ORIGINAL ARTICLE
Volume 14 Issue 1 2022
DOI: 10.21315/eimj2022.14.1.3
ARTICLE INFO
Received: 23-02-2021
Accepted: 16-08-2021
Online: 30-03-2022

Comparative Study of Malaysian Medical Students' Empathy Scores Between Preclinical and Clinical Training

Aye Swe Zin[1], Sein Htwe Htwe[1], Nyunt Myat Kalayar[2], Min Yupa[3]

[1]*Department of Paediatrics, Quest International University, Perak, MALAYSIA*

[2]*Department of Public Health, Newcastle University Medicine Malaysia, Johor, MALAYSIA*

[3]*Department of Pathology, Quest International University, Perak, MALAYSIA*

To cite this article: Aye SZ, Sein HH, Nyunt MK, Min Y. Comparative study of Malaysian medical students' empathy scores between preclinical and clinical training. Education in Medicine Journal. 2022;14(1):27–38. https://doi.org/10.21315/eimj2022.14.1.3

To link to this article: https://doi.org/10.21315/eimj2022.14.1.3

ABSTRACT

This study aims to compare the empathy scores of Malaysian medical students between preclinical and clinical training, and to identify the predictive factors for empathic behaviour. In this cross-sectional study, the medical student version of the Jefferson Scale of Empathy (JSE-S) was distributed to medical students at Quest International University (QIU), Malaysia. The JSE-S scores are analysed using independent *t*-tests to determine any significant difference between the preclinical and clinical training. We use a one-way ANOVA test to identify the factors influencing medical students' empathy levels. A total of 85% of the students responded to the questionnaires. The mean JSE-S scores for QIU medical students is 106.2 (M = 106.2, SD = 13.5). Female students have significantly higher empathy scores than males ($F_{(1,240)} = 8.32$, $p = 0.004$). The compassionate domain of empathy scores increased significantly with an increase in the year of medical school ($F_{(4,237)} = 3.135$, $p = 0.015$). Compared to medical students in preclinical training, clinical students had statistically significant higher empathy scores in compassionate care ($t_{(240)} = -2.08$, $p = 0.039$). In general, medical students in QIU exhibited an increasing trend of empathy scores across their training. Interestingly, compared to preclinical students, clinical students had higher affective empathy scores (compassionate care) whereas their cognitive empathy scores remained unchanged. We suggest including courses on cognitive empathy training in the QIU curriculum.

Keywords: *Empathy scores, Malaysian medical students, Preclinical training, Clinical training*

CORRESPONDING AUTHOR

Aye Swe Zin, Department of Paediatrics, Faculty of Medicine, Quest International University, 122A Jalan Haji Eusoff, 30250 Ipoh, Perak, Malaysia

Email: swezinaye2006@gmail.com

INTRODUCTION

Empathy is defined as the cognitive ability to understand the feelings of another by imagining oneself in that person's situation, combined with the expression of that awareness and the willingness to help (1). In medical settings, doctor-patient communication is important for improving patients' trust, satisfaction and compliance

with treatment recommendations (2). Several studies suggest that a high empathy level is strongly linked to positive outcomes in future medical professional life (3). Nowadays, the medical curriculum includes empathy as one of the most important skills which can be taught and developed during medical education (4). Therefore, medical educators should focus on teaching and evaluation pedagogies to enhance empathetic behaviour in medical students.

To promote empathy in medical students, medical schools have employed a range of interventions such as early clinical exposure, teaching medical ethics, professionalism training workshops, etc. (5). The Faculty of Medicine at Quest International University (QIU), Malaysia, is using an integrated modular curriculum which incorporates educational programmes, including courses in ethics and professionalism and hospital visits during the preclinical years of medical education. Thus, proper evaluation of the effectiveness of QIU's curriculum for developing empathetic behaviour is important.

The Jefferson Scale of Empathy (JSE) is the most widely used tool for measuring empathy in the healthcare setting and it has been translated to 56 languages/dialects (6). The JSE also has three different versions: medical students, health professions and health professions students. Worldwide, the Jefferson Scale of Empathy, medical student version (JSE-S) is a highly validated scale for measuring empathy for medical students (7–8). The Cronbach alpha value of JSE-S is at least 0.80, indicating high internal consistency and reliability (8–9). The JSE-S measures empathy in terms of three dimensions: compassionate care, perspective-taking and standing in the patient's shoes (9).

