Research Article

Relationship of Mental Health and Burnout with Empathy Among Undergraduate Medical Students in Lahore, Pakistan: A Cross-Sectional Study

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Abstract

Background: Empathy, crucial for effective communication and patient care in medicine can be influenced by stress, workload, burnout, and impaired mental well-being.

Objectives: To evaluate the burnout levels, mental health status, and factors influencing empathy among undergraduate medical students at King Edward Medical University in Lahore.

Methods: A descriptive cross-sectional study was conducted among MBBS students from the third to final year at King Edward Medical University, Lahore, with ethical approval granted by the Institutional Review Board. Four questionnaires were used: a personal and demographic survey, the Warwick-Edinburgh Mental Well-being Scale (WEMWBS), the Maslach Burnout Inventory (MBI), and the Toronto Empathy Questionnaire (TEQ). Data analysis involved assessing several factors influencing empathy using the Chi-square test or Fisher's exact test.

Results: The study evaluated 164 Muslim participants (mean age: 21.77 years; SD = 1.10), of whom 45.1% were male and 54.9% female. Physical illness was reported by 4.9% and psychiatric conditions by 6.7%. No significant association was found between socio-demographic factors (gender, illness, substance use, academic year, and specialty preference) and empathy. Empathy was not significantly related to mental health (WEMWBS) or burnout (MBI). Most participants (96.3%) demonstrated below-average empathy, with a median TEQ score of 31 (IQR: 28–35).

Conclusion: Most participants exhibited below-average empathy, high depersonalization, and low personal achievement. Despite these findings, mental health was generally good, and exhaustion levels were low. No significant association was found between empathy and other factors.

Keywords | Empathy, Mental health, Burnout

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Introduction

Empathy, the capacity to comprehend and connect with others' emotions, is fundamental to effective communication and patient care in the medical field.[1] It encompasses both cognitive and emotional components, allowing healthcare providers to comprehend and mirror the emotional states of their patients.[(2)] This empathetic connection has been linked to positive health impact, including decreased severity and duration of the common cold, improved management of chronic conditions, and reduced post-traumatic stress disorder (PTSD) symptoms following life-threatening medical emergencies.[3–5] However, empathy is not a static trait; it can be influenced by various factors, particularly stress, burnout, and mental health challenges, which are prevalent in the demanding environment of medical education.[6,7]

Burnout, a psychological syndrome resulting from chronic stress, is marked by emotional exhaustion, depersonalization, and a diminished sense of personal accomplishment.[8,9] Initially associated with professions requiring constant, direct contact with people, burnout has become a significant

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issue among students, especially in high-stress environments like medical school.[10] Factors contributing to student burnout include academic demands, tight deadlines, the challenge of balancing academic and social life, and financial pressures.[11] These stressors can lead to skepticism toward education, feelings of incompetence, and a sense of inefficacy.[12]

On the other hand, mental health is the state of psychological and emotional well-being that influences how people think, feel, and act.[13] It plays a crucial role in how medical students cope with training pressures. Poor mental health exacerbates burnout, leading to emotional detachment from patients and diminished empathetic care.[14] Studies indicate that nearly 50% of medical students experience burnout, adversely affecting academic performance, clinical skills, and overall well-being.[15] Therefore, both burnout and impaired mental health can have severe repercussions, including increased risk of depression, anxiety and suicidal ideation, jeopardizing their overall well-being.

Understanding the interplay between empathy, burnout, and mental health is essential for shaping the future of medical education and ensuring the well-being of both medical students and their future patients. Organizations like the World Federation of Medical Education (WFME) and the World Health Organization (WHO) stress the importance of integrating empathy training into medical curricula.[16] While empathy enhances physicians' diagnostic accuracy and patient compliance, the emotional demands of maintaining empathetic relationships may heighten the risk of burnout.[17]

While extensive research has assessed empathy levels among medical students, findings on how these levels correlate with burnout and mental health remain inconsistent and often context-specific.[18,19] For instance, research in Karachi, Pakistan, found that empathy was higher among female students and increased during clinical practice in later academic years compared to earlier years.[20] Despite these extensive research assessing empathy levels, there is a lack of studies analyzing the association of burnout and mental health with empathy among undergraduate medical students in Lahore, Pakistan, a critical gap, as this phase shapes the attitudes and behaviors crucial for future clinical interactions. Understanding these dynamics within Pakistani medical education is vital for promoting student well-being, enhancing patient care, and fostering professional development.

