Psychometric properties of the Medical Student Wellbeing Index at different interval of measurements in a cohort of medical students.

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ABSTRACT

Background: One of important educational climate roles is to provide an environment that promotes positive development of medical students' psychological wellbeing during training. Unfortunately, many studies have reported that educational climate in medical education are not favourable to them. Therefore, it is a real need for a simple, valid, reliable and stable tool that will help medical schools to screen psychological wellbeing of their students so that early intervention could be done. **Objective**: This study aimed to explore the psychometric properties of the Medical Student Wellbeing Index (MSWBI) to measure psychological wellbeing at different interval of measurements in a cohort of medical students. **Method**: A prospective study was done on a cohort of medical students. MSWBI was administered to the medical students at five different intervals. The confirmatory factor analysis, Cronbach's alpha and intra-class correlation analysis were applied to measure construct validity, internal consistency and agreement level at different interval of measurements. **Result**: A total of 153 (89.5%) medical students responded completely to the MSWBI. The MSWBI showed that the one-factor model had acceptable values for most of the goodness of fit indices signified its construct was stable across multiple measurements. The overall Cronbach's alpha values for the MSWBI at the five measurements ranged between 0.69 and 0.78. The ICC coefficient values for the MSWBI total score was 0.58 to 0.59. **Conclusion**: This study found that the MSWBI had stable psychometric properties as a screening tool for measuring psychological wellbeing among medical students at different time and occasions. Continued research is required to refine and verify its psychometric credentials at different educational settings.

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Introduction

It is widely agreed among medical educators that optimal educational environment is an important factor for effective learning to occur (1-4). Indeed, evaluation of the educational environment has been highlighted as a key to the delivery of a high quality medical education (1, 2). One of important educational climate roles is to provide a favourable environment that can promote the positive development of medical students' psychological wellbeing during medical training; therefore, they will get the best environment to facilitate their learning. Unfortunately, many studies have reported that the educational environment in medical education is not favourable to them, in fact their psychological wellbeing are deteriorating and escalating throughout the medical training (5-7). It is worthy highlighting that psychological wellbeing is crucial to the overall wellbeing of every individual including the medical students as future doctors, in which directly or indirectly will affect the quality of patient care provided (5, 8, 9). Therefore, it is a real need for medical schools to identify medical students' psychological wellbeing status so that early intervention could be planned and implemented as required. To facilitate this effort requires psychometrically valid, reliable and stable instrument that can be easily used to screen their psychological wellbeing. Among the existing instruments assessing psychological wellbeing is the Medical Student Wellbeing Index (MSWBI). It is a new and promising screening tool due to it is a valid, reliable, short (i.e. has 7 items), simple and consume less time to be administered (10, 11). Despite its potentials, so far only two articles (10, 11) reported its psychometric credentials, therefore more research is required to verify its psychometric credentials particularly the stability aspect. Likewise, to the author's knowledge, there is none of articles reported its psychometric credentials with regard to its stability in measuring the psychological wellbeing of medical students across different occasions and time. From that notion, this study aimed to explore its stability throughout different intervals and occasions through a cohort of medical students prospectively.

Validity is broadly described as the ability of a measurement tool to measure a attribute that is intended to measure (12) while reliability is broadly described as the consistency or reproducibility of a measurement over time and occasions. The reliability can be gauged in the form of internal consistency and stability (12). The internal consistency of a tool is commonly measured based on single administration while the stability of a tool is measured based on multiple administrations (12). The internal consistency is measured by various ways such as Cronbach's alpha, Kuder-Richardson and split halves (12). Stability is measured by the degree of agreement between observations based on multiple administrations in the form of test-retest reliability (12). The degree of agreement between multiple observations can be gauged as correlation coefficients such as intraclass correlation coefficient (ICC) and kappa Cohen coefficient (13-15). The initial psychometric evaluation that was carried out by its developer showed that the MSWBI has good level of content validity and internal consistency (i.e. the Cronbach's alpha value was 0.68) to measure psychological wellbeing (11). Likewise, a recent study reported that the MSWBI has good construct validity as the confirmatory factor analysis signified its model fitness and has good level of internal consistency as the Cronbach's alpha value was 0.69 (10); therefore these facts support its psychometric credentials. Nevertheless, so far none of article reported its stability, therefore, this study was done to fill in the gap and to add more evidence related to its psychometric credentials in measuring psychological wellbeing of medical students.

