics. *Informatics in Medicine Unlocked*. 2022;32. doi:10.1016/j.imu.2022.101051
14. Saraswathi I, Saikarthik J, Kumar KS, Srinivasan KM, Ardhanaari M, Gunapriya R. Impact of COVID-19 outbreak on the mental health status of undergraduate medical students in a COVID-19 treating medical college: A prospective longitudinal study. *PeerJ*. 2020;8. doi:10.7717/peerj.10164
15. Aftab M, Abadi AM, Nahar S, Ahmed RA, Mahmood SE, Madaan M, Ahmad A. COVID19 pandemic affects the medical students' learning process and assaults their psychological wellbeing. *International Journal of Environmental Research and Public Health*. 2021;18(11). doi:10.3390/ijerph18115792.
16. Halperin SJ, Henderson MN, Prenner S, Grauer JN. Prevalence of Anxiety and Depression Among Medical Students During the Covid-19 Pandemic: A CrossSectional Study. *Journal of*

- Medical Education and Curricular Development. 2021;8:238212052199115. doi:10.1177/2382120521991150
17. Peng P, Hao Y, Liu Y, Chen S, Wang Y, Yang Q, Wang X, Li M, Wang Y, He L, et al. The prevalence and risk factors of mental problems in medical students during COVID19 pandemic: A systematic review and meta-analysis. *Journal of Affective Disorders*. 2023;321:167–181. doi:10.1016/j.jad.2022.10.040
 18. Bao Y, Sun Y, Meng S, Shi J, Lu L. 2019-nCoV epidemic: address mental health care to empower society. *The Lancet*. 2020;395(10224):e37–e38. doi:10.1016/S0140-6736(20)30309-3
 19. Maroco J, Tecedorio M. Inventário de Burnout de Maslach para estudantes Portugueses. 2009.
 20. Pais-Ribeiro J, Silva I, Ferreira T, Martins A, Meneses R, Baltar M. Validation study of a Portuguese version of the Hospital Anxiety and Depression Scale. *Psychology, Health and Medicine*. 2007;12(2):225–237. doi:10.1080/13548500500524088
 21. Frajerman A, Morvan Y, Krebs MO. Burnout in medical students before residency: A systematic review and meta-analysis. *European Psychiatry*. 2019;55:36–42. doi:10.1016/j.eurpsy.2018.08.006
 22. Thiemann P, Brimicombe J, Benson J. When investigating depression and anxiety in undergraduate medical students timing of assessment is an important factor - A multicentre cross-sectional study. *BMC Medical Education*. 2020;20(1). doi:10.1186/s12909-020-02029-0
 23. Kroska EB, Calarge C, O'Hara MW, Deumic E, Dindo L. Burnout and depression in medical students: Relations with avoidance and disengagement. *Journal of Contextual Behavioral Science*. 2017;6(4):404–408. doi:10.1016/j.jcbs.2017.08.003
 24. Dyrbye LN, Thomas MR, Power D v, Durning S, Moutier C, Massie FS, Harper W, Eacker A, Szydlo DW, Sloan JA, et al. Burnout and Serious Thoughts of Dropping Out of Medical School: A Multi-Institutional Study. 2010.

