

RESEARCH ARTICLE

Burnout among medical students in Cyprus: A cross-sectional study

Antonios Nteveros[☉], Marios Kyprianou[☉], Artemios Artemiadis[☉],
Antrianthi Charalampous, Kallistheni Christoforaki, Stephanos Cheilidis^{ORCID},
Orestis Germanos^{ORCID}, Panagiotis Bargiotas, Andreas Chatzittofis^{ORCID}, Panagiotis Zis^{ORCID}*

Medical School, University of Cyprus, Nicosia, Cyprus

☉ These authors contributed equally to this work.

* takiszis@gmail.com



Abstract

Objectives

The primary aim was to estimate the burnout prevalence among all medical students at the Medical School of the University of Cyprus. Secondary aims were to ascertain the predictors of burnout and its relationship with lifestyle habits, sleep quality and mental health.

Background

Burnout in the healthcare sector has drawn significant scientific attention over the last few years. Recent research underscored the large burden of profession-related burnout among medical students.

Materials and methods

An anonymous questionnaire was administered to all 189 eligible candidates. This included demographic and lifestyle characteristics. Sleep quality was assessed via the Pittsburg Sleep Quality Index, mental health was assessed via the mental health (MH) domain of the 36-item Short Form Health Survey (SF-36) and burnout with the Maslach Burnout Inventory–Student Survey (MBI-SS).

Results

Overall response rate was 96.3%. The burnout prevalence was 18.1%. There was a significant linear effect of between the year of studies and the burnout frequency [$F(1) = 5.09$, $p = 0.024$], implying that with increasing academic year there were more students with burnout, especially after the 4th year of education which signifies the beginning of clinical education. Students with burnout were more likely to have poor sleep quality (90.9% vs. 60.8%, odds ratio 4.33, $p = 0.023$) and worse mental health (MH score 40.2 ± 17.7 vs 62.9 ± 20.3 , $p < 0.001$). Alcohol consumers had more symptoms of cynicism and less feelings of efficacy than non-alcohol consumers. Moreover, less feelings of efficacy were significantly associated with more alcohol consumption among alcohol consumers.

OPEN ACCESS

Citation: Nteveros A, Kyprianou M, Artemiadis A, Charalampous A, Christoforaki K, Cheilidis S, et al. (2020) Burnout among medical students in Cyprus: A cross-sectional study. PLoS ONE 15(11): e0241335. <https://doi.org/10.1371/journal.pone.0241335>

Editor: Stephan Doering, Medical University of Vienna, AUSTRIA

Received: May 18, 2020

Accepted: October 14, 2020

Published: November 18, 2020

Copyright: © 2020 Nteveros et al. This is an open access article distributed under the terms of the [Creative Commons Attribution License](https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Data Availability Statement: All relevant data are within the paper and its [Supporting Information](#) files.

Funding: The author received no specific funding for this work.

Competing interests: The authors have declared that no competing interests exist.

Conclusions

Burnout is prevalent in medical students and increases significantly during the clinical years. Students with burnout have worse sleep and mental health and might use alcohol as a coping mechanism. Implementing prevention strategies of burnout may be beneficial.

Introduction

Burnout is conceptualised as a consequence of inadequately managed chronic workplace stress. It is characterized by a triad of emotional exhaustion, depersonalisation regarding the person's occupation and a feeling of reduced personal accomplishment. Emotional exhaustion (EE) refers to feelings of being overextended and depleted of emotional resources. Depersonalisation (DP) is characterised by a negative, cynical, and detached response to the people including colleagues and supervisors. A feeling of reduced personal accomplishment (PA) occurs when a person feels less competent regarding professional efficacy [1,2]. Until recently, occupational burnout syndrome was not listed as a legitimate syndrome in the widely accepted classification systems. However, in 2019 burnout was officially included in the ICD-11 as an occupational phenomenon but not as a medical condition [1].

