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Development and Validation of a Tool to Assess the Sources and Severity of Stress in Medical Undergraduates

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Despite the understanding that medical undergraduates face stress in relation with their course, there are not many tools specific to Indian culture that measure stress along with its sources and severity. This study aims to validate an indigenously developed tool, Sources and Severity of Stress Scale (S3S) which assess the sources and severity of stress faced amongst the medical and dental students (n=518). Medical Students' Stress Questionnaire was used to establish criterion validity and WHO Quality of Life BREF Scale was used to find the construct validity. S3S showed very high internal consistency (Cronbach's alpha = 0.95, P< 0.001), and the criterion validity was established (r=0.84, P<0.001). Inter-domain correlation for construct validity showed alpha values greater than 0.7, and inter-domain correlation for content validity ranged between 0.36 to 0.68, P<0.05. It was concluded that the Sources and Severity of Stress Scale is a psychometrically sound tool with very high internal consistency, as its criterion validity and inter-domain construct validity is fit to be used with the target population.

Keywords: Sources & Severity of Stress, Scale Development, Medical Students, India.

Stress is prevalent among medical professionals, and that is also true for the medical students who have very busy and demanding schedules (Shah and Trivedi, 2009). Medicine is an emotionally demanding discipline and therefore pursuing medical education can sometimes be stressful (Niaura, Herbert, & Saritelli, 1991). Students are subjected to different kinds of stressors, such as the pressure of academics with an obligation to succeed, an uncertain future and difficulties of integrating into the system (Sreeramarddy et al. 2007). The students also face social, emotional and physical and family problems, which may affect their learning ability and academic performance (Fish & Nies, 1996; Chew-Graham, Rogers, & Yassin, 2003). Previous studies have showed relatively high levels of distress among medical students such as symptoms of depression (Sreeramarddy et al. 2007) and suicidal thoughts (Tyssen 2004). Stress may not only impair the quality of life of medical students, but can also influence patient care and the complex psychodynamics of the doctor-patient relationship (Troyer et al., 1990). As a consequence of increased stress, medical students can experience an alarming amount of stress-associated anxiety, depression, substance abuse, and even suicide (Ray & Joseph, 2010).

In India, getting into the medical school is considered to be very prestigious, but the accompanying challenges of being in medical school are largely overlooked. However, the existence of stress is acknowledged, little is done to find the exact nature of the stressors so that appropriate cognitive behavioral and psychological measures could be adopted to combat stress. In this context, quantification of stress would be more meaningful, by identifying the sources of stress along with its gradient. A stress scale meeting these specifications was developed in Nepal by Sreeramarddy et al. in 2007, by Shah et al. in 2010 in Pakistan, and in Malaysia by Yusoff & Rahim, in 2012. A similar scale to assess sources of stress as perceived by the students was used by Sohail (2013) again in Pakistan. However, these scales are not known to be validated, and it largely serves as a self report. Nevertheless, there is no dearth of scales that assess stress in college students – The College Adjustment Rating Scale (Zitzow 1984), Student Stress Scale (Insel & Roth,

1985), and Undergraduate Stress Questionnaire (Crandall, Preisler, & Aussprung (1992) - to name a few. Thus, it was decided that we use a scale, which assesses stress specifically in medical students. Review of literature showed that no such tool has been developed in India, which takes into consideration its unique cultural aspects.

The term stress, though by definition tends to be ambiguous there is no ambiguity on the experiential level. However, to lend more clarity to the concept as well as keeping in mind the nature of interventions that maybe required to be designed in future, we focused more on the sources and severity of stress rather than the stress itself. To determine the sources of stress five domains were identified, which contained relevant questions under them. Responses were made on a 5-point Likert type scale, which was used as a measure of severity. It was decided to name the scale as Sources and Severity of Stress Scale (S3S) – Medical Students' Version, keeping in mind that the stressors and their sources will be different for medical students when compared with that of students of other professional and non-professional courses. The development and validation of the tool - Sources and Severity of Stress Scale (S3S) – Medical Students' Version – is an attempt to understand the sources and severity of stress in medical undergraduates in the Indian cultural context.

