ORIGINAL ARTICLE

Volume 18 No. 2 2026

DOI: 10.21315/eimj2026.18.2.10

ARTICLE INFO

Submitted: 21-01-2026
Accepted: 20-04-2026
Online: 30-06-2026

Validation of the Medical Professional Resilience Scale Among Malaysian Undergraduate Medical Students: A Confirmatory Factor Analysis

Farhana Harzila Mohd Bahar[1,2], Nurhanis Syazni Roslan[2], Nurul Alimah Abdul Nasir[3], Mohd Salami Ibrahim[4], Siti Khadijah Adam[5], Shazrina Ahmad Razali[6], Muhamad Saiful Bahri Yusoff[5]

[1]*Department of Medical Education, Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah, Sabah, MALAYSIA*

[2]*Department of Medical Education, School of Medical Sciences, Universiti Sains Malaysia, Kelantan, MALAYSIA*

[3]*Department of Medical Education, Faculty of Medicine, Universiti Teknologi MARA, Selangor, MALAYSIA*

[4]*Department of Medical and Health Professional Education, Faculty of Medicine, Universiti Sultan Zainal Abidin, Terengganu, MALAYSIA*

[5]*Department of Medical Education, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, Selangor, MALAYSIA*

[6]*Medical Education Unit, Faculty of Medicine and Health Sciences, Universiti Malaysia Sarawak, Sarawak, MALAYSIA*

To cite this article: Mohd Bahar FH, Roslan NS, Abdul Nasir NA, Ibrahim MS, Adam SK, Ahmad Razali S, Yusoff MSB. Validation of the Medical Professional Resilience Scale among Malaysian undergraduate medical students: a confirmatory factor analysis. Education in Medicine Journal. 2026;18(2):129–143. https://doi.org/10.21315/eimj2026.18.2.10

To link to this article: https://doi.org/10.21315/eimj2026.18.2.10

ABSTRACT

Resilience is an essential attribute for medical professionals as they frequently encounter demanding academic, emotional, and clinical challenges. Reliable instruments are needed to assess resilience in medical education settings. The Medical Professional Resilience Scale (MeRS) was developed based on the integrated resilience model to measure resilience among healthcare professionals. However, validation of this instrument among undergraduate medical students remains limited. This study aimed to evaluate the construct validity and reliability of the MeRS among Malaysian undergraduate medical students using confirmatory factor analysis (CFA). A cross-sectional study was conducted among 242 undergraduate medical students from two Malaysian medical schools. The original MeRS consists of 37 items across four resilience domains such as growth, control, involvement, and resourcefulness. CFA was performed using IBM SPSS AMOS to evaluate the factor structure of the instrument. Model fit was assessed using absolute, incremental, and parsimonious fit indices. Model refinement was conducted by examining standardised factor loadings and modification indices. Composite reliability (CR), average variance extracted (AVE), and Cronbach's alpha were calculated to assess reliability and convergent validity. The initial 37-item model demonstrated inadequate model fit. Sequential removal of poorly fit items resulted in a refined model consisting of 20 items. The final model demonstrated satisfactory goodness-of-fit indices (χ^2/df = 1.438, CFI = 0.969, TLI = 0.965, GFI = 0.912, RMSEA = 0.043). Standardised factor loadings ranged from 0.58 to 0.98. CR values ranged from 0.79 to 0.88 and AVE values ranged from 0.46 to 0.69, indicating satisfactory reliability and convergent validity. The overall MeRS scale demonstrated good internal consistency with Cronbach's α = 0.926. The findings support the construct validity and reliability of MeRS-20UG among Malaysian undergraduate medical students. The scale provides a concise, psychometrically sound instrument for assessing resilience in medical education settings.

Keywords: *Resilience, Medical students, MeRS, Confirmatory factor analysis, Psychometric validation*

CORRESPONDING AUTHOR

Muhamad Saiful Bahri Yusoff, Department of Medical Education, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia

Email: saifulbahri@upm.edu.my

INTRODUCTION

Resilience is widely defined as the ability of individuals to adapt positively to adversity while maintaining psychological well-being and effective functioning. This is a fundamental quality in both personal and professional contexts (1–3). In healthcare settings, resilience is particularly important given the demanding nature of medical training and professional practice. Healthcare professionals frequently encounter stressful situations, heavy workloads, and emotionally challenging clinical encounters, making resilience an essential attribute for maintaining well-being and professional effectiveness (2, 4).