Burnout in the healthcare sector has drawn significant scientific attention over recent years. Most of this research focused on medical professionals or residents. Up to 50% of medical professionals might suffer from burnout [3,4]. However, recent research underscored the large burden of profession-related burnout among medical students [5]. Medical students endure stress due to numerous reasons including the strenuous nature of the medical training program, a requirement to absorb a great deal of information over short periods of time, interaction with death and disease, difficult career choices and financial burdens. These academic, existential and psychological stressors may cause students to experience deteriorating mental health during the course of their studies [6].

Burnout among medical students has many implications due to its association with absenteeism, low morale and dissatisfaction [7]. Burnout may also be associated with adverse outcomes at an individual level including poor decision making, hostility to patients, medical errors, poor relationships with colleagues, depression, anxiety and fatigue, sleep disturbances, alcoholism, drug misuse, and suicidal ideation [8].

The primary aim of this cross-sectional study was to estimate the burnout prevalence among all medical students at the Medical School of the University of Cyprus. Secondary aims included to ascertain the predictors of burnout and its relationship with lifestyle habits, sleep quality and mental health.

Methods

Participants

The Medical School Undergraduate Program runs for 6 years (three preclinical and three clinical years). In total 189 students are currently enrolled, all of which were invited to take part in this study.

An anonymous questionnaire was distributed in the form of a hard copy by members of the research team to all eligible candidates during the last week of January 2020 during scheduled classes by the research team members. Students were asked to return the completed questionnaires in a sealed envelope which they placed in a non-transparent empty box, in order to

ensure the anonymity of the questionnaire. All candidates were reminded to complete the questionnaire one week after the initial distribution.

Participation in the study was voluntary. All participants provided written informed consent. There was no interference in the study by anyone outside the team of researchers. Therefore, no pressure was applied by clinical or educational supervisors nor anyone else to either take part or decline to participate in the study. The study was approved by the Cyprus National Bioethics Committee (reference number 2019.01.205).

Assessments

Demographic characteristics included age, sex and marital status. *Academic characteristics* included year of studies, academic performance evaluated by the final grade during the previous academic year (applicable to years 2–6) and choice of future medical specialty. *General health characteristics* included smoking status, weekly alcohol unit consumption, weekly physical exercise per week, self-reported weight and height. Body mass index (BMI) was then calculated, and students were categorized as “underweight” (BMI < 18.5), “normal” (BMI 18.5 to 25), “overweight” (BMI 25 to 30) or “obese” (BMI > 30).

Mental health (MH) was evaluated by the MH domain of the 36-item Short Form Health Survey (SF-36) [9]. Students answered the five MH-related items concerning their emotional well-being during the last four weeks in a 6-point Likert-type scale, ranging from 1 (all of the time) to 6 (never). Two of those items (e.g., “Have you been a happy person?”) were reverse-scored to ensure that a higher item value indicated better MH. Then scores were transformed into a 0 to 100-point scale as follows; 1 = 100, 2 = 80, 3 = 60, 4 = 40, 5 = 20 and 6 = 0. The sum was divided by 5 (averaged). Higher scores denoted better MH. The instrument showed good reliability in this study (Cronbach’s alpha = 0.86).

Quality of Sleep (QoS). The quality of sleep during the last 30 days was measured by the Pittsburg Sleep Quality Index (PSQI) [10]. The PSQI consists of 19 self-reference questions measuring seven domains; subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication and daytime dysfunction. Scoring for each component ranges from 0 to 3 and the global score ranges from 0 (indicating high quality of sleep) to 21 (indicating low quality of sleep). A cut-off of 5 or greater is used to identify overall poor sleep quality [11]. The reliability of the instrument in this study was found to be acceptable (Cronbach’s alpha = 0.68).

Burnout. The Maslach Burnout Inventory–Student Survey (MBI-SS) was used to evaluate burnout among medical students [7]. This is a 16-item tool, with each item being rated on a 7-point Likert-type scale, ranging from 0 (never) to 6 (everyday). These items produce three subscales: exhaustion (EX), cynicism (CY) and efficacy (EF). As suggested by Schutte et al., one particular CY item (“When I’m in class or I’m studying I don’t want to be bothered”) was removed [12]. The construct and concurrent (i.e. criterion-related) validity and the reliability this instrument were verified (see S1–S5 Tables). The instrument showed good to excellent reliability for this study (Cronbach’s alpha: EX = 0.90, CY = 0.87, EF = 0.80).