Method

The study was a cross sectional exploratory survey cum tool development and validation exercise. The study adopted the following steps in the development and validation of S3S (a) establishing content validity (b) pretesting of the content validated questionnaire (c) establishing construct (convergent) validity and criterion validity (d) establishment of internal consistency and split half reliability and (e) exploratory and confirmatory factor analysis.

Scale development

The investigators developed a questionnaire, which comprised of 42 questions, identifying 10 stressor domains based on Arbitrary Approach. Under Consensus approach, a panel of judges (5 in numbers) evaluated the items and a pretest of the same was done in a small subset of the target population.

The Medical Student Stressor Questionnaire (MSSQ) manual was used for the Criterion Validation and the WHO Quality of Life - BREF, was chosen to determine the Construct (Convergent) Validity, which was administered to 32 respondents (4 subjects from each batch) chosen by convenience after obtaining their consent.

Instruments

The Medical Student Stressor Questionnaire (MSSQ) manual is a 40 item scale with 6 domains (Yusoff & Rahim 2012). The tool is developed by Yusoff, Rahim, & Yaacob in 2010. Its responses range from no stress, mild stress, moderate stress, high stress and severe stress and the subjects are required to mark their responses in a scale of zero to four. This instrument was considered as a gold standard against which S3S was validated.

WHO Health Related Quality of Life - BREF is a 26 item Likert type scale developed by World Health Organization. It assesses the Quality of Life along the dimensions of physical, psychological, social, and environmental. The subject is required to mark his responses along a scale of one to five. This tool was used to establish the construct validity of S3S.

Participants

The study was carried out in a full residential health care campus with a medical college and dental college in Kerala and both the dental and medical students were included in the study. The study period was of 5 months from May 2012 to September 2012. The campus consists of students from all parts of India, and is considered to be representative. Institutional Scientific and Ethics Committee clearance and approval to carry out the study was sought and the permission of the Deans for the above mentioned courses were obtained. A total of

640 subjects meeting inclusion criteria (100 * 4 batches of medical students & 60 * 4 batches of dental students), were administered with the questionnaire and a total of 534 returned the questionnaire with the Informed Consent. All the students who were willing to participate were given an opportunity to ask questions about the tool and about the study. Out of 534 responses 18 response sheets were discarded due to incomplete responses. Finally, 518 subjects with a men-women ratio of 1: 2.7 participated in the study.

Inclusion Criteria

Undergraduate medical and dental students who are willing to sign the informed consent, are of and above 18 years of age, who had just completed or were about to appear for the final examinations for each year of study, and who had at least 10 months of exposure at the institution.

Exclusion Criteria

Undergraduate medical and dental students with history of prolonged medical/neurological/ psychiatric illness newly joined first year students, and those who were not present on the day of questionnaire administration. Questionnaires were administered in the same week to different batches to minimize the effect of varying stress levels that may have occurred during the period.

Steps in Validation

Face validity

S3S was given to a panel of five experts to establish face validity. The expert panel consisted of Professors of Psychology, Community Medicine, and General Medicine, an Assistant Professor from Department of Psychiatry and a Stress Management Consultant. The panel examined the items for its comprehensiveness, relevance of each item for the target group in the Indian cultural context, and redundancy. Their suggestions were incorporated into the tool and necessary modifications were made.

Further, discussions about the items were held with a small sample of respondents with their consent, (n=32, 4 subjects from each batch including both genders), who are a subset to identify and eliminate potential problems. All aspects of the questionnaire, including question content, comprehension, wording, sequence, form and layout, question difficulty, and instructions were discussed (Diamantopoulos, Schlegelmilch, & Reynolds 1994; Martin & Poliyka, 1995). Based on the feedback from the pretest, the questionnaire was edited, and the identified problems rectified. Pretesting was continued until no further changes were needed. The final tool after pretesting consisted of 51 items and 10 domains.

Criterion Validity

For establishing the criterion validity Medical Students' Stress Questionnaire (MSSQ) was used as the standard against which S3S was validated. This tool together with S3S was administered to 64 students drawn both from dental and medical courses. Carl Pearson's Coefficient of correlation was computed and the criterion validity was established at r=0.84.