The JSE-S will be used to analyse the scores according to gender, age, curriculum, years of medical students, specialty and countries of origin. Increased empathy level in medical students as they progressed through medical school has been reported in studies conducted in Japanese, South Korean, Portuguese and Iranian medical schools (10–13). In contrast, American, Pakistani and Iranian medical school students showed a significant decline in empathy levels during clinical years of medical education (14–16).

Medical students' empathy levels declined in clinical training years until graduation compared to preclinical years. When medical students started clinical training, empathy level decreased significantly (14–16). These studies have suggested that overwhelming pressure to cope with the stress and emotions of the clinical settings caused the students to become less empathetic. On the other hand, empathy significantly increased in clinical years compared to preclinical years in some studies (10–13). These findings indicate that the learning practices, hidden curricula, cultural influences and targeted training to promote empathy might influence medical students' empathy level. Therefore, the contradicting results of many studies indicate the need to conduct well-structured research to evaluate the different empathy scores between preclinical and clinical medical students and develop strategies to help them become empathetic doctors.

Although there are many recent studies about the role of empathy in medical education, there is limited information about the different dimensions of empathy. Empathy is a multidimensional concept with three main domains: compassionate care or emotional empathy, perspective-taking and standing in the patient's shoes are collectively known as cognitive empathy (9). Cognitive empathy is a higher-order brain function, whereas emotional empathy is the primitive and automatic brain function (9). The current research compared this theoretical model of the subcomponents of empathy between preclinical and clinical years of medical education. Therefore, this study aims to assess and compare the medical students' empathy levels between preclinical and clinical years in the Faculty

of Medicine, QIU. We also assess the impact of QIU's curriculum on empathetic behaviour.

METHODOLOGY

Study Design and Settings

This was a cross-sectional, paper-based questionnaire study conducted in the middle of the 2019–2020 academic year on medical students in the first to fifth years of training. This study assessed the levels of empathy in medical students by using the JSE-S. It was conducted in QIU, Malaysia. QIU's Bachelor of Medicine, Bachelor of Surgery (MBBS) programme, a typical 5-year programme in Malaysia, uses an integrated modular curriculum that incorporates training about ethics and professionalism throughout the 5-year training period, with assessment of this training in year 4. Although QIU medical students have early hospital visits and clinical skills training in preclinical years, they begin their clinical rotations and clerkships at year 3. QIU's ethical review board approved this study with the reference number, JREC/Feb 2019/18.

Participants

Out of 284 medical students in QIU, 242 responded to the questionnaires. We included all the medical students of QIU who agreed to participate in this research and excluded the medical students who did not agree to participate. Their participation was entirely voluntary, with no credits or payment awarded. The participants were well-informed about the study and provided written informed consent form before participation.

Instruments

This study uses self-reporting questionnaires in English, which consist of 20 items measured on a 7-point Likert scale ranging from 1 = strongly disagree to 7 = strongly agree. Ten items are reverse-scored with scales ranging from 1 = strongly agree to 7 = strongly disagree. The total score is the sum of all individual responses with a minimum score of 20 to a maximum score of 140. Higher scores mean higher empathetic behaviour orientation. The items are divided into three components: perspective taking, compassionate care and standing in the patient's shoes.

Data Collection

Overall, 242 (85%) out of 284 QIU medical students responded to this survey. Medical students of basic preclinical training (years 1 and 2) and clinical training (years 3 to 5) were recruited at the end of lectures. One of the researchers explained the research. Printed informed consent forms were distributed to those students who wished to participate. Once these forms were completed and returned, paper-based JSE-S questionnaires were distributed.

Data Analysis

Statistical analysis was done by SPSS for Mac, version 26. We calculated Cronbach's alpha for internal consistency of JSE-S scores. In this study, demographic factors such as age, gender, years of medical school and specialty interest were analysed by using a one-way ANOVA test. We compared the empathy scores of preclinical and clinical students by using the independent *t*-test. All statistical analyses are 2-tailed and *p*-value < 0.05 is considered statistically significant.

RESULTS

Figure 1 shows the distribution of respondents and total students enrolled over the five years of medical school. Cronbach alpha coefficient of JSE-S was ($\alpha = 0.806$) which suggests adequate reliability, given that the accepted benchmark for internal consistency is 0.7.