Burnout was defined as having EX score higher than the 75th percentile (21 for this study) and in addition to either a CY score higher than the 75th percentile (5 for this study) or EF lower than the 25th percentile (22 for this study), as has been previously suggested [13].

Statistical analysis

Descriptive statistics of the study sample included absolute and relative (%) frequencies, means, standard deviations, medians, interquartile ranges and ranges. Statistical comparisons were performed between students with and without burnout. Categorical variables were

compared using the chi-square test (with Yates correction for 2x2 tables). Continuous variables were not normally distributed and sample sizes of the burnout groups were unequal, therefore they were assessed using the Mann-Whitney U test. Further comparisons for students' groups by the academic year in the medical school were also performed. Level of significance was set at 0.05. The data were analyzed with SPSS v22.0 for Windows (Armonk, NY: IBM Corp).

Results

Description of the study sample

Of the 189 students, 182 participated to the study giving a response rate of 96.3%. Of those who gave a response, 121 (66.5%) were females. Our study population had a mean age of 21.8 ± 3.3 . The full characteristics of our study population are summarized in [S6 Table](#). The majority of the students (73.6%) were ascertained to have poor sleep quality.

Burnout prevalence among medical students

The burnout prevalence among medical students was found to be 18.1% (*having EX score higher than 21 and either CY score higher than 5 or EF lower than 22*). The burnout prevalences among medical students in each academic year are summarized in [Table 1](#). Ninety three participants (51.1%) had abnormal scores in at least one MBI dimension, 43 (23.6%) in at least two MBI dimensions and 13 (7.1%) in all MBI dimensions.

Academic year of study had a significant effect on burnout frequency. Specifically, there were significantly less students with burnout during the 1st academic year and more students with burnout during the 4th year of education ($p = 0.004$).

Moreover, a significant linear effect was found [$F(1) = 5.09$, $p = 0.024$], implying that with increasing academic year there were more students with burnout. This effect was found particularly after the 4th year of education which marks the beginning of clinical study. Looking into the three dimensions separately, EX and CY symptoms also significantly increased with higher academic years, but no significant effects upon EF were found ([S7 Table](#)).

Burnout associations

[Table 2](#) presents the univariate associations of burnout among medical students. There were more students with burnout during the clinical years (4th to 6th) than during the non-clinical years of education (1st to 3rd) [27.1% vs. 10.3%, OR 3.23, 95%CI: 1.44–7.26, $F(1) = 7.471$, $p = 0.006^*$]. Moreover, students with burnout had worse mental health ($U = 1002$, $z = 5.33$, $p < 0.001$) and were more likely to have poor sleep quality than students with no burnout [90.9% vs. 60.8%, OR 4.33, 95%CI: 1.26–14.9, $F(1) = 5.161$, $p = 0.023^*$]. No significant effect of sex, age, marital status, academic performance, decision on specialty, exercise, smoking, alcohol or BMI were found in relation to burnout ([S8](#) and [S9 Tables](#)).

Alcohol consumers, however, had more symptoms of CY and less feelings of EF than non-alcohol consumers ([S10 Table](#)). Moreover, reduced feelings of EF were significantly associated with higher levels of alcohol consumption among those who alcohol ([S11 Table](#)).

Discussion

This study investigated the burnout prevalence among medical students at the University of Cyprus and explored its predictors.

We found that almost one in five study participants is “burned-out”. In the literature, burnout prevalence rates of up to 75.2% have been reported in the medical students [[14,15](#)].

Table 1. Burnout prevalence (n/N, %) among medical students in different academic years (N = 182).

