ORIGINAL ARTICLE

A Confirmatory Factor Analysis Study on the Medical Student Stressor Questionnaire among Malaysian medical students

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Abstract

Objective: To determine the construct validity, convergent validity, construct reliability and internal consistency of the Medical Student Stressor Questionnaire (MSSQ) among first-year medical students in Malaysia.

Methods: A multicenter cross-sectional study was done on 375 medical students of four medical schools in Malaysia. The confirmatory factor analysis and reliability analysis were applied to measure construct validity, construct reliability and internal consistency of the MSSQ. These analyses were done using Predictive Analytics SoftWare (PASW) version 18 and Analysis of Moment Structure (AMOS) version 19. The Composite Reliability and Average Variance Extracted of the final constructs were calculated manually to determine construct reliability and convergent validity.

Results: A total of 359 (95.7%) medical students responded to this study. The confirmatory factor analysis showed the six factor model with 20 items had a good fit with the latent constructs (X^2 (df) = 258.02 (155), $p < 0.001$, RMR = 0.055, GFI = 0.933, AGFI = 0.910, NFI = 0.931, RFI = 0.916, IFI = 0.971, TLI = 0.965, CFI = 0.971, RMSEA = 0.043). The Cronbach's alpha value of the MSSQ was 0.92. The Cronbach's alpha values of the six constructs were more than 0.7. Composite Reliability and Average Variance Extracted values of the six constructs were more than 0.6 and 0.5 respectively indicating good construct reliability and adequate convergent validity.

Conclusion: This study suggested that the six factor model with 20 items of the MSSQ had a good fit and shown good psychometric values. It is a valid and reliability measurement to identify stressors among medical students across institutions in Malaysia.

Keywords: validity, reliability, medical students, stressors, MSSQ, confirmatory factor analysis.

Introduction

The milieu of medical education has always been regarded as a stressful setting to students. There are so many potential stressors that can cause stress to medical students, however, studies have revealed that the stressors affecting medical students wellbeing seems to be related to the medical training (1-6). Stress is defined as the body's nonspecific response or reaction to demands made on it, or to disturbing events in the environment (7, 8). Good stress which can promote and facilitate learning is needed in medical training but bad stress that can inhibit and suppress learning should be avoided and minimized (9). Studies have reported high prevalence of psychological distress among medical students, ranging from 21% to 56% (1, 2, 10-14). Researchers have reported the association of bad stress level with lowered medical students' self-esteem (9), anxiety and depression (15, 16), difficulties in solving interpersonal conflicts (17), sleeping disorders (18), increased alcohol and drug consumption (19- 21), cynicism, decreased attention, reduced concentration and academic dishonesty (22). As a result, medical students may feel inadequate and unsatisfied with their career as a medical practitioner in the future (3). Thus, many researchers have stated the importance of early diagnosis as well as stressors identification, which can prevent possible future illnesses among medical students (1, 8, 11).

A stressor is defined as a personal or environmental event that causes stress (23). Stressors of medical students are generally related to academic, intrapersonal and interpersonal, teaching and learning, social, drive and desire, and group activities (24). Curriculum differences among medical schools seem did not influence the overall pattern of stressors (i.e. most of the top stressors are related to academic matters), although frequency (rank) of some stressors may be significantly different (4, 5). Similar stressors may be perceived differently by different medical students, depending on their cultural background, personal traits, experience and coping skills (4, 5, 24).

One of the instruments that have been used to identify stressors among medical students is the Medical Student Stressor Questionnaire (MSSQ) (24-26). The instrument has been validated on medical students across years of study and across medical schools in Malaysian (24, 25). These studies showed that it was remarkably reliable and valid in detecting stressor of medical students. However, the biggest limitation is its validity and reliability has been tested only for exploratory factor analysis not the confirmatory factor analysis. Therefore, the rationale of this study is to test the goodness of fit of the MSSQ constructs through confirmatory factor analysis hence in the future it could be used as a valid and reliable instrument to identify stressors among Malaysian medical students.