The conceptualisation of resilience remains complex and multidimensional, varying across disciplines, cultures, and situational contexts (5–9). A meta-analysis by Leppin and colleagues (10) underscored the lack of a unified definition of resilience, highlighting ongoing debates about its dimensions and measurement. Complementing this, a meta-synthesis by Wadi and colleagues (1) in the year 2020 identified 21 distinct resilience scales, each assessing different facets of the construct. These further reflect the conceptual diversity and lack of consensus in resilience research.

In the healthcare context, resilience has received increased attention for its essential role in maintaining well-being, performance, and professional satisfaction among individuals exposed to high-stress, demanding environments. Qualitative research demonstrates that resilience in medical professionals is not a static trait but rather a dynamic process, influenced by personal motivation, reflective coping, and the ability to maintain balance between professional and personal domains (3, 11–15). Despite these insights, the literature remains fragmented, and scholars argue that resilience should be interpreted as context and population-specific rather than generally defined (16).

While numerous instruments have been developed to assess resilience, no single tool has achieved universal acceptance or been deemed superior to others (1). The absence of a universally accepted measure poses a methodological challenge for researchers, often leading them to use scales that may not be contextually appropriate. In healthcare, two widely used instruments: the Brief Resilient Coping Scale (BRCS) and the Connor-Davidson Resilience Scale (CD-RISC), have been applied across disciplines but lack specificity for medical settings (1, 17, 18). Recognising this limitation, Rahman and colleagues (19) developed the Medical Professionals Resilience Scale (MeRS), a scale specifically designed for medical professionals and grounded in the Integrated Resilience Model (IRM) proposed by Wadi et al. (1). The IRM conceptualises resilience as a dynamic construct encompassing four interrelated domains such as control, resourcefulness, involvement, and growth. These domains collectively capture the cognitive, behavioural, and emotional mechanisms through which individuals sustain effectiveness and well-being in complex medical environments.

The MeRS has demonstrated strong psychometric properties, including content validity, face validity, construct validity, and internal consistency, in a sample of junior doctors (19). However, empirical validation beyond this professional group remains limited. Since resilience is shaped by situational and developmental factors, it is critical to examine whether the MeRS will maintain its validity and reliability in populations at earlier stages of medical training. Medical students, in particular, face numerous academic, clinical, and emotional stressors that test their capacity for adaptation and self-regulation (4, 20, 21). Consequently, validating MeRS among undergraduate medical students is essential to determine whether it accurately captures resilience constructs relevant to their experiences.

This study, therefore, aims to validate MeRS among undergraduate medical students in Malaysia. By confirming the factor structure, construct validity, and reliability of the MeRS in this new context, the research will provide essential evidence supporting its use as a psychometrically sound instrument for assessing resilience in undergraduate medical education. The results will also help establish MeRS as a potential tool for identifying strengths and areas for intervention to foster resilience during medical training, which will later serve as an essential basis for future healthcare professional development.

METHODS

This study employed a cross-sectional design to evaluate the construct validity and reliability of MeRS among undergraduate medical students in Malaysia. The study involved students from Universiti Malaysia Sabah (UMS) and Universiti Sains Malaysia (USM), with students from all academic years eligible to participate.

Data were collected using a self-administered online questionnaire, distributed to students through their respective batch leaders, who assisted in sharing the questionnaire link within their academic cohorts. Participation in the study was voluntary and responses were collected anonymously. Electronic informed consent was obtained on the first page of the online questionnaire before participants could proceed to the survey, and submission of the completed questionnaire indicated consent to participate in the study.

The required sample size for confirmatory factor analysis (CFA) was determined based on methodological recommendations suggesting at least 5 to 10 participants per item and a minimum of 200 participants to ensure stable parameter estimation (22–24). As the original MeRS instrument consists of 37 items, the recommended sample size ranged between 185 and 370 participants.

The questionnaire consisted of two sections. The first section collected sociodemographic information, including institution, year of study, and gender, while the second section comprised MeRS (19). The instrument originally consists of 37 items representing 4 domains of resilience including growth (15 items), involvement (12 items), control (6 items), and resourcefulness (4 items) (Table 1). All items were rated on a Likert-type scale, with higher scores indicating greater resilience competency (Table 2).