	Total	1 st	2 nd	3 rd	4 th	5 th	6 th	Significance ¹
Students with Burnout	33/182 (18.1)	1/27 (3.7)	6/33 (18.2)	3/37 (8.1)	11/27 (40.7)	4/29 (13.8)	8/29 (27.6)	p = 0.004
Students without Burnout	149/182 (81.9)	26/27 (96.3)	27/33 (81.8)	34/37 (91.9)	16/27 (59.3)	25/29 (86.2)	21/29 (72.4)	

¹Chi-square exact test.

Bold signify those frequencies lower or higher than the expected based on the adjusted standardized residuals (using the ± 1.96 cut-off).

<https://doi.org/10.1371/journal.pone.0241335.t001>

However, there is an enormous level of heterogeneity in international reporting of prevalence rates of burnout in medical students because the tools used to measure burnout differ and also because the exact definition utilised differs even when using the same instrument. In addition, discrepancies with other studies may be accounted for by differences in curricula, means of medical education, available facilities, cross-cultural characteristics and other factors.

We found that year of medical education was the only significant predictor of burnout, which increased towards the end of studies. This is in keeping with most cross-sectional studies [6,16–22]. It is possible that this effect is related to the impact of exposure to real clinical settings and interaction with patients during these years. In contrast to these findings, Dos Santos Boni et al. showed that the prevalence of burnout was higher in the first year of medical school than the other years [23], a finding that was attributed to high levels of stress prior to the entry exams [23].

In our study population, demographics were not found to have any statistically significant effect on the prevalence of burnout. This is in contrast with other studies, which found that females are affected by EX to a greater extent than men [15,24–28].

Even though alcohol consumption was not significantly associated with burnout in our study, alcohol consumers had higher scores in the CY and lower scores in the EF dimensions of the MBI-SS compared to non-alcohol consumers. Also, less feelings of EF were significantly associated with more alcohol consumption amongst those who consume alcohol. A possible explanation for this is that alcohol consumption might act as a coping strategy, as is indicated by other studies [29–31]. Physical exercise is another coping strategy, which has been reported to reduce the probability of burnout [29,32]. However, in our study population this was not confirmed.

Burnout has a significant impact in students' behaviors. Our finding that students with burnout have overall worse mental health is in keeping with what has been previously been reported. Fitzpatrick et al. showed that burnout is a significant risk factor for the development of depression in medical students and that higher levels of burnout are associated with less

Table 2. Burnout significant associations in medical students.

	Students with Burnout (N = 33)	Students without Burnout (N = 149)	Significance Tests ¹
Academic Period			F(1) = 7.471, p = 0.006*
Non-Clinical (1 st -3 rd year)	10/33 (30.3)	87/149 (58.4)	
Clinical (4 th -6 th year)	23/33 (69.7)	62/149 (41.6)	
Mental Health score	40.2 ± 17.7	62.9 ± 20.3	U = 1002, z = 5.33, p < 0.001*
Sleep Quality score	8.6 ± 3.5	6.1 ± 2.9	U = 1452.5, z = 3.67 p < 0.001*
Poor Sleep Quality	30/33 (90.9)	104/149 (69.8)	F(1) = 5.161, p = 0.023*

¹Chi-square tests (Yates correction for 2x2 tables) for categorical data, Mann-Whitney U test for numerical data.

*p < 0.05.

<https://doi.org/10.1371/journal.pone.0241335.t002>

help-seeking behavior for their mental health problems [17]. Furthermore, it has been shown that medical students with higher burnout risk have decreased engagement with studying and are more likely to engage in unprofessional behaviors [33,34].

In this study the quality of sleep during the last 30 days was measured via the PSQI. The majority of our study population (73.6%) had poor sleep quality. As was shown in other studies [31,35] students with burnout were more likely to have poor sleep quality compared to non-burned out students. A possible explanation is that poor sleep quality reflects the mental distress of students with burnout [36].