Internal Consistency and Reliability of S3S

Even though Cronbach's alpha and Spearman Brown Coefficient was observed, it was not deemed as a final measure as it was administered on a small sample and no meaningful result on factor analysis was attained.

Results and Discussion

Exploratory Factor Analysis

The 51itemscale with 10 domains was subjected to exploratory factor analysis (EFA). Exploratory factor analysis was done using the responses from 64 participants. However, this did not give any meaningful results and hence factor analysis was done on the response of 518 participants. By using the principal-components factor extraction method with a non-orthogonal rotation (promax) was carried out to frame the domains. This resulted in the shortening of number of domains to Five and recombination of stressors in each domain.

Table 1. Results of factor analysis

Sl. No.	Questions Numbers From Original S3s	Domains Formed - After Exploratory Factor Analysis	Number Of Questions In Each Domain
1	S 5 / S 6 / S 7 / S 8 / S 9 / S 10 / S 11 / S 13 / S 14 / S 15	Academics	10
2	S 2 / S 30 / S 31 / S 32 / S 33 / S 34 / S 35 / S 36	Self Expectation	8
3	S 1 / S 3 / S 4 / S 17 / S 18 / S 19 / S 20 / S 21 / S 22 / S 23 / S 24 S 25 / S 26 / S 48	Relationships	14
4	S 12 / S 16 / S 42 / S 43 / S 44 / S 45 / S 46 / S 47 / S 49 / S 50 / S 51	Living Conditions	11
5	S 27 / S 28 / S 29 / S 39 / S 40 / S 41 / S 37 / S 38	Health & Value Conflicts	8

Table 1-a consists of the stressor domains and few sample items under each of them.

Table 1a. Domains and the items after factor analysis

No:	Domain	Cause No stress	Cause Mild Stress	Cause Moderate Stress	Cause High Stress	Cause Severe Stress
I	**Academics**					
8	Lack of time to review what has been learnt	0	1	2	3	4
9	Difficulty to prioritize the task	0	1	2	3	4
II	**Self expectation**					
17	Need to excel/strive for perfection	0	1	2	3	4
18	Comparison of self with other students	0	1	2	3	4
III	**Relationships**					
20	Conflicts between parents	0	1	2	3	4
24	Biases (partiality OR prejudice)	0	1	2	3	4
32	Adjustment with roommates	0	1	2	3	4
IV	**Living Conditions**					
40	Unavailability of food of choice/ tasty foods/ variety of foods	0	1	2	3	4
43	Warden's / care-taker's approach	0	1	2	3	4
V	**Health & Value Conflicts**					
49	Resisting the peer pressure on substance use and abuse	0	1	2	3	4
50	Physical health and its related consequences	0	1	2	3	4

Confirmatory Factor Analysis

Confirmatory factor analysis was carried out to determine the factor structure of the data set. Root Mean Square of Approximation (RMSEA) tells us how well the model, with unknown, but optimally chosen parameter estimates would fit the population covariance matrix (Byrne 1998). In recent years, it is regarded as 'one of the most informative fit indices' (Diamantopoulos & Siguaw 2000) due to its sensitivity to the number of estimated parameters in the model. Browne and Cudeck (1993) recommended that a value of

Table 2. Results of convergent validity

Stress Domains	WHO QoL BREF – Components					
	Physical	Psychological	Social	Environmental	Q1	Q2
Academics	-0.299	-0.316	-0.191	-0.254	-0.222	-0.117
Self Expectations	-0.247	-0.317	-0.191	-0.185	-0.177	-0.104
Relationships	-0.383	-0.276	-0.288	-0.272	-0.172	-0.144
Living Conditions	-0.320	-0.291	-0.163	-0.441	-0.154	-0.086*
Health and Value Conflict	-0.319	-0.116	-0.242	-0.118	-0.118	-0.247
Total	-0.412	-0.382	-0.276	-0.372	-0.234	-0.175

p<0.05

the RMSEA of about 0.05 or less would indicate a close fit of the model in relation to the degrees of freedom' and that 'the value of about 0.08 or less for the RMSEA would indicate a reasonable error of approximation and would not want to employ a model with a RMSEA greater than 0.1. In this study, RMSEA estimate was 0.0789, which falls in the range of reasonable error of approximation.