The demographic characteristics of 242 medical students who participated in the study are presented in Table 1. The mean JSE-S score for all medical students was 106.2 (M = 106.2, SD = 13.5). Figure 2 shows changes in empathy scores across five years of medical school. The ANOVA test indicates a statistically significant effect for gender ($F_{(1,240)}$ = 8.32, p = 0.004), with higher mean JSE-S scores for female students (M = 108.0, SD = 13.0) compared to male students (M = 102.8, SD = 14.0). The lowest empathy scores were observed in year 1 medical students (M = 102.8, SD = 14.0), whereas the highest was found in year 4 students (M = 109.1, SD = 12.4). There was no significant effect of age ($F_{(4,237)}$ = 1.196, p = 0.355), education level ($F_{(4,237)}$ = 1.705, p = 0.15) or specialty preference ($F_{(1,240)}$ = 0.556, p = 0.457) (see Table 1). We used 22 years of age as the cut-off point because most of the preclinical students were less than 22 years of age, whereas those in clinical years were older than 22.

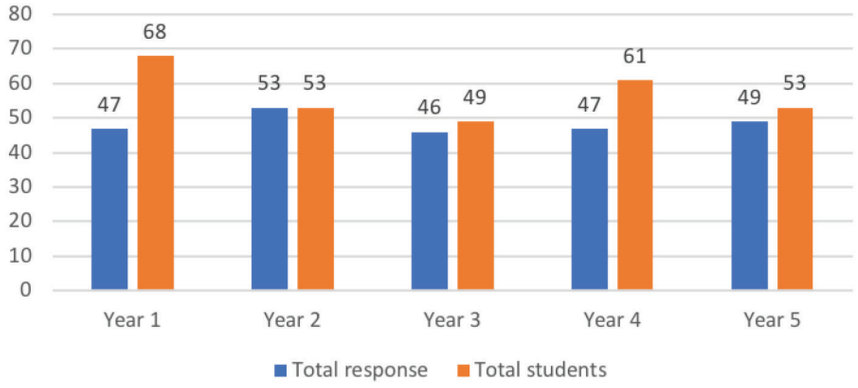

Figure 1: Demographic of total students and responses.

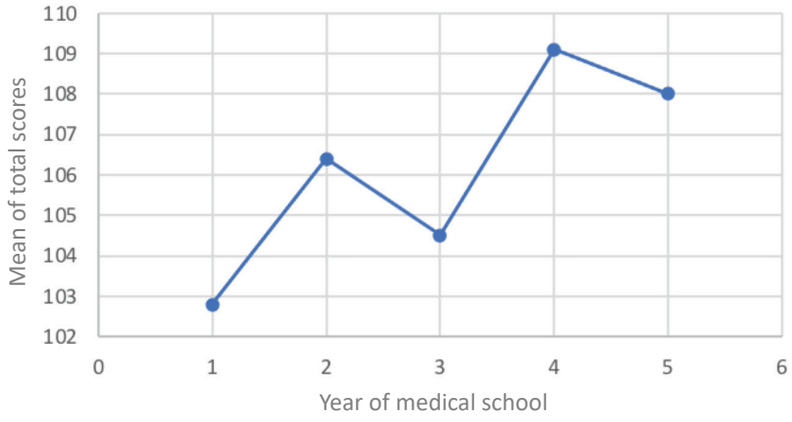

Figure 2: Changes in empathy scores across five years of medical school.

Table 1: Demographic characteristics and mean JSE-S scores distributions among medical students

Characteristics	Number (%) *N* = 242	Mean scores (SD) Total scores = 140	*p*-value
Response rate	242/284 (85.0)	106.2 (13.5)	
Gender			0.004
Male	83 (34.0)	102.8 (14.0)	
Female	159 (66.0)	108.0 (13.0)	
Age			0.355
<22 years	109 (45.0)	105.3 (13.8)	
≥22 years	133 (55.0)	106.9 (13.3)	
MBBS year			0.150
Year 1	47 (19.4)	102.8 (14.0)	
Year 2	53 (22.0)	106.4 (13.7)	
Year 3	46 (19.0)	104.5 (13.9)	
Year 4	47 (19.4)	109.1 (12.4)	
Year 5	49 (20.2)	108.0 (13.2)	
Future plan for specialty			0.457
Yes	184 (76.0)	105.8 (13.4)	
No	58 (24.0)	107.4 (13.8)	

The results of the three components and analysis of JSE-S scores across the years of study are reported in Table 2. One-way ANOVA analysis indicates that there is a statistically significant difference in compassionate care across the years of medical school ($F_{(4,237)} = 3.135$, $p = 0.015$). Post hoc Tukey test indicates that year 4 medical students had significantly higher scores of compassionate care than year 1 medical students ($p = 0.007$). No significant differences were found in perspective-taking or standing in the patient's shoes.