Limitations

Our study findings should be interpreted with caution due to some limitations. Firstly, the cross-sectional nature of this study does not permit etiological inferences. Secondly, we used self-reporting questionnaires to assess MH and sleep which asked questions relating to a period of weeks prior to participation. Such questionnaires carry a risk of recall bias, which should be acknowledged. Additionally, the questionnaires captured a period of four weeks before the last week of January which means that one week of the holidays was included. The fact that different sleep patterns are seen during a holiday and a non-holiday period might account for the questionable reliability of the PSQI instrument. On the other hand, burnout and MH are more complicated characteristics resulting from a constellation of environmental and personal factors, thus they would be less affected by the holiday effect described above. Longitudinal data would further validate our findings by eliminating the confounding factors of period of assessments, personality characteristics and other residual confounding in general. Finally, although our response rate was excellent the absolute sample size is relatively small.

Directions for the future

Studies in qualified doctors have shown that burnout ranges from 18 to 82% [37,38] which has a significant effect on overall mental health and work engagement [39,40]. Furthermore, burnout may lead to medical negligence and malpractice litigation, as well as suboptimal patient care practices and attitudes [38,41]. Residency programme directors are likely to inherit medical school graduates with a substantial burden of burnout symptoms [42]. Therefore, prevention strategies of burnout are needed at all levels, from medical students to specialists. A consistent finding across burnout studies in medical students is that it occurs during the clinical years. Program directors at medical schools should offer psychological support and services to students with burnout the medical education years.

Conclusion

In conclusion, burnout is prevalent among medical students especially during the clinical years of education. Furthermore, we showed that burnout affects sleep and overall mental health as well as it is linked to maladaptive coping behaviors such as increased alcohol consumption. Prevention strategies of burnout are needed during medical studies.

Supporting information

S1 Table. Rotated factor loadings of the principal component analysis (PCA) for the 15 items of the Maslach Burnout Inventory–Student Survey (MBI-SS).

(DOCX)

S2 Table. Descriptive measures of the MBI-SS subscale scores.

(DOCX)

S3 Table. Cronbach's alphas if items deleted for each MBI-SS subscale.
(DOCX)

S4 Table. Correlations between MBI-SS subscales (Pearson's rho).
(DOCX)

S5 Table. Correlations between MBI-SS subscales and academic performance, mental health and sleep quality (Pearson's rho).
(DOCX)

S6 Table. Study population's characteristics.
(DOCX)

S7 Table. MBI-SS subscale scores among academic years in the medical school.
(DOCX)

S8 Table. Non-significant burn-out associations in medical students.
(DOCX)

S9 Table. Gender differences for MBI-SS subscale scores.
(DOCX)

S10 Table. MBI-SS subscale scores and smoking, alcohol consumption and regular exercise status.
(DOCX)

S11 Table. Correlations between MBI-SS subscales and alcohol consumption units, total exercise per week in minutes and BMI (Pearson's rho).
(DOCX)

S1 Data.
(SAV)

Acknowledgments

We are sincerely thankful to all medical students that participated to this study. We are thankful to Professor Georgios Hadjigeorgiou for his valuable help in the study design and the critical revision of the manuscript. We are also thankful to Dr Thomas Julian for linguistically checking the manuscript.

Author Contributions

Conceptualization: Panagiotis Bargiotas, Panagiotis Zis.

Data curation: Antonios Nteveros, Marios Kyprianou, Artemios Artemiadis, Antrianthi Charalampous, Kallistheni Christoforaki, Stephanos Cheilidis, Orestis Germanos, Panagiotis Zis.

Formal analysis: Artemios Artemiadis, Panagiotis Zis.

Investigation: Panagiotis Bargiotas, Andreas Chatzittofis, Panagiotis Zis.

Methodology: Artemios Artemiadis, Panagiotis Zis.

Project administration: Panagiotis Zis.

Supervision: Panagiotis Zis.

Writing – original draft: Panagiotis Zis.

Writing – review & editing: Antonios Nteveros, Marios Kyprianou, Artemios Artemiadis, Antrianthi Charalampous, Kallistheni Christoforaki, Stephanos Cheilidis, Orestis Germanos, Panagiotis Bargiotas, Andreas Chatzittofis.