Table 1: 37-items Medical Professionals Resilience Scale (MeRS)

Domain	Definition	Items
Growth	Being able to grow stronger from adversity, and is oriented for future state internally	I can succeed if I keep trying
		I believe everything happens for a reason
		When I face new situations, I will learn from it
		I believe there is a wisdom behind everything in life
		I believe every problem comes with a solution
		I seek help to achieve my goals if necessary
		I believe by helping others, I am helping myself too
		I have goals to achieve
		I believe good planning is a key to success
		I believe self-motivation will change the final outcome
		I believe hard work really pays off in the end
		I am aware of my strengths and abilities
		I am positive I will be successful in the future
		When my work is criticised, I cope positively by trying harder the next time
		Believing in myself helps me to face any difficulties
*Involvement	Being committed to deal with the adversities, and is influenced by the present state externally	I am firm with my stand
		I can adapt to change at work situations
		People always believe in me to make difficult decision
		I am comfortable working in new environment
		I spend my life doing something great
		I have good coping skills when dealing with stress
		I am proud of my own accomplishments
		I become a stronger person when facing difficulties at work
		I always give my best at work
		I feel energetic doing my work even in difficult situations
		I can maintain interest in my work
		My colleagues can always rely on me
*Control	The quality of being composed and controlled in adversities, and is influenced by the present state inside a person	I can stay calm in hard situations
		I can handle unpleasant feelings
		I always try to stay calm in any situation
		I can control my anger
		I am in control of my surroundings
		I am good at adapting myself to different situations

(*Continued on next page*)

Table 1: (*Continued*)

Domain	Definition	Items
Resourceful	The ability to find appropriate solutions from available resources to deal with adversities, and is oriented for future state externally	I know who to talk to when I have a problem
		I know where to go if I need help
		I always have someone by my side when I have problems
		I figure out ways to solve my problems by talking about them

Note: *The domain was unintentional wrongly labelled in the publication by Rahman et al. (19). The correct label as stated in this table as per original list of MeRS items by resilience domains that is accessible at https://link.springer.com/article/10.1186/s12913-021-06542-w (refer to Supplementary Information - Additional file 1. [download DOCX])

Table 2: The total score for MeRS with a corresponding level of resilience competency

MeRS domain (n item)	Level of resilience competency (total score)		
	Developing (low)	Established (moderate)	Exceptional (high)
Growth (15)	15–27	28–47	48–60
*Involvement (12)	12–21	22–38	39–48
*Control (6)	6–11	12–18	19–24
Resourceful (4)	4–7	8–12	13–16
Global score (37)	37–66	67–118	119–148

Note: *The domain was unintentional wrongly labelled in the publication by Rahman et al. (19). The correct label, as stated in this table as per the original list of MeRS items by resilience domains that is accessible at https://link.springer.com/article/10.1186/s12913-021-06542-w (refer to 'Supplementary Information – Additional file 1. [download DOCX])

CFA was performed using IBM SPSS Analysis of Moment Structures (AMOS) version 29 to examine the factorial validity of the MeRS. CFA was employed because the instrument was developed based on a predefined theoretical framework, and the analysis aimed to test whether the observed data fit the hypothesised 4-factor measurement model. Model fit was evaluated using three categories of goodness-of-fit indices: parsimonious, absolute, and incremental. Parsimonious fit was assessed using the chi-square to degrees-of-freedom ratio (χ^2/df). Absolute fit indices included the Goodness-of-Fit Index (GFI) and Root Mean Square Error of Approximation (RMSEA). Incremental fit indices included the Comparative Fit Index (CFI), Tucker–Lewis Index (TLI), and Normed Fit Index (NFI). Acceptable model fit was determined based on commonly recommended thresholds of χ^2/df < 5.0, CFI and TLI ≥ 0.90, GFI ≥ 0.90, and RMSEA ≤ 0.08 (24, 25).

Model refinement was conducted through an iterative process. Items with standardised factor loadings below 0.50 were considered for removal. In addition, modification indices greater than four were examined to identify potential sources of model misfit. Items associated with high modification indices or overlapping measurement errors were removed sequentially while maintaining theoretical consistency with the four resilience domains.