A total of 100 preclinical and 142 clinical students were compared in terms of JSE-S scores, age, gender and plan for a specialty by using a 2-tailed *t*-test (Table 3). Here as well, clinical students had significantly higher compassionate care scores (M = 41.7, SD = 7.5) than preclinical students (M = 39.6, SD = 8.2) ($t_{(240)} = -2.08$, $p = 0.039$). No significant differences in empathy scores between preclinical and clinical students were found in perspective taking ($t_{(240)} = 0.46$, $p = 0.648$) or standing in the patient's shoes ($t_{(240)} = -0.26$, $p = 0.796$). Similarly, there was no significant difference in total JSE-S scores between preclinical and clinical students for age or gender.

Table 2: Changes in three dimensions of empathy scores across five years of medical school

Perspectives/Year of medical school	Number of students	Mean scores	SD	Significance *p*-value
Cognitive/perspective-taking				0.345
Year 1	47	57.5	7.5	
Year 2	53	56.6	10.3	
Year 3	46	55.6	8.3	
Year 4	47	58.1	7.4	
Year 5	49	58.8	6.7	
Compassionate care				0.015
Year 1	47	37.6	9.6	
Year 2	53	41.3	6.3	
Year 3	46	40.7	8.3	
Year 4	47	43.0	6.0	
Year 5	49	41.3	7.8	
Standing in the patient's shoes				0.519
Year 1	47	7.7	2.5	
Year 2	53	8.5	2.9	
Year 3	46	8.3	2.6	
Year 4	47	8.0	2.5	
Year 5	49	7.9	2.8	

Table 3: Comparison of empathy scores between preclinical and clinical year (2-tailed *t*-test)

Outcomes	Preclinical (*n* = 100) Mean (SD)	Clinical (*n* = 142) Mean (SD)	95% (CI)	*p*-value
Three dimensions of JSE-S scores				
Cognitive/perspective	57.0 (9.0)	57.5 (7.5)	–2.6 to 1.6	0.648
Compassionate care	39.6 (8.2)	41.7 (7.5)	–4.1 to –0.11	0.039
Standing in the patient's shoes	8.2 (2.7)	8.1 (2.6)	–0.59 to 0.77	0.796
JSE-S total scores	104.7(13.9)	107.2(13.2)	–6.0 to 0.96	0.155
JSE-S scores with different age groups				
<22 years	105.4 (14.1)	105 (13)	–5.5 to 6.3	0.888
≥22 years	102.1 (12.9)	107.8 (13.2)	–11.9 to 0.48	0.070
Gender difference in JSE-S scores				
Male	99.5 (14.7)	105.2 (13.1)	–11.8 to 0.39	0.066
Female	107.6 (12.6)	108.3 (13.2)	–4.9 to 3.4	0.73

(continued on next page)

Table 3: *(continued)*

Outcomes	Preclinical (*n* = 100) Mean (SD)	Clinical (*n* = 142) Mean (SD)	95% (CI)	*p*-value
Gender difference in JSE-S scores				
Male	99.5 (14.7)	105.2 (13.1)	–11.8 to 0.39	0.066
Female	107.6 (12.6)	108.3 (13.2)	–4.9 to 3.4	0.73
Future plan for specialty				
Yes	104.2 (13.8)	107.3 (13.1)	–7.0 to 0.8	0.118
No	108.0 (14.5)	107.2 (13.7)	–7.6 to 9.1	0.118

DISCUSSION

In the present study, the mean JSE-S score of Malaysian medical students at QIU is 106.2 (SD = 13.5) (Table 1), which is lower than those observed in the US, Ireland, South Korea and the Jeffery Cheah School of Medicine, Malaysia (9, 11, 17–18) and higher than those observed in Japan, Iran, China and Pakistan (10, 13, 19–21). Therefore, QIU empathy scores are higher than those of most Asian medical schools, except one Malaysian counterpart and one South Korean school. One of the most important influences on medical students' empathy is the medical school curriculum, which includes early patient contact, communication and clinical skills courses, mentoring relationships and self-reflection skills for students and teachers (22).