Methods

This was a multicenter cross-sectional study involving first year medical students from four Malaysian public universities in academic session 2008/2009; Universiti Sains Malaysia (USM), Universiti Putra Malaysia (UPM), Universiti Malaysia Sabah (UMS) and Universiti Malaysia Sarawak (UNIMAS). The total number of first year medical students for the four universities was approximately 800. Simple random sampling was done in one university and for the other three universities, convenient sampling method was applied due to logistic and timing constraints where the researchers had difficulties in obtaining student list before hand and examination periods were close to each other.

The MSSQ is a validated instrument used to identify sources of stress (24-26). The items in MSSQ represent 40 possible sources of stress in medical students identified from the literature grouped into six main domains; Academic Related Stressor (ARS), Intrapersonal and Interpersonal Related Stressor (IRS), Teaching and Learning Related Stressor (TLRS), Social Related Stressor (SRS),

Drive and Desire Related Stressor (DRS), and Group Activities Related Stressor (GARS). Respondents were asked to rate each source by choosing from five responses, 'causing no stress at all', 'causing mild stress', 'causing moderate stress', 'causing high stress' and 'causing severe stress'. The scoring method assigns marks from 0 to 4 to each of the responses respectively. The reliability coefficients of the stressor groups have ranged from 0.64 to 0.92 (24-26).

The investigator obtained permission and clearance from the School of Medical Sciences and Human Ethical Committee of Universiti Sains Malaysia. Informed consent was obtained from the respondents and they were requested to fill in the questionnaire voluntarily. Guided self-administered questionnaire were distributed to the medical students during face-to-face sessions in a lecture hall. The students were told to follow the instructions. Filling in the questionnaire took about 10 to 15 minutes and they were returned right after they had completed the questionnaire.

The confirmatory factor analysis was done using Analysis of Moment Structure (AMOS) software version 19. The measurement model fit with the data was checked with model chi-square goodness-of-fit, and approximate fit indexes (27). Insignificant model chi-square goodness-of-fit (set at 0.05) signifies model fit. For approximate fit indexes, Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), Normed fit index (NFI), relative fit index (RFI), incremental fit index (IFI), Tucker-Lewis fit index (TFI) and comparative fit index (CFI) of above 0.9 would indicate model fit (27, 28). For another approximate fit index, root mean square error of approximation (RMSEA), a value less than 0.08 Root Mean Squared Residual (RMR) value less than 0.05 would signify reasonable model fit (29). Significance of standardized regression weight (standardized loading factor) estimates signifies that the indicator variables are significant and representative of their latent variable. Significance of estimates of correlations indicates significant two-way correlation between specified variables. Modification indices (M.I) suggested correlations between variables and the respective reductions in chi-square values should these correlations added to the model. Though reduction in chi-square values would improve model fit, following the suggestions in M.I. should be based on literature review or theoretical basis (28).

Based on the final model, Composite Reliability (CR) and Average Variance Extracted (AVE) were calculated manually by computing formulas given by Fornell and Larckers (1981) using the Microsoft Excell 2007 (refer to table 3 for the formulas). The CR and AVE values of more than 0.6 and 0.5 respectively indicating good construct reliability and adequate convergent validity (30).

The Cronbach's alpha values was analysed by PASW version 18. For an estimation of reliability, statistical reliability of individual items was done. Items with corrected-item total correlation value of more than 0.3 indicated the items were loaded well in the constructs. The Cronbach's alpha value of deleted item could determine which item highly contributed to the reliability of the MSSQ. If the Cronbach's alpha value for those items-deleted decreased, it would indicate that the items highly contributed to alpha value. In contrast, if the Cronbach's alpha value for those items-deleted increased, it would indicate that the items poorly contributed to alpha value. The items of MSSQ were considered to represent measure of good internal consistency if the total alpha value was more than 0.6 (27, 31).