Construct reliability and convergent validity were assessed using composite reliability (CR) and average variance extracted (AVE). CR values of 0.70 or higher were considered acceptable indicators of internal consistency, while AVE values of 0.50 or higher indicated adequate convergent validity (26). Internal consistency of the overall scale was additionally evaluated using Cronbach's alpha, calculated based on item-total statistics.

RESULTS

Participant Characteristic

A total of 242 undergraduate medical students participated in this study, as shown in Table 3. The respondents were from UMS (66.5%) and USM (33.5%). Participants were distributed across all academic years, with the largest proportion from Year 4 (26.9%), followed by Year 3 (21.5%), Year 5 (19.4%), Year 1 (18.2%), and Year 2 (14.0%). Female students constituted the majority of respondents (70.7%), while 29.3% were male.

Table 3: Demographic characteristics of participants, n = 242

Characteristic	Category	Frequency, n (%)
University	UMS	161 (66.5)
	USM	81 (33.5)
Year of study	Year 1	44 (18.2)
	Year 2	34 (14.0)
	Year 3	52 (21.5)
	Year 4	65 (26.9)
	Year 5	47 (19.4)
Gender	Male	71 (29.3)
	Female	171 (70.7)

Confirmatory Factor Analysis (CFA)

CFA was performed to evaluate the factor structure of the MeRS. The initial 37-item 4 factor model demonstrated inadequate model fit based on several goodness-of-fit indices (Figure 1).

The standardised factor loadings for all items exceeded the recommended threshold of 0.50, indicating acceptable indicator reliability. Therefore, model refinement was guided primarily by examining modification indices greater than four. Items associated with high modification indices, suggesting potential redundancy or correlated measurement errors, were sequentially removed while maintaining the theoretical structure of the four resilience domains. This iterative refinement process resulted in several intermediate models with progressively improved fit indices. A summary of the model refinement process and the items removed at each stage is presented in Table 4.