Convergent Validity

Convergent validity is said to be established when the constructs used in two tools are related. Convergent validity was assessed using WHO HRQOL BREF. Although, a reasonably good convergent validity was observed with the 51item scale with 10 domains, we decided to recalculate the convergent validity after subjecting the tool to factor analysis. The association between the degrees of stress and Quality of Life was studied for its statistical significance by applying Spearmans' rank correlation. All the domains of S3S showed a significant low Correlation with different Components of WHO QoL BREF Scale, with the exception of Domain 4 from S3S and Q2 component of WHO QoL BREF Scale.

Internal Consistency and Reliability of factor analysis of S3S

Although, the scale enjoyed a good measure of internal consistency and reliability prior to factor analysis, it was put under another assessment of the same in the light of reshuffled domains and the items. Cronbach's alpha was used for the overall scale and each domain was calculated to assess the internal consistency, which was 0.94.

Table 3. Results of Internal consistency

Internal Consistency		
Stress	Cronbach's Alpha	No. of Items
Academics	0.86	10
Self Expectations	0.86	8
Relationships	0.88	14
Living Conditions	0.91	11
Health and Value Conflict	0.74	8
Total	0.94	51

Split half technique was used to establish external reliability and Spearman's Brown coefficient for split half reliability was established to be 0.84.

Table 4. Results of Split half reliability

Stress	Spearman Brown Coefficient	No. of items
Domain 1	0.853	10
Domain 2	0.825	8
Domain 3	0.893	14
Domain 4	0.893	11
Domain 5	0.805	8
Total	0.843	51

Grading The Scale

Response to each item is required to be on a Likert type scale ranging from 0 to 4, with a choice of zero as indicative of 'no stress', one as 'mild stress', two as 'moderate stress', three as 'high stress' and four as 'severe stress'.

(i) Preparation of class interval and determination of domain score.

The total number of questions in each domain is multiplied by 'Four' (i.e., the lowest

possible score for one Question). This output figure is divided by 'Four' (4), in order to determine various ranges for each domain. Even though there are 'Five' class intervals and since the first class interval is kept as 'Zero', the above-mentioned division is done with 'Four'. [For Example: if the total number of questions in One Domain is 10, then 10*4 = 40, 40/4 = 10. The below-mentioned are the Class Intervals for this example].

Table 5. Class intervals, range and interpretation of the scores

Class Interval	Range – Discrete variable	Final Score	Interpretation
1	0	0	No Stress
2	1 – 10	1	Mild Stress
3	11 – 20	2	Moderate Stress
4	21 – 30	3	High Stress
5	31 – 40	4	Severe Stress

The sum of all the scores in one domain (domain score) is put against each class interval to help to grade the stress experienced in that domain [For Example: the arithmetic sum of all scores: 0 + 1+ 2+ 2 + 3 + 2 + 1 + 1 + 0 + 0 = 12. The sum =12, falls between 11–20. The Final score for that domain is taken as 2, which shall be interpreted as "Moderate Stress" in this particular domain].

(ii) Determination of individual stress score.

The Single typical Stress Score for an Individual is taken as the Highest Score in any one domain. The rationale behind this is that whether 'stress' is in whichever domain it is present and is capable of bringing about an impact in almost all the walks of life.

Scope

The scale, being an indigenously developed tool, could be used in Indian culture. The tool can identify specific areas of stress in a medical student's life, thus enabling intervention in the right direction. Since the tool gives both an individual stress score and a domain specific score, it helps to identify the overall stress tolerance capacity as well as the domain or aspect that is stressful for the student. This, in turn, could help in the development of specific stress management programs relevant to that particular domain and counseling sessions.

Conclusion

The scale named as Sources and Severity of Stress Scale (S3S) – Medical Students' Version was developed to identify the stressors that are specific to medical education. The scale was tested for internal consistency, reliability, criterion validity and convergent validity. It was also tested for goodness-of-fit through factor analysis, both exploratory and confirmatory. In all the psychometric properties assessed and established, the scale showed good to excellent outcomes. Thus, the scale is rendered to be statistically and psychometrically fit, and can be used with the target population of Indian medical and dental students.

Conflict of interests: none

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