Furthermore, empathy grows as students' progress through medical school with two sharp decrease in empathy scores (dips) in the year 3 and final year (Figure 2). The downward trend in year 3 medical school, marked by the transition to clinical placement, was also found in a longitudinal study at Jefferson Medical College, US (14) and 18 other studies (23). A similar trend of empathy scores was also observed in one of the Korean medical schools with two dips; one in the year 3 and the other was in the year 5 (24). The reduced level of empathy in the two clinical years may be due to a lack of role models (25–26), a lack of reflection practice in medical education (27), sleep deprivation (28), a higher academic workload (18) or negative educational environments (29). In contrast, a cross-sectional study of Portuguese medical students reports higher empathy scores in senior medical students compared to preclinical years (13). Our findings are also not in agreement with the results of a cross-sectional 2006 Japanese study using the same JSE-S scores, which reports an increasing trend of empathy level in medical students (10).

Recently published cross-sectional or longitudinal studies report contrasting trends of increasing, decreasing, stable and swinging empathy scores in medical students (30). The studies showed that the "hidden", "formal" and "informal" curricula could be the main reasons for these results (23). Our data support an emphasis on teaching empathy and communication skills in the QIU curriculum to restore the empathy level of medical students in the year 3 and final year of medical education.

Female medical students' empathy scores were significantly higher in this study than those of their male counterparts (Table 1). This contrasts with the result of no correlation between empathy scores and gender from the South Korean study which involved 233 medical students after one year of medical education (11). The

contrasting results were thought to be due to culture-specific characteristics (11). Our finding is consistent with the results of other studies (15, 18, 21, 24, 31–33). Higher empathy scores in females are explained by gender role expectations and stronger non-verbal emotional recognition skills in females (32). Moreover, women are more emotionally sensitive compared to men, due to the higher levels in brain activation in the amygdala (34) and the right cerebral hemisphere (35) in response to empathy-inducing events, according to neuroimaging studies.

Interestingly, we found no significant difference in empathy level in terms of age or career preference. This contrasts with a 2010 cross-sectional Iranian study of 260 medical students, which evidenced an inverse relationship between empathy scores and age and showed a significant decline in empathy level in clinical years (15). However, Chatterjee et al. (36) align with our finding that empathy levels do not correlate with age or specialty interest. It is unclear whether these age-related empathy patterns in QIU medical students are the results of the potential cohort effects or true non-linear correlation between the age and the empathy level of medical students. Our data could not clearly differentiate between the two causes, as we took cross-sectional samples of medical students.

A comparative analysis using three subscales of JSE-S (perspective taking, compassionate care, standing in the patient's shoes) was performed on QIU medical students across the years of medical school. Perspective-taking and standing in the patient's shoes are included under cognitive empathy, which is the ability to recognise and understand the feelings of others. On the other hand, compassionate care is affective or emotionally based empathy, which is the ability to share the feeling of others and the capacity for intuitive emotional responses (9). We found that compassionate care increased significantly whereas the difference in the remaining two subscales is not significant between preclinical and clinical students (Table 2). In contrast, a cross-sectional Pakistani study conducted by Mirani et al. (21) reported a decreasing trend in three dimensions of empathy scores across the five years of medical education. This was attributed to the stress of long working hours, lack of sleep and increased responsibilities that come in the later years of medical education (21). Our findings also contrasted with those of Quince et al.'s (37) study at the University of Cambridge over a period of four years. This longitudinal study reports that affective empathy was significantly decreased with no change in cognitive empathy during the medical course. It is postulated that QIU medical curriculum enhanced the development of compassionate care subscale. One possible explanation could be that the students' clinical experience with the patients stimulated their empathetic system to develop affective empathy, which is more of an autonomic and primitive process compared to cognitive empathy (38). It is suggested that the QIU curriculum has adequate clinical training with patients.

There is a linear relationship between cognitive empathy and clinical outcomes, whereas the relationship between emotional empathy and clinical outcomes corresponds to a bell-shaped curve (14). An excess of emotional empathy could lead to detrimental effects such as fatigue, exhaustion and traumatisation. On the other hand, cognitive empathy progressively improves clinical outcomes and might be enhanced by training (38). Interestingly, the cognitive empathy levels in QIU medical students remained unchanged between preclinical and clinical training. Our results closely matched those of Quince et al. (37) in terms of cognitive empathy levels. The cognitive empathy level could be enhanced by a fuller understanding of the biopsychosocial model of healthcare (38). For example, medical students could achieve cognitive empathy if they act not only on patients' symptoms (biological factors) but also on the psychological and social factors contributing to patients'

illnesses and plan optimal management accordingly. Currently, the QIU curriculum is based on this biopsychosocial model of healthcare; however, we recommend incorporating more of this model of healthcare into our clinical teaching.