This study aims to assess burnout levels, evaluate mental health status, and explore their correlations with empathy among undergraduate medical students in Lahore, Pakistan. By uncovering these relationships, the study seeks to inform strategies for overcoming burnout, improving mental health and empathetic capacity of future healthcare professionals.

Methods

After ethical approval from the IRB (Institutional Review Board) committee of King Edward Medical University Lahore, Pakistan, this descriptive cross-sectional study was conducted on undergraduate medical students from the same university. The students from 3rd to final year of MBBS were targeted for the analysis. Inclusion criteria required participants to be aged 18–25 years, currently enrolled in the university, and willing to provide informed consent. Only students who completed the entire questionnaire were included. Exclusion criteria included students not currently enrolled, those who transferred or were on extended leave, and individuals who did not provide informed consent or withdrew during the study. Students with incomplete or invalid questionnaire responses were also excluded. The sample size of 164 medical students was decided, using a 95% confidence level, 7% absolute precision with an expected percentage response rate of 70.3% as indicated in our reference study.[21]

The data were collected using online questionnaire-based proformas created through Google Forms. These were shared online via social media platforms with eligible students only, meeting the criteria, following non-probability, convenience sampling method. To ensure strict confidentiality, the responses were kept anonymous, and personal identifiers such as names and signatures of participants were not required. They were informed of their right to withdraw from the study at any time, indicating their participation was entirely on a voluntary basis.

For the data analysis, mean, standard deviation (SD), median and interquartile range (IQR) were calculated for quantitative variables whereas frequencies and percentages were calculated for qualitative variables. The Chi-square test (or Fisher's exact test) was used to identify associations between socio-demographic characteristics, mental health, and burnout with the level of empathy. Statistical analysis was performed utilizing IBM SPSS (Statistical Package for the Social Sciences) software, v23. The p-values which were less than 0.05 were considered to be statistically significant values.

The following four questionnaires are used in this study.

The socio-demographic and personal details questionnaire, including questions about age, gender, academic year, religious affiliation, physical or psychiatric disease, alcohol consumption, substance usage and specialty interests.

The Warwick Edinburgh Mental Well-being Scale (WEMWBS) is a standardized questionnaire, consisting of 14 items. The score of each question ranges from 1-5; none of the time (1), rarely (2), some of the time (3), often (4) and all the time (5) and the total scores range from 14 to 70, with greater

scores implying better mental well-being. The scores of 41-44 indicate mild or possible depression and the scores which are below 41 suggest probable clinical depression. The Cronbach's alpha value of WEMWBS is 0.890.[22]

The Burnout Self-Test, Maslach Burnout Inventory (MBI) questionnaire comprises of three subscales which are exhaustion subscale, depersonalization subscale and personal achievement subscale. Exhaustion subscale ranges from 0 (never) to 6 (every day), with Cronbach's alpha coefficient value of 0.819, and for this subscale higher mean scores indicate higher degrees of burnout (exhaustion subscale scores: 17 or less=low, 18-29=moderate, above 30= high). Depersonalization subscale ranges from 0 (never) to 6 (every day), with Cronbach's alpha coefficient value of 0.850, and higher means indicating greater burnout for this subscale as well (depersonalization subscale scores: 5 or less = low, 6-11 = moderate, above 12 = high). Lastly, the personal achievement subscale ranges from 0 (never) to 6 (every day), with Cronbach's alpha coefficient value of 0.785 and for this subscale lower mean scores correspond to greater levels of burnout (personal achievement subscale scores: above 40 = low, 34–39 = moderate, 33 or less = high). The Cronbach's alpha value for MBI is between 0.761.[23]

The Toronto Empathy Questionnaire (TEQ) is a 16 item self-report measure, employing a 5-point likert scale rating for each question. The scale ranges from 0 to 4 with each value indicating as; 0 (never); 1 (rarely); 2 (sometimes); 3 (often); and 4 (always). The scores range from 0 to 64 after summing responses for each of the 16 questions. Empathy scores above 45 suggest higher empathy levels whereas scores below 45 indicate lower empathy levels.[24] The Cronbach's alpha coefficient for this tool is 0.85.[25]