This study was designed to answers three questions; 1) what is the construct validity of the MSWBI over multiple administrations? 2) What is the internal consistency of the MSWBI over multiple administrations? 3) What is the degree of agreement between measurements of the MSWBI over multiple administrations? The author hypothesized that the MSWBI would demonstrate good level of stability in measuring medical students' psychological wellbeing over multiple administrations. It was hoped that this study will provide evidence for its stability to

measure psychological wellbeing across time and occasions.

Method

A prospective study was conducted and a total of 500 medical students from year one to five were invited to participate in this study through stratified random sampling method. They were stratified according sex and ethic group (i.e. Malay and non-Malay). They were invited to participate in this study through postal invitation. Letters of invitation were sent out to them 2 weeks before data collection. Those who agreed to participate in this study were requested to fill in and sign on an informed consent form prior to the MSWBI administration. The MSWBI were administered to the participants at five different intervals; baseline (time 1), 4 weeks (time 2), 8 weeks (time 3), 16 weeks (time 4) and 32 weeks (time 5) in the 2011-2012 academic session. Ethical approval was obtained from the Human Ethical Committee of Universiti Sains Malaysia prior to the study start.

The MSWBI was developed as a screening tool for psychological distress among medical students (the term distress is broadly referred to anxiety, depression, burnout and mental health related problems) (11). It has seven items representing manifestations of burnout, depression, fatigue, stress and quality of life. All response options were YES or NO; binary scoring system was applied where YES and NO responses were given score 1 and 0 respectively (10). A high score indicates a high level of psychological distress experienced (10, 11). So far it was validated among medical students in US (11) and Malaysia (10). However, both studies did not explore the stability aspects of it.

The confirmatory factor analysis (CFA) was performed using the Analysis of Moment Structure (AMOS) 19 at each measurement interval. The measurement of model fit with the data was checked with model chi-square goodness-of-fit, and approximate fit indices (Piaw, 2009). Insignificant model chi-square goodness-of-fit (set at 0.05) signifies model fit. For approximate fit indexes, Adjusted Goodness

of Fit Index (AGFI), Goodness of Fit Index (GFI), relative fit index (RFI), incremental fit index (IFI), Tucker-Lewis fit index (TFI), comparative fit index (CFI) and Normed fit index (NFI) of above 0.9 would indicate model fit (16-20). For another approximate fit index, root mean squared residual (RMR) value less than 0.05 and root mean square error of approximation (RMSEA) value less than 0.08 would signify sound model fit (17, 19-22). Significant of estimates of correlations indicates significant two-way correlation between specified variables. Modification indices (MI) suggested correlations between variables and the respective reductions in chi-square values should these correlations added to the model (17). Significant of standardized regression weighted (i.e. standardized loading factor) estimates signify that the indicator variables are significant and representative of their latent variable (17). Standardized residual covariances (SRC) is used to estimate a standard normal distribution if the model is correct, so, if the model is correct, most of items should have an SRC value of less than two in absolute value (16, 17). Thus, MI, SRC and standardized regression weighted were used as indicators to select which items fit to be remained in the model (17). Though reduction in chi-square values would improve model fit, following the suggestions in MI, SRC and standardized regression weighted should be based on literature review or theoretical basis (18-20, 22). Its construct was considered as having good degree of stability if the goodness of fit indices consistently signifies model fit throughout the five measurements.

Reliability analysis was performed using Statistical Package for Social Sciences version 19 (SPSS 19) to determine the internal consistency of the MSWBI The items were considered to represent an acceptable level of internal consistency if the Cronbach's alpha value within 0.5 to 0.7 and good level if the Cronbach's alpha value more than 0.7 (12, 13, 23). The MSWBI was considered as having good level of stability if its Cronbach's alpha value consistently more than 0.6 across the five measurements (22-25).

Intra-class correlation (ICC) analysis was performed using SPSS 19 to determine level of agreement between measurements at four different intervals. The ICC coefficient value less than 0.2 was considered as poor agreement, 0.21 to 0.40 was considered as fair agreement, 0.41 to 0.60 was considered as moderate agreement, 0.61 to 0.80 was considered as good agreement and 0.81 to 1.0 was considered as very good agreement (12-14). The MSWBI was considered as having good level of stability if the ICC value more than 0.4.