The strength of this study is its separate analysis for the three dimensions of JSE-S scores across the years of medical education. In medical education, emotions are generally believed to be harmful to clinical decision-making. By doing the dimensional analysis of JSE-S scores, increased emotional empathy improved clinical outcomes up to a certain limit; beyond that limit, excessive emotional empathy could lead to negative clinical outcomes due to mental exhaustion (38). However, better cognitive empathy is directly related to positive clinical outcomes and could be enhanced by medical education (38). Therefore, dimensional analysis of empathy scores supports the idea that medical educators should understand the correlations between the subcomponents of empathy and their impacts on clinical outcomes.

However, there are several limitations to this study. First, it was conducted in just one private medical university in Malaysia, which limits the generalisability of our findings. Second, the cross-sectional design of our study could not confirm the validity of our results because the baseline differences could not be controlled. Third, we used a self-reported questionnaire which is not always accurate in reflecting actual behaviours. The students might know the desirable answers of the questionnaires from some source of information which will reduce the reliability and validity of the responses.

In future, it would be valuable to conduct studies from the first year of medical school to the final year to eliminate the baseline difference. Ideally, future studies should be carried out by comparing the international cohorts of medical students from various medical universities with different medical curricular designs, to overcome the above-mentioned limitations. It would also be interesting to see whether factors such as role-modelling, self-reflection practice, communication skills training courses, mentoring schemes or stressful and hostile medical culture have any impact on empathy level in medical students.

CONCLUSION

Our results show increased empathy scores of medical students, with two dips in the third and final years, across their training in QIU. These results contrast with findings of reducing empathy scores in many medical universities across the world. In addition, we discovered that female medical students were more empathetic than their male counterparts in QIU. We also found that the compassionate domain of empathy scores increased significantly with progress in the year of medical school. Dimensional analysis of empathy scores indicates an increase in affective empathy scores (compassionate care) in clinical students compared to pre-clinical students, whereas the cognitive empathy scores remained unchanged. This study helps to conceptualise the individual domains of empathy levels across the years of medical school and to identify the subcomponents which need to be promoted or curbed in order to enhance clinical decision-making. The findings of this study will also assist in reshaping the QIU curriculum to optimise the different dimensions of empathy.

ACKNOWLEDGEMENTS

We would like to thank Jefferson Medical College, a copyright holder, for allowing us to use the JSE-S. The authors would also like to acknowledge all of the students who participated in this study.

ETHICAL APPROVAL

The QIU's ethical review board approved this study with the reference number, JREC/Feb 2019/18.

REFERENCES

1. Hojat M, DeSantis J, Ney DB, DeCleene-Do H. Empathy of medical students and compassionate care for dying patients: an assessment of "No One Dies Alone" program. J Patient Exp. 2020;7(6):1164–8. https://doi.org/10.1177/2374373520962605

2. Street RLJr., Gordon H, Haidet P. Physicians' communication and perceptions of patients: is it how they look, how they talk, or is it just the doctor? Soc Sci Med. 2007;65(3):586–98. https://doi.org/10.1016/j.socscimed.2007.03.036

3. Hojat M, Mangione S, Nasca TJ, Gonnella JS, Magee M. Empathy scores in medical school and ratings of empathic behavior in residency training 3 years later. J Soc Psychol. 2005;145(6):663–72. https://doi.org/10.3200/SOCP.145.6.663-672

4. Sulzer SH, Feinstein NW, Wendland CL. Assessing empathy development in medical education: a systematic review. Med Educ. 2016;50(3):300–10. https://doi.org/10.1111/medu.12806

5. Stepien KA, Baernstein A. Educating for empathy: a review. J Gen Intern Med. 2006;21(5):524–30. https://doi.org/10.1111/j.1525-1497.2006.00443.x

6. Thomas Jefferson University [Internet]. Philadelphia: Thomas Jefferson University; c2022 [cited 2021 July 6]. Jefferson scale of empathy 2021. Available from: https://www.jefferson.edu/academics/colleges-schools-institutes/skmc/research/research-medical-education/jefferson-scale-of-empathy.html