Results

Demographic profile of respondents

A total of 359 (92.7%) medical students responded. 226 (63%) were female students. There were 188 (52.4%) Malays, 126 (35.1%) Chinese, 26 (7.2%) Indians and 19 (5.3%) others. Approximately 278 (77.4%) students were from matriculation, 69 (19.2%) students

were from STPM and 12 (3.3%) students had other entry qualifications. There were 198 (55.2%) were Muslim, 83 (23.1%) were Buddhist, 54 (15%) were Christian, 17 (4.7%) were Hindu and 7 (1.9%) were of other religions. There were 98 (27.6%) from USM, 103 (28.9%) from UPM, 71 (19.9%) from UMS, and 84 (23.6%) from UNIMAS. A total of 162 (45.1%) students' fathers' education were at secondary level, 140 (39%) at tertiary level, 45 (12.5%) at primary level, 7 (1.9%) had other levels, and 5 (1.4%) never underwent formal education. Students' mothers' education level were 193 (53.8%) at secondary level, 97 (27%) at tertiary level, 59 (16.4%) at primary level, 6 (1.7%) never underwent formal education, and 4 (1.1%) at other levels. Regarding students' parents' total income per month, 140 (39%) earned between RM 1501 to RM 5000, 101 (28.1%) earned between RM 701 to RM 1500, 55 (15.3%) earned between RM 5001 to RM 10000, 31 (8.6%) earned less than RM 700, 20 (5.6%) earned between RM 10001 to RM 20000, and 12 (3.3%) earned more than RM 20000. Students' parents' relationship status were 325 (90.5%) living together, 13 (3.6%) divorced, 14 (3.9%) mother stays alone (father passed away), 5 (1.4%) father stays alone (mother passed away), and 2 (0.6%) others.

Confirmatory Factor Analysis & Reliability Analysis

Model 1: The original six-factor model with 40 items as suggested by previous studies (15) (ARS was represented by item 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 16 and 17; IRS was represented by item 25, 26, 27, 28, 29, 30 and 31; TLRS was represented by item 19, 20, 22, 34, 35, 36, and 37; SRS was represented by item 18, 21, 23, 24, 38, and 39; DRS was represented by item 32, 33 and 40; GARS was represented by item 12, 13, 14, and 15 as shown in table 1) was analysed by the AMOS revealed a poor fit with the latent constructs (X^2 (df) = 2041.99 (725), $p < 0.001$, RMR = 0.091, GFI = 0.772, AGFI = 0.742, NFI = 0.759, RFI = 0.741, IFI = 0.830, TLI = 0.816, CFI = 0.829, RMSEA = 0.071), indicating needs for further modification based on the Modification indices (M.I).

Model 2: Seven items (i.e. item 8, 12, 17, 25, 26, 30, and 38) were removed based on the M.I of the model 1. The six-factor model with 33 items (ARS was represented by item 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, and 16; IRS was represented by item 27, 28, 29 and 31; TLRS was represented by item 19, 20, 22, 34, 35, 36, and 37; SRS was represented by item 18, 21, 23, 24, and 39; DRS was represented by item 32, 33 and 40; GARS was represented by item 13, 14, and 15) was analysed and showed a poor fit with the latent constructs (X^2 (df) = 1010.61 (449), $p < 0.001$, RMR = 0.071, GFI = 0.847, AGFI = 0.820, NFI = 0.836, RFI = 0.819, IFI = 0.902, TLI = 0.891, CFI = 0.901, RMSEA = 0.059), indicating further modification was necessary based on the M.I to improve the model fitness.

Model 3: Another 11 items (i.e. item 4, 5, 6, 9, 10, 16, 18, 20, 22, 34, and 39) were removed based on the M.I of the model 2. The six-factor model with 22 items (ARS was represented by item 1, 2, 3, 7, and 11; IRS was represented by item 27, 28, 29 and 31; TLRS was represented by item 19, 35, 36, and 37; SRS was represented by item 21, 23, and 24; DRS was represented by item 32, 33 and 40; GARS was represented by item 13, 14, and 15) was analysed and showed a poor fit with the latent constructs (X^2 (df) = 355.10 (194), $p < 0.001$, RMR = 0.060, GFI = 0.918, AGFI = 0.893, NFI = 0.912, RFI = 0.895, IFI = 0.958, TLI = 0.949, CFI = 0.958, RMSEA = 0.048), indicating further modification was necessary based on the M.I to improve the model fitness.