Results:

The study included 164 participants, all identifying as Muslim. They were distributed across three academic years: 34.1% (n=56) in the 3rd year, 42.7% (n=70) in the 4th year, and 23.2% (n=38) in the final year. Mean age was calculated to be 21.77 years with a standard deviation (SD) of 1.10 years. The gender distribution was relatively balanced, with 45.1% (n=74) males and 54.9% (n=90) females. The analysis revealed no significant differences in empathy levels based on gender (p = 0.411), physical illness (p = 1.000), psychiatric illness (p = 1.000), alcohol drinking (p=1.000), substance use (p = 1.000), specialty preference (p=0.778) or year of study (p=0.232) (Table 1).

The Warwick-Edinburgh Mental Well-being Scale (WEMWBS) assessed the association between mental health status and empathy. Among the participants, 26.8% (n=44) were identified with probable depression, 14% (n=23) had mild depression, and 59% (n=97) demonstrated good mental health (as shown in fig 1), with a median mental health score of 47 (IQR: 40-53). The Pearson Chi-Square test (p = 0.116) indicated no significant association between mental health and empathy (Table 2).

The Burnout Self-Test, Maslach Burnout Inventory (MBI) was utilized to analyze the association between three dimensions of burnout and empathy for 164 valid cases. The median

Table 1: *Descriptive statistics*

Variables	Number (%)
Gender	
Male	74 (45.1)
Female	90 (54.9)
Academic Year	
3rd year	56 (34.1)
4th year	70 (42.7)
Final year	38 (23.2)
Physical Illness	
No	156 (95.1)
Yes	8 (4.9)
Psychiatric Illness	
No	153 (93.3)
Yes	11 (6.7)
Alcohol Drinking	
No	163 (99.3)
Yes	1 (0.7)
Substance Use	
No	161 (98.2)
Yes	3 (1.8)
Specialty Preference	
General / Not Specified	111 (67.7)
Major	43 (26.2)
Minor	10 (6.1)
Burnout Exhaustion	
Low	70 (42.7)
Moderate	56 (34.1)
High	38 (23.2)
Depersonalization	
Low	32 (19.5)
Moderate	36 (21.9)
High	96 (58.5)
Personal Achievement	
Low	97 (59.1)
Moderate	28 (17.1)
High	39 (23.8)
Mental Health	
Probable Depression	44 (26.8)
Mild Depression	23 (14.0)
Good Mental Health	97 (59.1)
Empathy level	
Below average (<45)	158 (96.3)
Above average (>45)	6 (3.7)

exhaustion score was 19.5 with an IQR of 12-29, with majority of participants experiencing low exhaustion levels. Depersonalization had a median score of 13 with an IQR of 7-20.75, and majority demonstrating high levels of depersonalization. In terms of personal achievement, the median score was 31 and IQR was 22.5-39, and majority exhibited low personal achievement levels (as shown in fig 2). These findings illustrate the varied burnout experiences among the participants. The Pearson Chi-Square tests for the three domains of burnout revealed no significant associations with empathy. Specifically, emotional exhaustion (p=0.080), personal achievement (p = 0.506), and depersonalization (p = 0.110) each showed non-significant relationships with empathy (Table 2).

Using the Toronto Empathy Questionnaire, 96.3% (n=158) of participants had below-average empathy, while 3.7% (n=6) had above average empathy. The median empathy score was 31, with an interquartile range (IQR) of 28-35 (Table 2).