25. Yusoff MSB, Abdul Rahim AF, Baba AA, Ismail SB, Mat Pa MN, Esa AR. Prevalence and associated factors of stress, anxiety and depression among prospective medical students. *Asian Journal of Psychiatry*. 2013;6(2):128–133. doi:10.1016/j.ajp.2012.09.012
26. IsHak WW, Lederer S, Mandili C, Nikraves R, Seligman L, Vasa M, Ogunyemi D, Bernstein CA. Burnout During Residency Training: A Literature Review. *Journal of Graduate Medical Education*. 2009;1(2):236–242. doi:10.4300/jgme-d-09-00054.1
27. Dahlin ME, Runeson B. Burnout and psychiatric morbidity among medical students entering clinical training: A three year prospective questionnaire and interviewbased study. *BMC Medical Education*. 2007;7. doi:10.1186/1472-6920-7-6
28. Milagros R, Ockene I. A longitudinal Study of Students' Depression at one Medical School. 1997.
29. Hojat M, Glaser K, Veloski J, Christian EB. Gender comparisons of medical students' psychosocial problems. 1999
30. Johnson AK, Blackstone SR, Skelly A. The Relationship Between Depression, Anxiety, and Burnout Among Physician Assistant Students: A Multi-Institutional Study. *Health Professions Education*. 2020;6(3):420–427. doi:10.1016/j.hpe.2020.04.003
31. Dyrbye LN, Thomas MR, Shanafelt TD. Systematic Review of Depression, Anxiety, and Other Indicators of Psychological Distress Among U.S. and Canadian Medical Students. 2006.
32. Harries AJ, Lee C, Jones L, Rodriguez RM, Davis JA, Boysen-Osborn M, Kashima KJ, Krane NK, Rae G, Kman N, et al. Effects of the COVID-19 pandemic on medical students: a multicenter quantitative study. *BMC Medical Education*. 2021;21(1). doi:10.1186/s12909-020-02462-1
33. Ausín B, González-Sanguino C, Castellanos MÁ, Sáiz J, Zamorano S, Vaquero C, Muñoz M. The Psychological Impact of the COVID-19 Pandemic in Spain: A Longitudinal Study. *Psicothema*. 2022;34(1):66–73. doi:10.7334/PSICOTHEMA2021.290

34. Gao J, Zheng P, Jia Y, Chen H, Mao Y, Chen S, Wang Y, Fu H, Dai J. Mental health problems and social media exposure during COVID-19 outbreak. PLoS ONE. 2020;15(4). doi:10.1371/journal.pone.0231924
35. Maheshwari S, Gupta P, Sinha R, Rawat P. Knowledge, attitude, and practice towards coronavirus disease 2019 (COVID-19) among medical students: A cross-sectional study. Journal of Acute Disease. 2020;9(3):100.doi:10.4103/22216189.283886
36. Halperin SJ, Henderson MN, Prenner S. Prevalence of Anxiety and Depression Among Medical Students During the Covid-19 Pandemic: A Cross-Sectional Study. Journal of Medical Education and Curricular Development.2021; 8:238212052199115. doi:10.1177/2382120521991150
37. Aktekin M, Karaman T, Senol YY, Erdem S, Erengin H, Akaydin M. Anxiety, depression and stressful life events among medical students: a prospective study in Antalya, Turkey. 2001.
38. Firth J. MEDICAL PRACTICE Contemporary Themes Levels and sources of stress in medical students. 1986. doi:10.1177/2382365791205219
39. Arora RS, Thawani R, Goel A. Burnout and Sleep Quality: A Cross-Sectional Questionnaire-Based Study of Medical and Non-Medical Students in India. Cureus. 2015 Oct 22. doi:10.7759/cureus.361
40. Helmers KF, Danoff D, Steinert Y, Leyton M, Young SN. Stress and depressed mood in medical students, law students, and graduate students at McGill University. Academic Medicine. 1997;72(8):708–714. doi:10.1097/00001888-199708000-00018
41. Dahlin M, Nilsson C, Stotzer E, Runeson B. Mental distress, alcohol use and helpseeking among medical and business students: A cross-sectional comparative study. BMC Medical Education. 2011;11(1). doi:10.1186/1472-6920-11-92
42. Singh G, Hankins M, Weinman JA. Does medical school cause health anxiety and worry in medical students? Medical Education. 2004;38(5):479–481. doi:10.1046/j.1365-2929.2004.01813.x