Model 4: Based on the M.I of the model 3 another two items (i.e. item 19 and 40) were removed from the model 3 based on the M.I. The six-factor model with 20 items (ARS was represented by item 1, 2, 3, 7, and 11; IRS was represented by item 27, 28, 29 and 31; TLRS was represented by item 35, 36, and 37; SRS was represented by item 21, 23, and 24; DRS was represented by item 32 and 33; GARS was represented by item 13, 14, and 15) was analysed and found a good fit with the latent constructs (X^2 (df) = 258.02 (155), $p < 0.001$, RMR = 0.055, GF = 0.933, AGFI = 0.91, NFI = 0.931, RFI = 0.916, IFI = 0.971, TLI = 0.965, CFI = 0.971, RMSEA = 0.043). This final model was

shown in the figure 1. Standardized factor loadings showed that all the items in the model 4 well loaded on each latent construct and the correlations between constructs ranged from 0.38 to 0.75 as shown in table 2.

Reliability analysis (table 3) showed that the total Cronbach's alpha value of the model 4 of the MSSQ was 0.915 indicating a high level of internal consistency (31-34). All the items had corrected-item total correlation of more than 0.3 and highly contributed to the inventory reliability. The Cronbach's alpha values of the ARS, IRS, TLRS, SRS, DRS and GARS were more than 0.7. Those domains show high levels of internal consistency (31, 35)Composite Reliability (CR) and Average Variance Extracted (AVE) was more than 0.6 and 0.5 respectively indicating good construct reliability and adequate convergent validity (21). These findings suggested that the 20 items of the MSSQ was reliable and had a high level of internal consistency.

Discussion

Reliability generally is defined as consistency or reproducibility of measurement over time or occasions, while validity is generally defined as to what extent the measurement measures what it should measure (31-36). The confirmatory factor analysis showed that the final model with 20 items had a good fit as all the goodness of fit indices support the model fit. The 20 items were also well loaded into the six constructs (figure 1) as all the items had standardized loading factors of more than 0.3 (28). It concurred that the MSSQ had a good latent constructs. It was evidence to suggest that the MSSQ measured what it should measure. The present findings provide evidence to support that the MSSQ is a valid instrument to determine stressors among medical students across medical schools. The finding is comparable with the previous study (24, 25).

The reliability analysis suggested that the final model items of the MSSQ exhibited a measure of high internal consistency as their Cronbach's alpha were more than 0.7 as shown in table 3; it reflected the high internal reliability of the inventory (35). The six constructs had also shown a measure of good internal consistency, good constructs reliability and convergent validity as the Cronbach's alpha, Composite Reliability and EVA values were more than 0.7, 0.6 and 0.5 respectively; it was another evidence to support good construct reliability and adequate convergent validity of the inventory (35, 30). These findings provided evidence to support that the MSSQ is a reliable instrument that could be used in the future to indentify stressors among medical students across medical schools. Present study findings are in keeping with the previous study (24, 25)

The reliability and factor analyses have provided evidences of validity and reliability of the MSSQ in identification of stressors among medical students across institutions and cultures. However, limitation of this study was it is only confined to the Malaysian medical student population. Therefore it is recommended that a multinational validation study should be conducted in the future to determine the validity and reliability of the MSSQ across nationalities.

Conclusion

This study suggested that the six factor model with 20 items of the MSSQ had a good fit and shown good psychometric values. It is a valid and reliability measurement to identify stressors among medical students across institutions in Malaysia.

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Table 1: The original six-factor model as reported by two previous studies (24, 25).