References

1. World Health Organisation [internet]. c2019-2020 [cited 2020 May 1]. Burn-out an "occupational phenomenon": International Classification of Diseases; Available from: https://www.who.int/mental_health/evidence/burn-out/en/.
2. Maslach C, Jackson SE, Leiter MP. Maslach Burnout Inventory Manual. Consulting Psychologists Press 3rd edition. 1996.
3. Shanafelt T, Boone S, Tan L, Dyrbye LN, Sotile W, Satele D, et al. Burnout and satisfaction with work–life balance among U.S. physicians relative to the general U.S. population. *Arch Intern Med*. 2012; 172(18): 1–9.
4. Ripp J, Babyatsky M, Fallar R, Bazari H, Bellini L, Kapadia C, et al. The incidence and predictors of job burnout in first-year internal medicine residents: a five-institutions study. *Acad Med*. 2011 Oct; 86(10): 1304–1310. <https://doi.org/10.1097/ACM.0b013e31822c1236> PMID: 21869661
5. Backović DV, Živojinović JI, Maksimović J, Maksimović M. Gender differences in academic stress and burnout among medical students in final years of education. *Psychiatr Danub*. 2012; 24(2): 175–181. PMID: 22706416
6. Dyrbye LN, Thomas MR, Huntington JL, Lawson KL, Novotny PJ, Sloan JA, et al. Personal life events and medical student burnout: a multicenter study. *AcadMed*. 2006; 81(4): 374–384. <https://doi.org/10.1097/00001888-200604000-00010> PMID: 16565189
7. Schaufeli WB, Martinez IM, Pinto AM, Salanova M, Bakker AB. Burnout and engagement in university students: a cross-national study. *J Cross-Cult Psychol*. 2002; 33: 464–481.
8. Kumar S. Burnout and Doctors: Prevalence, Prevention and Intervention. *Healthcare (Basel)*. 2016; 4(3): 37–46. <https://doi.org/10.3390/healthcare4030037> PMID: 27417625
9. Hays RD, Sherbourne CD, Mazel RM. The rand 36-item health survey 1.0. *Health econ*. 1993 Oct; 2(3): 217–227. <https://doi.org/10.1002/hec.4730020305> PMID: 8275167
10. Buysse DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry res*. 1989 May 1; 28(2): 193–213. [https://doi.org/10.1016/0165-1781\(89\)90047-4](https://doi.org/10.1016/0165-1781(89)90047-4) PMID: 2748771
11. Grandner MA, Kripke DF, Yoon IY, Youngstedt SD. Criterion validity of the Pittsburgh Sleep Quality Index: Investigation in a non-clinical sample. *Sleep Biol Rhythms*. 2006 Jun 1; 4(2): 129–139. <https://doi.org/10.1111/j.1479-8425.2006.00207.x> PMID: 22822303
12. Schutte N, Toppinen S, Kalimo R, Schaufeli W. The factorial validity of the Maslach Burnout Inventory-General Survey (MBI-GS) across occupational groups and nations. *J Occup Organ Psychol*. 2000 Mar; 73(1): 53–66.
13. Zis P, Artemiadis AK, Lykouri M, Xirou S, Roussopoulou A, Papageorgiou E, et al. Residency training: determinants of burnout of neurology trainees in Attica, Greece. *Neurology*. 2015 Sep 15; 85(11):e81–4. <https://doi.org/10.1212/WNL.0000000000001924> PMID: 26370193
14. Dyrbye L, Shanafelt T. A narrative review on burnout experienced by medical students and residents. *Med Educ*. 2016; 50(1): 132–149. <https://doi.org/10.1111/medu.12927> PMID: 26695473
15. Erschens R, Keifenheim KE, Herrmann-Werner A, Loda T, Schwille-Kiuntke J, Bugaj TJ, et al. Professional burnout among medical students: systematic literature review and meta-analysis. *Med Teach*. 2019 Feb 1; 41(2):172–183. <https://doi.org/10.1080/0142159X.2018.1457213> PMID: 29656675
16. Paro HBMS, Silveira PSP, Perotta B, Gannam S, Enns SC, Giaxa RRB, et al. Empathy among medical students: Is there a relation with quality of life and burnout? *PLoS One*. 2014; 9(4):e94133. <https://doi.org/10.1371/journal.pone.0094133> PMID: 24705887
17. Fitzpatrick O, Biesma R, Conroy RM, McGarvey A. Prevalence and relationship between burnout and depression in our future doctors: A cross-sectional study in a cohort of preclinical and clinical medical students in Ireland. *BMJ Open*. 2019; 9(4):e023297. <https://doi.org/10.1136/bmjopen-2018-023297> PMID: 31048421
18. Santen SA, Holt DB, Kemp JD, Hemphill RR. Burnout in medical students: Examining the prevalence and associated factors. *South Med J*. 2010; 103(8): 758–763. <https://doi.org/10.1097/SMJ.0b013e3181e6d6d4> PMID: 20622724