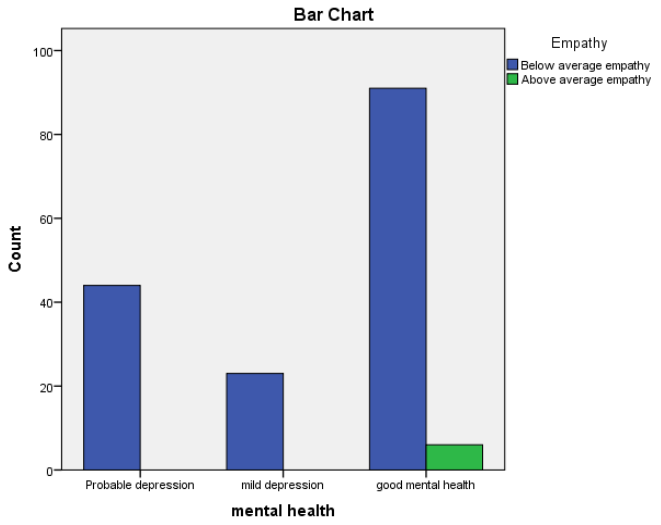

Figure 1: *Mental health rating according to WEMWBS (Warwick Edinburgh Mental Well-being Scale*

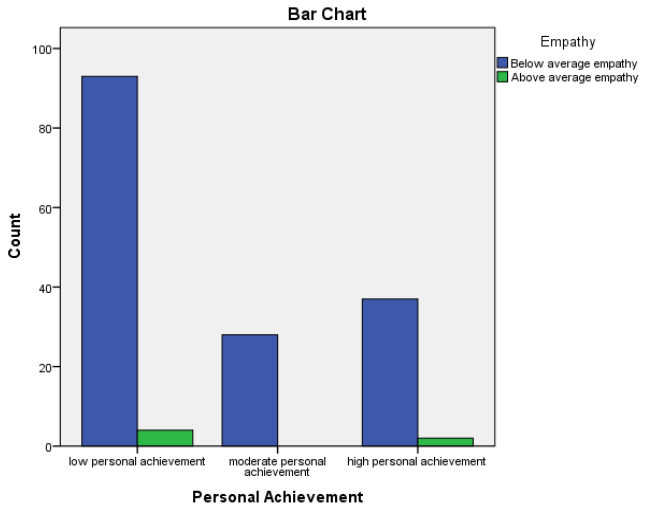

Figure 2: *Burnout domain in accordance with Burnout Self-Test Maslach Burnout Inventory (MBI)*

Table 2: *Bivariate analysis of factors associated with empathy levels among participants*

Variables	Level of Empathy Number (%)		
	Below average <45 (N = 158)	Above average ≥45(N=6)	P-value
Gender			
Male	70 (42.7)	4 (2.4)	0.411
Female	88 (53.7)	2 (1.2)	
Physical illness			
No	150 (91.4)	6 (3.7)	1.000
Yes	8 (4.9)	0	
Psychiatric illness			
No	147 (89.6)	6 (3.7)	1.000
Yes	11 (6.7)	0	
Alcohol Drinking			
No	157 (95.7)	6 (3.7)	1.000
Yes	1 (0.6)	0	
Substance Use			
No	155 (94.5)	6 (3.7)	1.000
Yes	3 (1.8)	0	
Specialty Preference			
General/Not Specified	107 (65.3)	4 (2.4)	0.778
Major	41 (25.0)	2 (1.2)	
Minor	10 (6.1)	0	
Academic year			
3rd year	54 (32.9)	2 (1.2)	0.232
4th year	69 (42.2)	1 (0.6)	
Final year	35 (21.3)	3 (1.8)	
Mental Health			
Probable depression	44 (26.8)	0	0.116
Mild depression	23 (14.0)	0	
Good mental health	91 (55.5)	6 (3.7)	
Burnout			
Exhaustion			
Low	70 (42.7)	0	0.080
Moderate	53 (32.4)	3 (1.8)	
High	35 (21.3)	3 (1.8)	
Depersonalization			
Low	32 (19.5)	0	0.110
Moderate	36 (21.9)	0	
High	90 (54.9)	6 (3.7)	
Personal Achievement			
Low	93 (56.7)	4 (2.4)	0.506
Moderate	28 (17.1)	0	
High	37 (22.6)	2 (1.2)	

Discussion

This study separately evaluated empathy levels, burnout,

and mental health status of 164 undergraduate medical students from King Edward Medical University, Lahore. The findings suggest that mental health status had no significant statistical relationship with empathy; however, burnout showed a marginal relationship. Students with high levels of burnout, especially those experiencing high depersonalization, often displayed below-average empathy. In addition to this, no significant relationships were observed between empathy and demographic characteristics such as gender, physical or mental disease, and substance use.