No	Items	Stressor group*
1	Tests/examinations	
2	Falling behind in reading schedule	
3	Large amount of content to be learnt	
4	Having difficulty understanding the content	
5	Getting poor marks	
6	Quota system in examinations	
7	Lack of time to review what have been learnt	**ARS**
8	Need to do well (self-expectation)	
9	Learning context – full of competition	
10	Unable to answer the questions from the teachers	
11	Heavy workload	
16	Unjustified grading process	
17	Not enough medical skill practice	
25	Conflicts with other students	
26	Poor motivation to learn	
27	Verbal or physical abuse by other student(s)	
28	Verbal or physical abuse by teacher(s)	**IRS**
29	Verbal or physical abuse by personnel(s)	
30	Conflict with personnel(s)	
31	Conflict with teacher(s)	
19	Teacher – lack of teaching skills	
20	Not enough study material	
22	Inappropriate assignments	
34	Lack of guidance from teacher (s)	**TLRS**
35	Not enough feedback from teacher (s)	
36	Uncertainty of what is expected of me	
37	Lack of recognition for work done	
18	Lack of time for family and friends	
21	Unable to answer questions from patients	
23	Talking to patients about personal problems	**SRS**
24	Facing illness or death of the patients	
38	Working with computers	
39	Frequent interruption of my work by others	
32	Unwillingness to study medicine	
33	Parental wish for you to study medicine	**DRS**
40	Family responsibilities	
12	Participation in class discussion	
13	Participation in class presentation	**GARS**
14	Need to do well (imposed by others)	
15	Feeling of incompetence	

*Stressor groups; **ARS** = Academic Related Stressor, **IRS** = Intrapersonal & Interpersonal Related Stressor, **TLRS** = Teaching & Learning Related Stressors, **SRS** = Social Related Stressors, **DRS** = Drive & Desire Related Stressors, **GARS** = Group Activities Related Stressors.