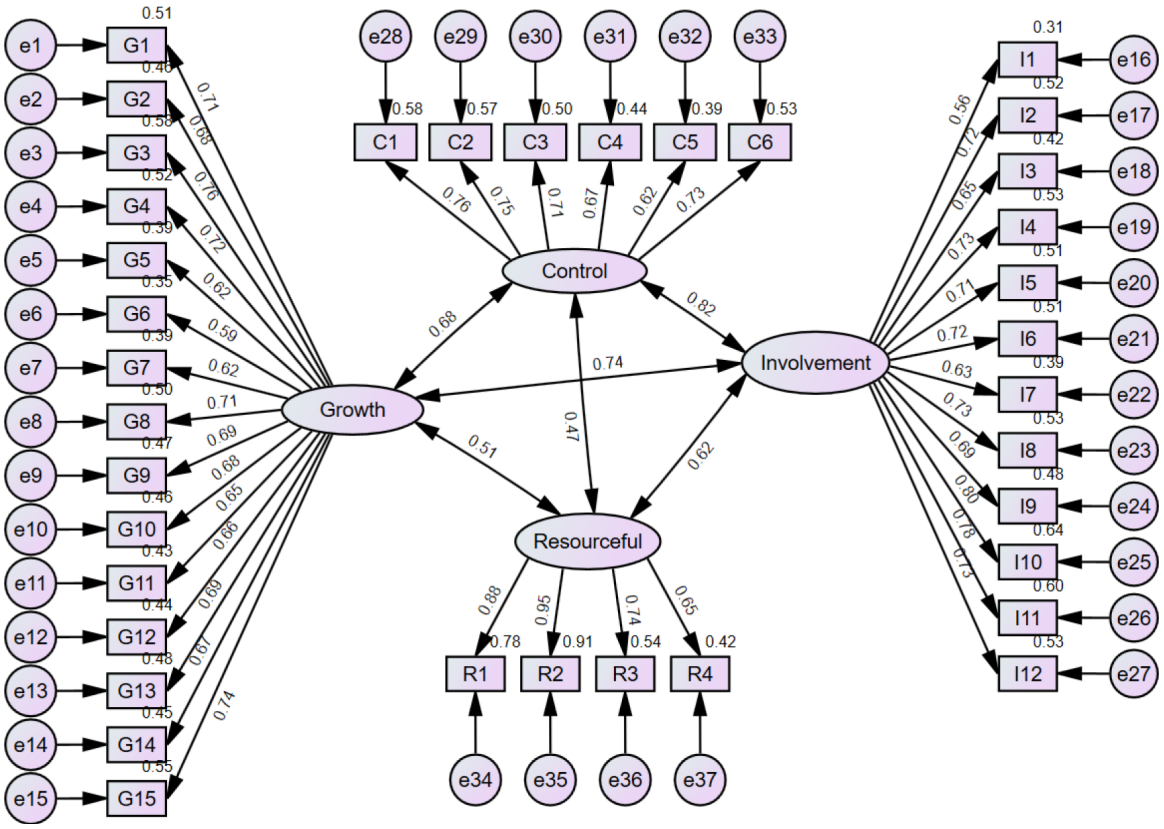

Figure 1: Initial model of the 4-factor MeRS.

Table 4: Comparison of model fit indices for MeRS CFA

Model	Items removed	χ^2	df	Parsimonius fit	Absolute fit		Incremental fit		
				χ^2/df	GFI	RMSEA	CFI	TLI	NFI
Model A Initial model (37 items)	–	1426.567	623	2.290	0.756	0.073	0.851	0.841	0.765
Model B (32 items)	C11, G11, I6, C9, G14	941.740	458	2.056	0.808	0.066	0.889	0.880	0.806
Model C (26 items)	C6, G13, R3, C5, G9, I5	553.984	293	1.891	0.852	0.061	0.921	0.912	0.847
Model D (22 items)	C3, I3, G2, C2	331.212	203	1.632	0.891	0.051	0.950	0.944	0.882
Final model (20 items)	C1, G7	235.835	164	1.438	0.912	0.043	0.969	0.965	0.907

Note: All p-value < 0.001

The standardised factor loadings for the final 20-item model ranged from 0.58 to 0.98 (Table 5), exceeding the recommended minimum threshold of 0.50, indicating that the retained items adequately represented their respective latent constructs.

Table 5: Standardised factor loadings for the final MeRS model

Domain	Item	Standardised loading
Growth	G1	0.71
	G3	0.77
	G4	0.68
	G5	0.63
	G6	0.58
	G8	0.70
	G10	0.69
	G12	0.67
	G15	0.73
Involvement	I4	0.71
	I7	0.59
	I8	0.75
	I10	0.78
	I12	0.73
Control	C1	0.80
	C2	0.83
	C4	0.62
Resourcefulness	R1	0.86
	R2	0.98
	R4	0.63

The final measurement model, consisting of 20 items across 4 resilience domains, is illustrated in Figure 2. The CFA supported a 4-factor structure comprising growth (9 items), involvement (5 items), control (3 items), and resourcefulness (3 items). These retained items represent the refined structure of the MeRS for undergraduate medical students. The complete list of the final validated items is presented in Table 6.