Evaluating the association between mental health and empathy, our research findings showed no statistically significant association ($p = 0.116$) between empathy levels and mental health, despite the fact that most of the students had reported below-average empathy. This finding contradicts other research that indicates a clear negative correlation between empathy and mental health issues, particularly depression. For instance, a study carried out in Thailand discovered a strong correlation between empathy and mental health.[21] Likewise, studies conducted on Spanish medical students revealed that those with high empathy levels had fewer symptoms of depression.[26] Cultural and personal differences or unique features of our study sample might be the cause of our discrete results compared to those of prior studies. Furthermore, the absence of a significant relationship in our study showed that empathy, being a cognitive construct, is influenced by a number of psychological and environmental factors beyond mental health alone.

The relationship between burnout and empathy appears to be more intricate. The Pearson Chi-Square test did not indicate a significant association ($p = 0.080$) between the two, which is in line with the results indicated by a previous study conducted in Thailand.[21] In contrast to the widely accepted inverse association between burnout and empathy, this suggests that students suffering higher degrees of burnout may nevertheless maintain or even increase their levels of empathy. However, the likelihood ratio test and linear-by-linear association provided evidence of a marginal relationship between burnout levels and empathy ($p = 0.029$ and 0.028, respectively). Research in the past has demonstrated a negative correlation between higher levels of burnout and lower empathy levels. For instance, Brazeu et al. conducted a study that discovered the association between burnout and lower levels of empathy. The authors of that study found that lower professionalism and empathy scores among medical students were linked to higher levels of burnout.[15] Likewise, a study by Wenzhi et al. reported that learning burnout was inversely correlated with medical students' empathy and this marginal correlation between burnout and empathy in our study may be due to increased personal resilience.[27] Perhaps some students are driven by innate motivation, a sense of duty to treat patients with empathy, or both, but they are nevertheless feeling burnout.

According to our research, students who experienced high levels of depersonalization-a crucial aspect of burnout-tended to have below-average empathy; the likelihood ratio test revealed a minor relationship between the two ($p = 0.037$). This result is consistent with recent research demonstrating the negative impact of depersonalization on empathy. For example, a study by Sathaporn and Pitanupong et al. suggests an inverse relationship between the two, indicating that empathy levels improved in correlation with female gender, improved mental health, and minimal depersonalization.[28] There is no meaningful concordance between empathy and personal achievement, as suggested by our study.

Demographic factors like gender, substance usage, psychiatric and physical illnesses, and empathy levels had no substantial correlation, according to our research. This is in line with some previous studies, but it differs from other studies that suggest gender and empathy are closely related.[29,30] Moreover, no correlation between empathy levels and specialty preference was discovered in our study ($p = 0.778$). This result contradicts with a prior study carried out at Saudi Arabia's Tabuk University that indicated that students who were female in the clinical phase and planning to choose people-oriented specializations over procedure-oriented specialties had the highest levels of empathy with the patients.[31]

Hence, our study's results show that burnout, particularly its depersonalization component, does seem to be somewhat correlated with medical students' levels of empathy, even though mental health and demographic factors may not have a significant relationship with empathy.

Key limitations and strengths of this study are highlighted here. Based on the current research, this is one of the initial studies that assessed the impact of mental health and burnout on empathy among undergraduate medical students in Lahore, Pakistan, addressing a significant gap in the literature. It employed validated tools like the Warwick-Edinburgh Mental Well-being Scale (WEMWBS), the Maslach Burnout Inventory (MBI), and the Toronto Empathy Questionnaire (TEQ). These tools are acknowledged for their validity and reliability, which ensures the credibility of our findings. In addition to this, our study includes undergraduate medical students across three academic years, offering a comprehensive understanding of how these variables might evolve during the course of medical education. However, this study had some limitations. While this study identifies correlations, its cross-sectional study design precludes causal explanations for the relationships between mental health, burnout, and empathy. This study had a small sample size and lacked heterogeneity.