43. Arsandaux J, Montagni I, Macalli M, et al Mental health condition of college students compared to non-students during COVID-19 lockdown: the CONFINS study *BMJ Open* 2021;11:e053231. doi: 10.1136/bmjopen-2021-053231
44. Bjorksten O, Sutherland S, Miller C, Stewart T. Identification of medical student problems and comparison with those of other students. *Jornal of Medical Education*. 1983
45. Cao, W., Fang, Z., Hou, G., Han, M., Xu, X., Dong, J., & Zheng, J. (2020). The psychological impact of the COVID-19 epidemic on college students in China. *Psychiatry Research*, 287, 112934.
46. COVID-19 epidemic in China. *Journal of Affective Disorders*, 278, 144-148. OdriozolaGonzález, P., Planchuelo-Gómez, Á., Iruñia, M. J., & de Luis-García, R. (2020). Psychological effects of the COVID-19 outbreak and lockdown among students and workers of a Spanish university. *Psychiatry Research*, 290, 113108.
47. Loades, M. E., Chatburn, E., Higson-Sweeney, N., Reynolds, S., Shafran, R., Brigden, A., & Linney, C. (2020). Rapid systematic review: The impact of social isolation and loneliness on the mental health of children and adolescents in the context of COVID-19. *Journal of the American Academy of Child and Adolescent Psychiatry*, 59(11), 1218-1239.
48. Magson, N. R., Freeman, J. Y., Rapee, R. M., Richardson, C. E., Oar, E. L., Fardouly, J., & Lugo, R. G. (2021). Risk and protective factors for prospective changes in adolescent mental health during the COVID-19 pandemic. *Journal of Youth and Adolescence*, 50(1), 44-57.
49. Zhou, S. J., Zhang, L. G., Wang, L. L., Guo, Z. C., Wang, J. Q., Chen, J. C., & Chen, J. X. (2020). Prevalence and socio-demographic correlates of psychological health problems in Chinese adolescents during the outbreak of COVID-19. *European Child and Adolescent Psychiatry*, 29(6), 749-758.
50. Ball S, Bax A. Self-care in Medical Education: Effectiveness of Health-habits Interventions for First-year Medical Students. 2002. doi:10.1186/1472374920476

51. Fares J, Saadeddin Z, al Tabosh H, Aridi H, el Mouhayyar C, Koleilat MK, Chaaya M, el Asmar K. Extracurricular activities associated with stress and burnout in preclinical medical students. *Journal of Epidemiology and Global Health*.2016;6(3):177–185. doi:10.1016/j.jegh.2015.10.003
52. Shanafelt TD, Noseworthy JH. Executive Leadership and Physician Well-being: Nine Organizational Strategies to Promote Engagement and Reduce Burnout.*Mayo Clinic Proceedings*. 2017;92(1):129–146.doi:10.1016/j.mayocp.2016.10.004
53. Marra D. Rapport sur la Qualité de vie des étudiants en santé. 2018.
54. Rotenstein LS, Ramos MA, Torre M, Bradley Segal J, Peluso MJ, Guille C, Sen S, Mata DA. Prevalence of depression, depressive symptoms, and suicidal ideation among medical students a systematic review and meta-analysis. *JAMA – Journal of the American Medical Association*. 2016;316(21):2214–2236.doi:10.1001/jama.2016.17324
55. Wright B, Richmond Mynett J. Training medical students to manage difficult circumstances- a curriculum for resilience and resourcefulness? *BMC Medical Education*. 2019;19(1). doi:10.1186/s12909-019-1712-x
56. Ayala EE, Winseman JS, Johnsen RD, Mason HRC. U.S. medical students who engage in self-care report less stress and higher quality of life. *BMC Medical Education*. 2018;18(1). doi:10.1186/s12909-018-1296-x
57. Aherne D, Farrant K, Hickey L, Hickey E, McGrath L, McGrath D. Mindfulness based stress reduction for medical students: Optimising student satisfaction and engagement. *BMC Medical Education*. 2016;16(1). doi:10.1186/s12909-016-0728-8
58. Slavin SJ, Chibnall JT. Finding the why, changing the how: Improving the mental health of medical students, residents, and physicians. *Academic Medicine*.2016;91(9):1194– 1196. doi:10.1097/ACM.0000000000001226