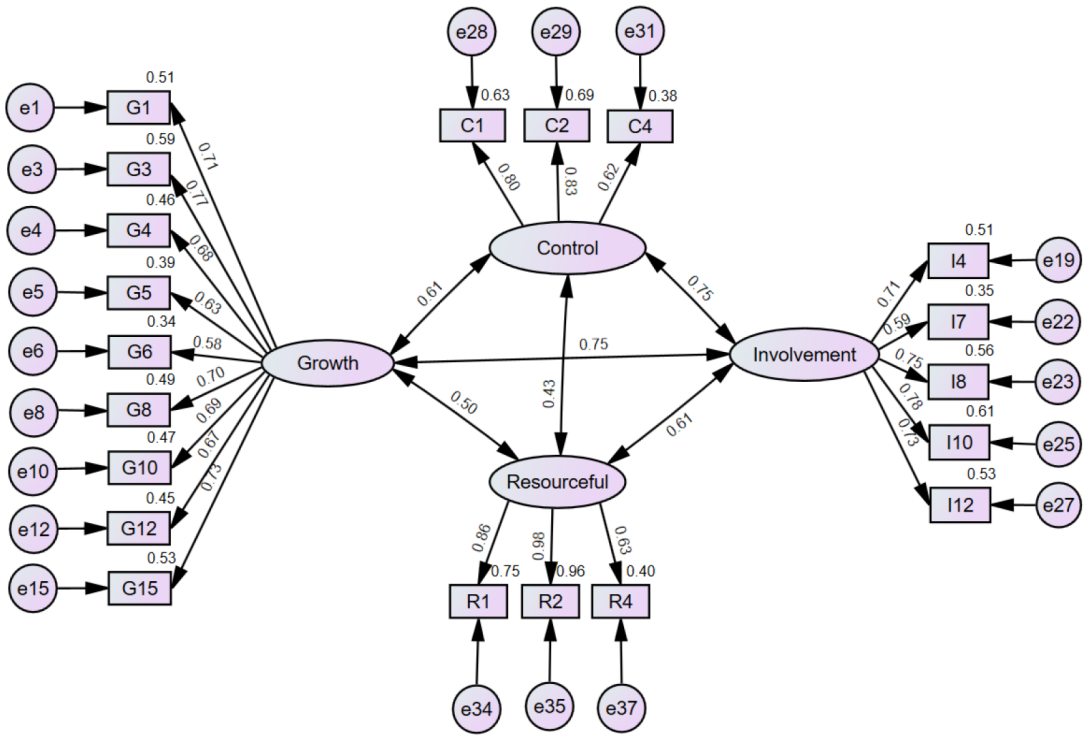

Figure 2: Final CFA Model MeRS-20UG.

Table 6: Final 20-item validated MeRS among medical students

Domain	Items
Growth	I can succeed if I keep trying
	When I face new situations, I will learn from it
	I believe there is a wisdom behind everything in life
	I believe every problem comes with a solution
	I seek help to achieve my goals if necessary
	I have goals to achieve
	I believe self-motivation will change the final outcome
	I am aware of my strengths and abilities
	Believing in myself helps me to face any difficulties
Involvement	I am comfortable working in new environment
	I am proud of my own accomplishments
	I become a stronger person when facing difficulties at work
	I feel energetic doing my work even in difficult situations
	My colleagues can always rely on me
Control	I can stay calm in hard situations
	I can handle unpleasant feelings
	I can control my anger

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Table 6: (*Continued*)

Domain	Items
Resourceful	I know who to talk to when I have a problem
	I know where to go if I need help
	I figure out ways to solve my problems by talking about them

Reliability and Convergent Validity

Construct reliability and convergent validity were evaluated using CR and AVE. CR values ranged from 0.79 to 0.88 (Table 7), exceeding the recommended threshold of 0.70, indicating satisfactory internal consistency across the 4 resilience domains. The AVE values ranged from 0.46 to 0.69, demonstrating acceptable convergent validity. Although the AVE value for the growth domain was slightly below the recommended threshold of 0.50, its CR exceeded 0.60, which is considered acceptable according to established guidelines. The overall MeRS scale also demonstrated good internal consistency, with a Cronbach's alpha value of 0.926.

Table 7: Measurement model validity and reliability of the final MeRS

Construct	Item	Factor loading (λ)	λ^2	Cronbach alpha	CR	AVE
Growth	G1	0.71	0.50	0.888	0.88	0.46
	G3	0.77	0.59			
	G4	0.68	0.46			
	G5	0.63	0.40			
	G6	0.58	0.34			
	G8	0.70	0.49			
	G10	0.69	0.48			
	G12	0.67	0.45			
	G15	0.73	0.53			
Involvement	I4	0.71	0.50	0.837	0.84	0.52
	I7	0.59	0.35			
	I8	0.75	0.56			
	I10	0.78	0.61			
	I12	0.73	0.53			
Control	C1	0.80	0.64	0.787	0.79	0.57
	C2	0.83	0.69			
	C4	0.62	0.38			
Resourcefulness	R1	0.86	0.74	0.858	0.86	0.69
	R2	0.98	0.96			
	R4	0.63	0.40			

Note: λ = Standardised factor loading; λ^2 = Indicator reliability; CR = Composite reliability; AVE = Average variance extracted

DISCUSSION

The results demonstrated that the final 20-item model provided an adequate fit to the data and retained the four underlying constructs of resilience: growth, involvement, control, and resourcefulness. The findings support the multidimensional structure of resilience and suggest that the shortened MeRS model (MeRS-20UG) is a valid instrument for assessing resilience among medical students. The results also provide empirical support for the Integrated Resilience Model, which conceptualises resilience as a multidimensional construct encompassing internal and external adaptive processes (1). In the present study, the four conceptual domains of resilience were retained in the final model, indicating that these dimensions remain relevant in the context of undergraduate medical education.