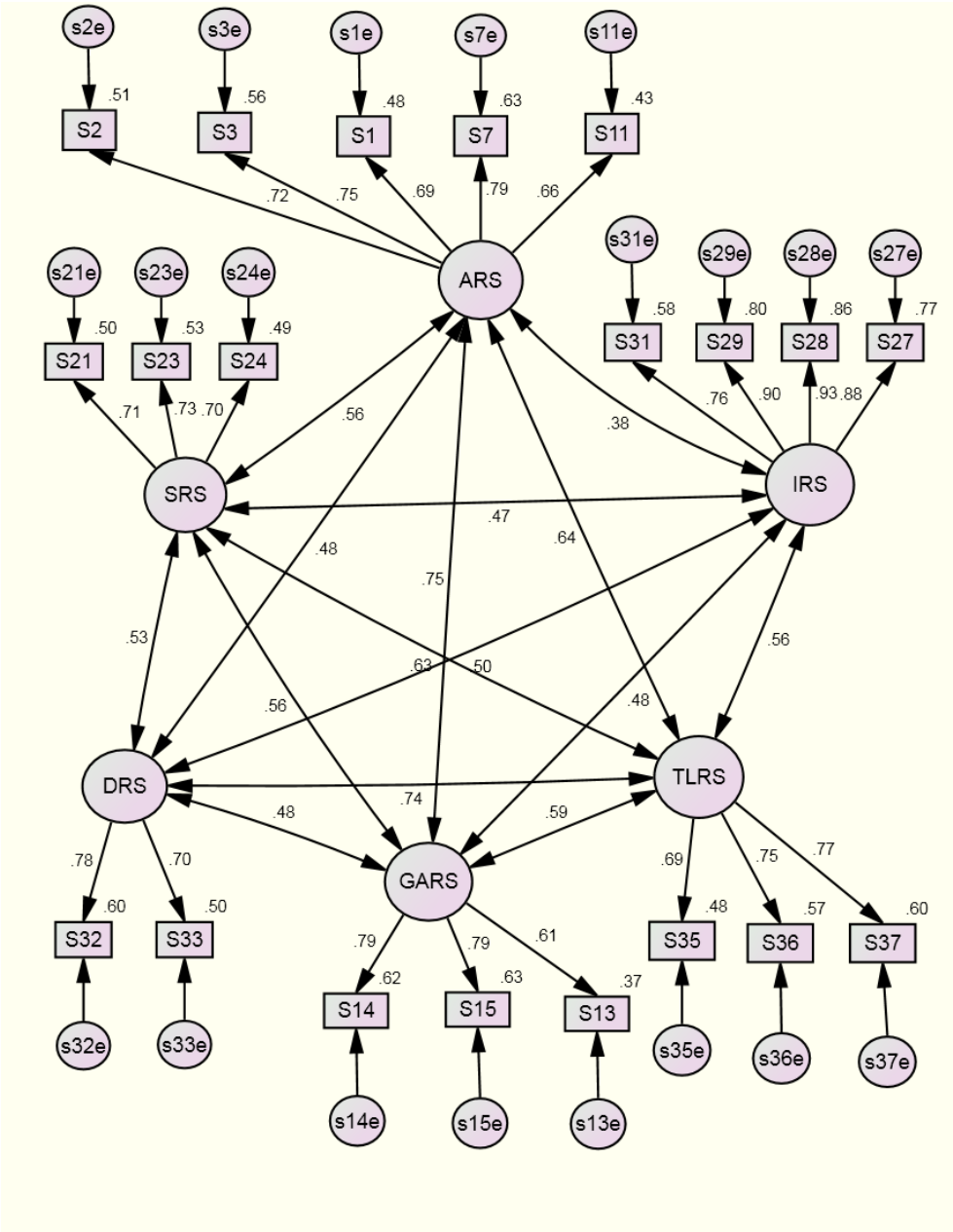

Figure 1: Standardized factor loading of the final model of the MSSQ in Malaysian first year medical students.

Table 2: The estimated correlations between the six constructs based on the final model (model 4).

Variable	Estimated Correlation Coefficient (r)[a] (N=359)				
	IRS	TLRS	SRS	DRS	GARS
ARS	0.38**	0.64**	0.56**	0.48**	0.75**
IRS		0.56**	0.47**	0.50**	0.48**
TLRS			0.63**	0.74**	0.59**
SRS				0.53**	0.56**
DRS					0.48**

[a] Analysis was done by AMOS version 19, ** $p < 0.01$

Table 3: The reliability analysis of the 20 items of the MSSQ based on the final model.

No	Item	[a]Corrected Item-Total Correlation	[a]Cronbach's Alpha if Item Deleted	[b]Domain	[a]Cronbach's Alpha	[c]AVE	[d]CR
1	Tests/examinations	0.522	0.912	ARS	0.84	0.52	0.87
2	Falling behind in reading schedule	0.523	0.912				
3	Large amount of content to be learnt	0.546	0.911				
7	Lack of time to review what have been learnt	0.606	0.910				
11	Heavy workload	0.564	0.911				
27	Verbal or physical abuse by other student(s)	0.619	0.910	IRS	0.92	0.76	0.91
28	Verbal or physical abuse by teacher(s)	0.607	0.910				
29	Verbal or physical abuse by personnel(s)	0.657	0.909				
31	Conflict with teacher(s)	0.600	0.910				
35	Not enough feedback from teacher (s)	0.619	0.910	TLRS	0.78	0.54	0.78
36	Uncertainty of what is expected of me	0.590	0.910				
37	Lack of recognition for work done	0.613	0.910				
21	Unable to answer questions from patients	0.536	0.912	SRS	0.75	0.51	0.76
23	Talking to patients about personal problems	0.534	0.912				
24	Facing illness or death of the patients	0.481	0.913				
32	Unwillingness to study medicine	0.536	0.912	DRS	0.71	0.55	0.71
33	Parental wish for you to study medicine	0.486	0.913				
13	Participation in class presentation	0.528	0.912	GARS	0.77	0.54	0.78
14	Need to do well (imposed by others)	0.565	0.911				
15	Feeling of incompetence	0.600	0.910				

[a]Reliability analysis; Cronbach's Alpha Coefficient, overall Cronbach's alpha = 0.915

[b]Domains were predetermined based on previous two studies.

[c]AVE (Average Variance Extracted) was calculated manually based on formula given by Fornell & David (1981)

$$VE = \frac{\sum_{i=1}^{n} \lambda_i^2}{n}$$

λ = standardized factor loading, *n* = number of item

[d]CR (Composite Reliability) was calculated based on formula given by Fornell & David (1981)

$$CR = \frac{(\sum_{i=1}^{n} \lambda_i)^2}{(\sum_{i=1}^{n} \lambda_i)^2 + (\sum_{i=1}^{n} \delta_i)}$$

λ = standardized factor loading, δ = error variance

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