Result

A total of 460 (92%) students responded to the invitation and only 171 (34.2%) agreed to participate in the study. Throughout the five measurements, a total of 153 (89.5%) students responded completely to the MSWBI. The demographic profile of the participants was summarized in the table 1. They responded to the MSWBI completely within 5 minutes.

Table 1: Demographic profile of respondents

Variables		N = 153
Gender, n (%)	Male	54 (35.3)
	Female	99 (64.7)
Ethnic group, n (%)	Malay	119 (77.7)
	Non-Malay	34 (22.2)
Religion adherents, n (%)	Islam	119 (77.8)
	Buddha	19 (12.4)
	Christian	12 (7.8)
	Hindu	3 (2.0)
Year of study, n (%)	First year	73 (47.7)
	Second year	25 (16.3)
	Third year	28 (18.3)
	Fourth year	10 (6.5)
	Fifth year	17 (11.2)
Age, mean (min, max)		20 (18, 25)

The CFA showed that most of the goodness of fit indices across different intervals (Table 2) suggested that the one-factor model with seven items as proposed by Dyrbye et al (2010) had a good and stable construct. The standardised regression weight of each item at different interval of measurements was summarised in the table 3. These findings support the stability of the MSWBI construct and items in measuring medical student wellbeing at different occasions and time.

Table 2: The results of confirmatory factor analysis by different intervals

Interval	X^2 - statistic	p-value	Goodness of fit indices								
			RMSEA	RMR	GFI	AGFI	CFI	NFI	RFI	IFI	TLI
Time 1	31.048	0.005	0.090	0.011	0.949	0.898	0.900	0.838	0.757	0.904	0.850
Time 2	14.279	0.429	0.011	0.007	0.974	0.947	0.998	0.916	0.874	0.998	0.997
Time 3	34.794	0.002	0.099	0.014	0.938	0.877	0.861	0.796	0.694	0.867	0.792
Time 4	27.692	0.016	0.080	0.010	0.951	0.902	0.940	0.889	0.833	0.942	0.910
Time 5	48.744	< 0.001	0.128	0.016	0.901	0.801	0.842	0.797	0.696	0.847	0.763

[a] One-factor model based on the proposed construct by Dyrbye et al (2010);

Table 3: Standardised regression weighted by measurement intervals for the MSWBI items

Item	Standardised regression weighted value*					Average
	Time 1	Time 2	Time 3	Time 4	Time 5	
1: Feel burned out (Do you feel burned out from medical school?)	0.37	0.44	0.55	0.57	0.51	0.49
2: Hardened emotionally (Do you worry that medical school is hardening you emotionally?)	0.23	0.51	0.55	0.57	0.54	0.48
3: Down, depressed, hopeless (During the past month have you often been bothered by feeling down, depressed, or hopeless?)	0.56	0.70	0.66	0.84	0.72	0.70
4: Fallen asleep while driving (In the past month, have you fallen asleep while stopped in traffic or driving?)	0.32	0.13	0.03	0.04	0.20	0.14
5: Things piling up so high (During the past month, have you felt that all things you had to do were piling up so high that you could not overcome them)	0.64	0.53	0.59	0.59	0.56	0.58
6: Bothered by emotional problems (During the past month, have you been bothered by emotional problems (such as feeling anxious, depressed, or irritable)?)	0.82	0.73	0.43	0.69	0.77	0.69
7: Physical Health (During the past month, has your physical health interfered with your ability to do your daily work at home and/or away from home?)	0.51	0.41	0.49	0.40	0.40	0.44

AMOS 19 was used for analysis   * it indicates the extend of an item contributes to the construct measuring the intended attribute (17).

Table 4: Internal consistency and ICC values across the five measurements.

Variable	Cronbach's Alpha value					ICC value (95% CI)[a]
	Time 1	Time 2	Time 3	Time 4	Time 5	
MSWBI	0.693	0.711	0.687	0.760	0.754	0.58 (0.51, 0.65)**

[a] ICC analysis (single measure) between Time 1, Time 2, Time 3, Time 4 and Time 5   ** $p < 0.001$

Reliability analysis (Table 4) showed that the overall Cronbach's alpha value of the 7-item MSWBI at the five measurements ranged between 0.68 and 0.76, indicating good level of internal consistency at different time and occasions. The ICC analysis (Table 4) showed that ICC coefficient value for the 7-item MSWBI was 0.58, indicating an acceptable level of agreement across the five measurements. This finding provided evidence to support the stability of psychometric property of the MSWBI to measure medical students' wellbeing at different time and occasions. Likewise, the stability of the original and shortened version did not substantially different.