The growth domain retained the largest number of items in the final model, suggesting that internal cognitive adaptation and personal development may represent a central component of resilience in this population. Previous research has shown that resilience is associated with positive coping strategies and academic adjustment among medical students, enabling them to maintain motivation and performance despite academic stressors (27).

The control domain demonstrated satisfactory factor loadings and reliability, indicating that the ability to regulate emotions and remain composed under stress is an important component of resilience in medical education. Emotional regulation plays a central role in maintaining psychological stability, particularly in high-pressure academic and clinical environments. Previous studies have shown that emotional regulation not only contributes directly to psychological well-being but also mediates the relationship between resilience and stress-related outcomes (28). Similarly, emotional regulation strategies have been reported to be significantly associated with resilience and reduced test anxiety among medical students (29).

The involvement domain reflects medical students' active engagement, persistence, and sense of commitment in navigating the challenges of medical training. This includes maintaining motivation, adapting to new environments, taking pride in achievements, and sustaining energy despite difficulties. These characteristics indicate a behavioural and motivational dimension of resilience, where individuals remain functionally engaged even under stress. Empirical evidence suggests that students who exhibit higher levels of engagement and adaptive functioning are better able to cope with academic and clinical demands among medical students and contribute to their ability to navigate the demands of medical education (30).

Finally, the resourcefulness domain highlights the importance of utilising available resources and support systems when encountering difficulties. Social and institutional support have been widely recognised as important factors contributing to resilience among healthcare trainees. Supportive learning environments, mentorship, and peer networks can help students manage stress and maintain well-being throughout their medical training (31).

Together, these findings support the multidimensional nature of resilience and highlight the importance of both internal psychological factors, such as emotional regulation and cognitive adaptation, and external factors, such as coping strategies and social support, in promoting resilience among medical students. From an educational perspective, MeRS-20UG may serve as a practical tool for assessing resilience among medical students. Identifying resilience levels in medical students may help educators design targeted interventions to support student well-being and coping strategies.

Strengths and Limitations

This study provides important psychometric evidence supporting the validity and reliability of the MeRS among undergraduate medical students. A key strength of this study is the use of CFA to evaluate the instrument's factor structure, enabling a rigorous assessment of construct validity. The analysis was conducted using AMOS and multiple model fit indices, including parsimonious, absolute, and incremental indices, thereby strengthening the robustness of the validation process. In addition, the study contributes to the limited literature on resilience measurement specifically tailored to medical professionals, as most existing resilience scales were originally developed for general populations rather than healthcare trainees. By validating the MeRS among medical students, this study broadens the instrument's applicability to individuals at an earlier stage of medical training.

However, several limitations should be considered when interpreting the findings. First, the study employed a cross-sectional design, which limits the ability to examine changes in resilience over time. Longitudinal studies would be useful for exploring how resilience evolves across different stages of medical education. Second, participants were recruited using convenience sampling, which may introduce selection bias and limit the generalisability of the findings to other medical schools or cultural contexts. Future studies involving larger and more diverse samples across multiple institutions would help further confirm the stability of the measurement model. Third, the data were collected using self-administered questionnaires, which may be subject to response bias, including social desirability bias. Despite these limitations, the study provides valuable evidence supporting the use of the MeRS as a psychometrically sound instrument for assessing resilience among medical students.

CONCLUSION

This study provides evidence supporting the construct validity and reliability of the MeRS among undergraduate medical students. The CFA supported a refined 20-item four-domain model comprising growth, control, involvement, and resourcefulness, which demonstrated satisfactory model fit and internal consistency. These findings suggest that MeRS-20UG is a valid instrument for assessing resilience within the context of undergraduate medical education. The scale may serve as a useful tool for identifying resilience levels among medical students and for informing educational strategies to strengthen resilience during medical training.

ACKNOWLEDGEMENTS

This research is part of a project supported by the Fundamental Research Grant Scheme (FRGS/1/2024/SSI09/USM/02/12), Ministry of Higher Education, Malaysia.

ETHICAL APPROVAL

Ethical approval for this study was obtained from the UMS Medical Research Ethics Committee (Ref: JKEtika 4/24 [9]) and from the USM Medical Research Ethics Committee (Ref: USM/JEPeM/KK/24100910).

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