It included only 164 participants, all from a single institution. This homogeneity limits the generalizability of our findings, as the results may not be representative of all medical students, especially those having diverse ethnic origins. The use of self-reported questionnaires may lead to bias, where respondents might underestimate negative behaviors or overestimate positive attributes, impacting the validity of the findings. Another drawback was that our study relies solely on quantitative data, which may neglect the nuances of students' experiences. A better knowledge of the variables affecting empathy could be obtained through qualitative analyses. Although a number of demographic factors were taken into account throughout the study, there may be other confounding factors (such as past clinical experience or personality traits) that were overlooked, which could influence the observed relationships.

Henceforward, studies are recommended to utilize a larger and more diverse sample, including students from different institutions, to increase the generalizability of the findings. Longitudinal studies should be implemented to explore causal relationships among the variables. Post-graduate medical students should be included to provide a broader view of how empathy evolves throughout medical training. Moreover, future studies should include other potentially influential variables like socioeconomic status, family support, and academic performance, which would offer a more comprehensive analysis of the factors affecting empathy.

Empathy is an essential component of patient care, so necessary interventions should be taken to preserve it and reduce burnout, such as mental health support, resilience building, and stress management training. In order to match students' empathy levels with their preferred specializations and improve the standard of patient care delivered by future healthcare professionals, empathy training and career counseling should also be incorporated into the medical curriculum.

Conclusion

Most of the medical students demonstrated below-average empathy levels, only a few reported above-average empathy levels. Although, majority of the participants exhibited high depersonalization and low personal achievement, they had good mental health and low exhaustion levels. There was no statistically significant relationship found between any of the factors and empathy levels. Since mostly demonstrated lower levels of empathy, to encourage higher levels of empathy among medical students, empathy training and career counseling should also be incorporated into the medical curriculum.

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Authors Contribution:

NU: Involved in conceptualization of study

SZB, TM, MK: Involved in data collection

TF, SM: Involved in manuscript writing

References

1. Contact Center Compliance. The power of empathy: fostering connection, understanding, and positive change [Internet]. 2022 [cited 2024 Aug 30]. Available from: https:// www.dnc.com/blog/power-empathy-fostering-connection-understanding-and-positive-change
2. de Waal FBM, Preston SD. Mammalian empathy: behavioural manifestations and neural basis. Nat Rev Neurosci. 2017;18(8):498–509.
3. Rakel D, Barrett B, Zhang Z, Hoeft T, Chewning B, Marchand L, et al. Perception of empathy in the therapeutic encounter: effects on the common cold. Patient Educ Couns. 2011; 85(3):390–7.
4. Etingen B, Miskevics S, LaVela SL. Assessing the associations of patient-reported perceptions of patient-centered care as supplemental measures of health care quality in VA. J Gen Intern Med. 2016;31(S1):10–20.
5. Moss J, Roberts MB, Shea L, Jones CW, Kilgannon H, Edmondson DE, et al. Healthcare provider compassion is associated with lower PTSD symptoms among patients with life-threatening medical emergencies: a prospective cohort study. Intensive Care Med. 2019;45(6):815–822.
6. Wahjudi JW, Findyartini A, Kaligis F. The relationship between empathy and stress: a cross-sectional study among undergraduate medical students. Korean J Med Educ. 2019;31(3):215–226.
7. Sulaiman R, Ismail S, Shraim M, El Hajj MS, Kane T, El-Awaisi A, et al. Experiences of burnout, anxiety, and empathy among health profession students in Qatar University during the COVID-19 pandemic: a cross-sectional study. BMC Psychol. 2023;11(1). 1-10
8. Ch M, Jackson SE, Leiter M. The Maslach Burnout Inventory Manual. In: Evaluating Stress: A Book of Resources. 3rd ed. 1997. p. 191–218. Available from: https://www.worldcat.org/title/evaluating-stress-a-book-of-resources/oclc/ 36568769.
9. Bridgeman PJ, Bridgeman MB, Barone J. Burnout syndrome among healthcare professionals. Am J Health Syst Pharm. 2018;75(3):147–152.
10. Atalayin C, Balkis M, Tezel H, Onal B, Kayrak G. The prevalence and consequences of burnout on a group of preclinical dental students. Eur J Dent. 2015;9(3):356–63.