7. Hojat M, Gonnella JS, Mangione S, Nasca TJ, Veloski JJ, Erdmann JB, et al. Empathy in medical students as related to academic performance, clinical competence and gender. Med Educ. 2002;36(6):522–7. https://doi.org/10.1046/j.1365-2923.2002.01234.x

8. Hojat M, Gonnella JS. Eleven years of data on the Jefferson Scale of Empathy-medical student version (JSE-S): proxy norm data and tentative cutoff scores. Med Princ Pract. 2015;24(4):344–50. https://doi.org/10.1159/000381954

9. Hojat M, DeSantis J, Shannon SC, Mortensen LH, Speicher MR, Bragan L, et al. The Jefferson Scale of Empathy: a nationwide study of measurement properties, underlying components, latent variable structure, and national norms in medical students. Adv Health Sci Educ Theory Pract. 2018;23(5):899–920. https://doi.org/10.1007/s10459-018-9839-9

10. Kataoka HU, Koide N, Ochi K, Hojat M, Gonnella JS. Measurement of empathy among Japanese medical students: psychometrics and score differences by gender and level of medical education. Acad Med. 2009;84(9):1192–7. https://doi.org/10.1097/ACM.0b013e3181b180d4

11. Hong M, Lee WH, Park JH, Yoon TY, Moon DS, Lee SM, et al. Changes of empathy in medical college and medical school students: 1-year follow up study. BMC Med Educ. 2012;12:122. https://doi.org/10.1186/1472-6920-12-122

12. Magalhaes E, Salgueira AP, Costa P, Costa MJ. Empathy in senior year and first year medical students: a cross-sectional study. BMC Med Educ. 2011;11:52. https://doi.org/10.1186/1472-6920-11-52

13. Rahimi-Madiseh M, Tavakol M, Dennick R, Nasiri J. Empathy in Iranian medical students: a preliminary psychometric analysis and differences by gender and year of medical school. Med Teach. 2010;32(11):e471–8. https://doi.org/10.3109/0142159X.2010.509419

14. Hojat M, Vergare MJ, Maxwell K, Brainard G, Herrine SK, Isenberg GA, et al. The devil is in the third year: a longitudinal study of erosion of empathy in medical school. Acad Med. 2009;84(9):1182–91. https://doi.org/10.1097/ACM.0b013e3181b17e55

15. Khademalhosseini M, Khademalhosseini Z, Mahmoodian F. Comparison of empathy score among medical students in both basic and clinical levels. J Adv Med Educ Prof. 2014;2(2):88–91.

16. Shariat SV, Habibi M. Empathy in Iranian medical students: measurement model of the Jefferson Scale of Empathy. Med Teach. 2013;35(1):e913–8. https://doi.org/10.3109/0142159X.2012.714881

17. Williams B, Sadasivan S, Kadirvelu A. Malaysian medical students' self-reported empathy: a cross-sectional comparative study. Med J Malaysia. 2015;70(2):76–80.

18. O'Sullivan DM, Moran J, Corcoran P, O'Flynn S, O'Tuathaigh C, O'Sullivan AM. Medical school selection criteria as predictors of medical student empathy: a cross-sectional study of medical students, Ireland. BMJ Open. 2017;7(7):e016076. https://doi.org/10.1136/bmjopen-2017-016076

19. Li D, Xu H, Kang M, Ma S. Empathy in Chinese eight-year medical program students: differences by school year, educational stage, and future career preference. BMC Med Educ. 2018;18(1):241. https://doi.org/10.1186/s12909-018-1348-2

20. Yi K, Kang M, Li D, Wang Z, Bai J, Xu H, et al. A multi-institutional and cross-sectional study on empathy in Chinese medical students: differences by student cadre or not, future career preference, and father's education status. BMC Med Educ. 2020;20(1):24. https://doi.org/10.1186/s12909-020-1935-x

21. Mirani SH, Shaikh NA, Tahir A. Assessment of clinical empathy among medical students using the Jefferson Scale of Empathy-student version. Cureus. 2019;11(2):e4160. https://doi.org/10.7759/cureus.4160

22. Pohontsch NJ, Stark A, Ehrhardt M, Kotter T, Scherer M. Influences on students' empathy in medical education: an exploratory interview study with medical students in their third and last year. BMC Med Educ. 2018;18(1):231. https://doi.org/10.1186/s12909-018-1335-7