Discussion

Previous studies have shown that the MSWBI has good degree of content validity, face validity, discriminative validity, and concurrent and divergent validity (17). Our data found that the MSWBI showed a consistent level of construct validity as most of the goodness of fit indices showed reasonable level values to signify its model fitness at the five different measurement intervals (Table 2); indicating it measured what it is supposed to measure at different time and occasions. Likewise, most of the items had standardised loading factor values (i.e. the standardised regression weighted values as shown in table 3) more than 0.3 except item 4 that was poorly contributing to the measured construct (26). This result is consistent with a recent study reported that the item 4 was poorly contributing to the construct, but it was still included in the inventory due to it did not disturb the MSWBI construct validity and internal consistency (10). One possible reason for item 4 (i.e. '*in the past month, have you fallen asleep while stopped in traffic or driving?*') poorly contributed to the construct is due to most of the

respondents were not driving therefore it was very difficult for them to respond appropriately to the item which eventually lead to poor contribution to the measured construct. Perhaps the item should be rephrased to suit with the local context. Nevertheless, this result indicate the MSWBI items had contributed reasonably to the measured construct (17). Most importantly, the construct validity of the MSWBI as well as the items' loading factors was reasonably stable across the five measurements. Thus provide an evidence for supporting its stability credential to measure psychological wellbeing of medical students at different time and occasions. One important lesson learnt from this finding is that the MSWBI is a valid, stable, useful and helpful tool to medical schools to screen their medical students' psychological wellbeing (10, 11). As reported by a previous study, students who scored more than 2 should be further accessed (10) and if necessary they are given appropriate support to improve their psychological wellbeing.

Our data found that overall Cronbach's alpha of the MSWBI demonstrated good to high level of internal consistency across multiple administrations that were done at different time and occasions as the Cronbach's alpha value ranged between 0.69 and 0.76 (12, 13, 23). These results showed that the MSWBI had good level of internal stability to reproduce similar results on similar cohort of studied population at different time and occasions. On top of that, our finding was comparable with previous studies that reported the its overall Cronbach's alpha value was more than 0.6 (10, 11). In addition, ICC analysis showed that the overall ICC coefficient was more than 0.5, indicating reasonable level of agreement between measurements that were done at different time and occasions (12-14). These findings

demonstrated that the MSWBI was a stable tool to measure psychological wellbeing of medical students across multiple measurements. One implication of this finding is that, medical schools could depend on the MSWBI to screen their medical students' psychological wellbeing at any occasion and time because of the consistency or reproducibility of results produced by the MSWBI. The result suggests that it is a helpful and useful screening tool for medical schools to quickly scan through their students' psychological health status.

The CFA and reliability analysis have provided evidence of stability for the construct and internal consistency of the MSWBI in measuring psychological wellbeing of a sample of Malaysian medical students who were from different phases of medical training. Despite these encouraging findings, this study has several limitations that should be considered for future research as well as for interpretation. First, this study was conducted at a medical school in Malaysian, so the findings may not be generalized to the whole Malaysian medical student population. Therefore, a study involving multiple medical schools from all over Malaysian medical schools is recommended to verify the present findings. Second, the number of study subjects was relatively small for CFA, therefore the current findings should be interpreted with cautious because it might compromise the accuracy of the results obtained. Future study should increase the sample size to verify the results obtained. Finally, majority of the medical students were from non-clinical years therefore it limited the generalisability of the results to clinical years of study. Future study should recruit more medical students from clinical years of study to verify the results in this study. Despite the limitations, this study has several strengths. First, the study subjects were selected randomly, so selection bias was minimized. Second, to the authors' knowledge, this is the first study to explore the stability of the instrument. Finally, this study administered the MSWBI more than three times over one-year duration which would be able to capture the 'true' psychometric stability of the MSWBI over different time and occasions. Considering these limitations and strengths, interpretation and any attempt to generalise the result should be done within context. Continued research is required to optimise its psychometric credential across educational settings.

Conclusion

This study found that the MSWBI had stable psychometric properties as a screening tool for measuring psychological wellbeing among medical students at different time and occasions. Continued research is required to refine and verify its psychometric credentials at different educational settings

Acknowledgement

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