19. Voltmer E, Rosta J, Aasland OG, Spahn C. Study-related health and behavior patterns of medical students: a longitudinal study. *Med Teach*. 2010; 32(10):e422–8. <https://doi.org/10.3109/0142159X.2010.496008> PMID: 20854148
20. Chang E, Eddins-Folensbee F, Coverdale J. Survey of the prevalence of burnout, stress, depression, and the use of supports by medical students at one school. *Acad Psychiatry*. 2012; 36: 177–182. <https://doi.org/10.1176/appi.ap.11040079> PMID: 22751817
21. Cecil J, McHale C, Hart J, Laidlaw A. Behaviour and burnout in medical students. *Med Educ Online*. 2014; 19: 25209. <https://doi.org/10.3402/meo.v19.25209> PMID: 25160716
22. Scholz M, Neumann C, Steinmann C, Hammer CM, Schroder A, Essel N, et al. Development and correlation of work-related behavior and experience patterns, burnout and quality of life in medical students from their freshman year to the first state examination. *Psychother Psychosom Med Psychol*. 2015; 65 (3–4): 93–98. <https://doi.org/10.1055/s-0034-1375630> PMID: 25029252
23. Dos Santos Boni RA, Paiva CE, De Oliveira MA, Lucchetti G, Fregnani JHTG, Paiva BSR. Burnout among medical students during the first years of undergraduate school: Prevalence and associated factors. *PLoS One*. 2018; 13(3): 1–15.
24. Gyorfy Z, Birkás E, Sándor I. Career motivation and burnout among medical students in Hungary—Could altruism be a protection factor? *BMC Med Educ*. 2016; 16(1): 15–18. <https://doi.org/10.1186/s12909-016-0690-5> PMID: 27430960
25. Fares J, Saadeddin Z, Al Tabosh H, Aridi H, El Mouhayyar C, Koleilat MK, et al. Extracurricular activities associated with stress and burnout in preclinical medical students. *J Epidemiol Glob Health*. 2016; 6(3): 177–85. <https://doi.org/10.1016/j.jegh.2015.10.003> PMID: 26644345
26. Worly B, Verbeck N, Walker C, Clinchot DM. Burnout, perceived stress, and empathic concern: differences in female and male Millennial medical students. *Psychol Health Med*. 2019 Apr 21; 24(4): 429–438. <https://doi.org/10.1080/13548506.2018.1529329> PMID: 30295048
27. Popa-Velea O, Diaconescu L, Mihăilescu A, Popescu MJ, Macarie G. Burnout and its relationships with alexithymia, stress, and social support among romanian medical students: A cross-sectional study. *Int J Environ Res Public Health*. 2017; 14(6): 21–23.
28. Pagnin D, De Queiroz V, Oliveira Filho MA De, Gonzalez NVA, Salgado AET, Oliveira BCE, et al. Burnout and career choice motivation in medical students. *Med Teach*. 2013; 35(5): 388–94. <https://doi.org/10.3109/0142159X.2013.769673> PMID: 23458255
29. Erschens R, Loda T, Herrmann-Werner A, Keifenheim KE, Stuber F, Nikendei C, et al. Behaviour-based functional and dysfunctional strategies of medical students to cope with burnout. *Med Educ Online*. 2018 Jan 1; 23(1):1535738. <https://doi.org/10.1080/10872981.2018.1535738> PMID: 30371222
30. Prinz P, Hertrich K, Hirschfelder U, de Zwaan M. Burnout, depression and depersonalisation—psychological factors and coping strategies in dental and medical students. *GMS Z Med Ausbild*. 2012; 29(1): 1–14.
31. Jackson ER, Shanafelt TD, Hasan O, Satele DV, Dyrbye LN. Burnout and alcohol abuse/dependence among U.S. Medical Students. *Acad Med*. 2016; 91(9): 1251–1256. <https://doi.org/10.1097/ACM.0000000000001138> PMID: 26934693
32. Wolf MR, Rosenstock JB. Inadequate sleep and exercise associated with burnout and depression among medical students. *Acad Psychiatry*. 2017 Apr 1; 41(2): 174–179. <https://doi.org/10.1007/s40596-016-0526-y> PMID: 26976402
33. Liu H, Yansane AI, Zhang Y, Fu H, Hong N, Kalenderian E. Burnout and study engagement among medical students at Sun Yat-sen University, China. *Medicine (Baltimore)*. 2018; 97(15):e0326. <https://doi.org/10.1097/MD.00000000000010326> PMID: 29642167
34. Dyrbye LN, Massie FS Jr, Eacker A, Harper W, Power D, Durning SJ, et al. Relationship between burnout and professional conduct and attitudes among US medical students. *JAMA*. 2010; 304(11): 1173–1180. <https://doi.org/10.1001/jama.2010.1318> PMID: 20841530
35. Pagnin D, De Queiroz V, Carvalho YTMS, Dutra ASS, Amaral MB, Queiroz TT. The relation between burnout and sleep disorders in medical students. *Acad Psychiatry*. 2014; 38(4): 438–444. <https://doi.org/10.1007/s40596-014-0093-z> PMID: 24683060
36. Boehm MA, Lei QM, Lloyd RM, et al. Depression, anxiety, and tobacco use: overlapping impediments to sleep in a national sample of college students. *J Am Coll Health* 2016; 64: 565–574. <https://doi.org/10.1080/07448481.2016.1205073> PMID: 27347758
37. Prins JT, Gazendam-Donofrio SM, Tubben BJ, van derHeijden FM, vandeWiel HBM, Hoekstra-Weebers JE. Burnout in medical residents: a review. *Med Educ* 2007; 41(8): 788–800. <https://doi.org/10.1111/j.1365-2923.2007.02797.x> PMID: 17661887