23. Neumann M, Edelhauser F, Tauschel D, Fischer MR, Wirtz M, Woopen C, et al. Empathy decline and its reasons: a systematic review of studies with medical students and residents. Acad Med. 2011;86(8):996–1009. https://doi.org/10.1097/ACM.0b013e318221e615

24. Roh MS, Hahm BJ, Lee DH, Suh DH. Evaluation of empathy among Korean medical students: a cross-sectional study using the Korean version of the Jefferson scale of physician empathy. Teach Learn Med. 2010;22(3):167–71. https://doi.org/10.1080/10401334.2010.488191

25. Burgess A, Oates K, Goulston K. Role modelling in medical education: the importance of teaching skills. Clin Teach. 2016;13(2):134–7. https://doi.org/10.1111/tct.12397

26. Khan F, Masud Khan RA. Role modelling: a missing link in medical education1554. J Pak Med Assoc. 2018;68(11):1554–6.

27. Schei E, Fuks A, Boudreau JD. Reflection in medical education: intellectual humility, discovery, and know-how. Med Health Care Philos. 2019;22(2):167–78. https://doi.org/10.1007/s11019-018-9878-2

28. Killgore WD, Kahn-Greene ET, Lipizzi EL, Newman RA, Kamimori GH, Balkin TJ. Sleep deprivation reduces perceived emotional intelligence and constructive thinking skills. Sleep Med. 2008;9(5):517–26. https://doi.org/10.1016/j.sleep.2007.07.003

29. Frank E, Carrera JS, Stratton T, Bickel J, Nora LM. Experiences of belittlement and harassment and their correlates among medical students in the United States: longitudinal survey. BMJ. 2006;333(7570):682. https://doi.org/10.1136/bmj.38924.722037.7C

30. Ferreira-Valente A, Monteiro JS, Barbosa RM, Salgueira A, Costa P, Costa MJ. Clarifying changes in student empathy throughout medical school: a scoping review. Adv Health Sci Educ Theory Pract. 2017;22(5):1293–313. https://doi.org/10.1007/s10459-016-9704-7

31. Haque M, Sa B, Majumder MAA, Islam MZ, Othman N, Lutfi S, et al. Empathy among undergraduate medical students: a cross-sectional study in one Malaysian public medical school. Ann Afr Med. 2018;17(4):183–8. https://doi.org/10.4103/aam.aam_57_17

32. Santos MA, Grosseman S, Morelli TC, Giuliano IC, Erdmann TR. Empathy differences by gender and specialty preference in medical students: a study in Brazil. Int J Med Educ. 2016;7:149–53. https://doi.org/10.5116/ijme.572f.115f

33. Leombruni P, Di Lillo M, Miniotti M, Picardi A, Alessandri G, Sica C, et al. Measurement properties and confirmatory factor analysis of the Jefferson Scale of Empathy in Italian medical students. Perspect Med Educ. 2014;3(6):419–30. https://doi.org/10.1007/s40037-014-0137-9

34. Derntl B, Finkelmeyer A, Eickhoff S, Kellermann T, Falkenberg DI, Schneider F, et al. Multidimensional assessment of empathic abilities: neural correlates and gender differences. Psychoneuroendocrinology. 2010;35(1):67–82. https://doi.org/10.1016/j.psyneuen.2009.10.006

35. Rueckert L, Naybar N. Gender differences in empathy: the role of the right hemisphere. Brain Cogn. 2008;67(2):162–7. https://doi.org/10.1016/j.bandc.2008.01.002

36. Chatterjee A, Ravikumar R, Singh S, Chauhan PS, Goel M. Clinical empathy in medical students in India measured using the Jefferson Scale of Empathy-student version. J Educ Eval Health Prof. 2017;14:33. https://doi.org/10.3352/jeehp.2017.14.33

37. Quince TA, Parker RA, Wood DF, Benson JA. Stability of empathy among undergraduate medical students: a longitudinal study at one UK medical school. BMC Med Educ. 2011;11:90. https://doi.org/10.1186/1472-6920-11-90

38. Tamayo CA, Rizkalla MN, Henderson KK. Cognitive, behavioral and emotional empathy in pharmacy students: targeting programs for curriculum modification. Front Pharmacol. 2016;7:96. https://doi.org/10.3389/fphar.2016.00096