11. 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(5): 464– 81.
12. Jacobs SR, Dodd D. Student burnout as a function of personality, social support, and workload. J Coll Stud Dev. 2003;44(3):291–303.
13. World Health Organization. WHO guidelines on mental health at work. Geneva: World Health Organization; 2022 Sep 28. Available from: https://www.who.int/ publications/ i/item/9789240053052.
14. Chiara P, Luca C, Annalisa P, Chiara R. Emotional exhaustion among healthcare professionals: the effects of role ambiguity, work engagement and professional commitment. Acta Biomed. 2019;90(Suppl 6):60–7.
15. Brazeau CMLR, Schroeder R, Rovi S, Boyd L. Relationships between medical student burnout, empathy, and professionalism climate. Acad Med. 2010;85(1):S33–6.
16. Shakurnia A, Maniati M, Barani M, Khajeali N. Changes in medical students' empathy level in different academic years: a trend analysis. Educ Med J. 2023; 15(4): 99– 108.
17. Decety J. The neurodevelopment of empathy in humans. Dev Neurosci. 2010;32(4):257–67.
18. Aye SZ, Sein HH, Nyunt MK, Min Y. Comparative study of Malaysian medical students' empathy scores between preclinical and clinical training. Educ Med J. 2022; 14(1): 27–38.
19. Wang Q, Wang L, Shi M, Li X, Liu R, Liu J, et al. Empathy, burnout, life satisfaction, correlations and associated sociodemographic factors among Chinese undergraduate medical students: an exploratory cross-sectional study. BMC Med Educ. 2019;19(1). 1-10
20. Naseem M, Tahir B, Salman A, Qadir S, Farhan R, Ali S, et al. Empathy levels among undergraduate medical students in Karachi, Pakistan: a cross-sectional study. Ann Med Surg (Lond). 2023;85(8):3858–62.
21. Pitanupong J, Sathaporn K, Ittasakul P, Karawekpanyawong N. Relationship of mental health and burnout with empathy among medical students in Thailand: a multicenter cross-sectional study. PLoS One. 2023;18(1):e0279564. 1-13
22. Fung S. Psychometric evaluation of the Warwick-Edinburgh Mental Well-being Scale (WEMWBS) with Chinese university students. Health Qual Life Outcomes. 2019; 17(1). 1-9
23. Amri A, Abidli Z, Bouzaaboul M, Rabea Z, Ahami AO, Soulaymani A, et al. Psychometric validation of the Maslach Burnout Inventory (MBI) adapted to Moroccan teachers. Med Leg Update. 2021;21(1):1–6.
24. Kato T. Frequently used coping scales: a meta-analysis. Soc Sci. 2017;6(2):62.
25. Spreng RN, McKinnon MC, Mar RA, Levine B. The Toronto Empathy Questionnaire: scale development and initial validation of a factor-analytic solution to multiple empathy measures. J Pers Assess. 2009;91(1):62–71.
26. Capdevila-Gaudens P, García-Abajo JM, Flores-Funes D, García-Barbero M, García-Estañ J. Depression, anxiety, burnout and empathy among Spanish medical students. PloS One. 2021;16(12). 1-16
27. Wu W, Ma X, Liu Y, Qi Q, Guo Z, Li S, et al. Empathy alleviates the learning burnout of medical college students through enhancing resilience. BMC Med Educ. 2022;22(1). 1-11
28. Sathaporn K, Pitanupong J. Factors associated with the improvement of empathy levels among clinical-year medical students in Southern Thailand: a university-based cross-sectional study. BMC Psychol. 2022;10(1). 1-10
29. Guilera T, Batalla I, Forné C, Soler-González J. Empathy and big five personality model in medical students and its relationship to gender and specialty preference: a cross-sectional study. BMC Med Educ. 2019;19(1).1-8
30. Hojat M, DeSantis J, Shannon SC, Speicher MR, Bragan L, Calabrese LH, et al. Empathy as related to gender, age, race and ethnicity, academic background and career interest: a nationwide study of osteopathic medical students in the United States. Med Educ. 2020;54(6):571–581.
31. El Seifi OS, Alenazi AA, Alfuhaymani AM, Alanazi AA, Alanazi OA, Alanazi LA, et al. The level of empathy among medical students at the University of Tabuk, Saudi Arabia. Cureus. 2024;16(1).1-10