38. Zis P, Anagnostopoulos F, Sykioti P. Burnout in Medical Residents: A Study Based on the Job Demands-Resources Model. *ScientificWorldJournal*. 2014; 2014: 1–10. <https://doi.org/10.1155/2014/673279> PMID: 25531003
39. Anagnostopoulos F, Demerouti E, Sykioti P, Niakas D, Zis P. Factors associated with mental health status of medical residents: a model-guided study. *J Clin Psychol Med Settings*. 2015 Mar 1; 22(1): 90–109. <https://doi.org/10.1007/s10880-014-9415-2> PMID: 25554496
40. Zis P, Anagnostopoulos F, Artemiadis AK. Residency Training: Work engagement during neurology training. *Neurology*. 2016 Aug 2; 87(5):e45–8. <https://doi.org/10.1212/WNL.0000000000002911> PMID: 27481462
41. Anagnostopoulos F, Liolios E, Persefonis G, Slater J, Kafetsios K, Niakas D. Physician burnout and patient satisfaction with consultation in primary health care settings: evidence of relationships from a one-with-many design. *J Clin Psychol Med Settings*. 2012; 19(4): 401–410. <https://doi.org/10.1007/s10880-011-9278-8> PMID: 22327237
42. Dyrbye LN, Moutier C, Durning SJ, Massie FS Jr, Power DV, Eacker A, et al. The problems program directors inherit: medical student distress at the time of graduation. *Med Teach* 2011; 33: 756–8. <https://doi.org/10.3109/0142159X.2011.577468> PMID: 21854153