RELIABILITY, VALIDITY, AND FACTOR STRUCTURE OF THE 12-ITEM GENERAL HEALTH QUESTIONNAIRE (GHQ-12) AMONG STUDENTS AT CAN THO UNIVERSITY OF MEDICINE AND PHARMACY

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Received: 05/5/2023

Reviewed:25/05/2023

Accepted: 19/9/2023

ABSTRACT

Background: *Stress in medical education has been inevitable among medical students. The prevalence of mental health problems among medical students is increasing, requiring a reliable tool for accessing assessments. The General Health Questionnaire (GHQ-12), designed to screen for mental disorders and psychological stress, is a promising tool. Although the factor structure of GHQ-12 has been studied internationally, it is still unclear in Vietnam.* ***Objectives:*** *To evaluate the reliability, validity, and factor structure of the Vietnamese version of the GHQ-12 questionnaire.* ***Materials and method:*** *An analytic cross-sectional study of the online Microsoft survey on 1763 students majoring in medicine, traditional medicine, and preventive medicine at Can Tho University of Medicine and Pharmacy from May 2022 to May 2023.* ***Results:*** *Samples in the study comprised 1763 respondents, out of whom male respondents were 42.8%, and female respondents were 57.2%. The average age was 22.62 with the highest proportion being the age group 18-29 years old (95.7%). Our research subjects were mainly studying medicine (86.5%), and the remaining disciplines included Traditional Medicine (8.1%) and Preventive Medicine (5.4%). The average GHQ-12 score was 16.22 points with the mean score obtained on item 5 (1.74) being the highest, indicating that most students were under strain. Cronbach's alpha coefficient of 0.893 showed an appropriate level of confidence. A two-factor structure with nine categories of "negative items" (2, 5, 6, 9, 10) and "positive items" (1, 3, 4, 8) had a cumulative variance of 60.175% drawn from the study.* ***Conclusions:*** *The Vietnamese version of GHQ-12 has enough reliability and validity to assess the mental health of medical students. The results indicated that students had higher-than-average scores, meaning poorer mental health. Furthermore, the study revealed a two-factor structure with nine categories including "negative items" and "positive items" with a cumulative variance of 60.175%. The two-factor structure suggests that GHQ-12 can be a multidimensional measure.*

Keywords: *Stress, students, GHQ-12, reliability, factor structure.*

I. INTRODUCTION

The World Health Organization (WHO) conceptualizes mental health as a "state of well-being in which the individual realizes his or her abilities, can cope with the normal stresses of life, can work productively and fruitfully, and can contribute to his or her community" [1]. Most mental health disorders have their peak onset in adulthood (ages 18-25) [2]. Stress in students is noted to be especially severer than in other professions, especially in the field of medicine and pharmacy. According to Masilamani R. et al, the overall prevalence of stress among medical students was 48.15% [3]. Therefore, it is

necessary to strengthen screening and early detection of mental disorders in medical students to ensure appropriate treatment.

At the present time, the General Health Questionnaire (GHQ) was developed by Goldberg in the 1970s and recognized as a reliable measure of health [4]. GHQ-12 is the most popular due to its simplicity and ease of use. The GHQ-12 consists of 12 items, and a higher score reflects a greater degree of psychological distress [5]. GHQ-12 has good specificity, reliability, and high sensitivity. The GHQ-12 was originally posited as having a unidimensional structure, where all 12 items load on a single latent variable. However, several underlying dimensions of the GHQ-12 have been explored, with results suggesting a two- or three-factor structure.

The objective of this study was to evaluate the reliability, validity, and factor structure of the Vietnamese version of the GHQ-12 questionnaire for medical students at Can Tho University of Medicine and Pharmacy. According to our knowledge, this is the first study of the GHQ-12 factor structure with Vietnamese students.

II. MATERIALS AND METHODS

2.1. Study design and subjects

This was an analytic cross-sectional study. The study was conducted with the participation of first- to sixth-year students of three majors, including Medicine, Traditional Medicine, and Preventive Medicine, at Can Tho University of Medicine and Pharmacy from May 2022 to May 2023.

2.2. Sample size

We used the formula $n = Z^2_{1-\frac{\alpha}{2}} \frac{p(1-p)}{d^2}$, with: n as the sample size; p=0.4815 (according to a study by Masilamani R., the overall prevalence of stress among medical students was 48.15% [3]); d is the allowable error, with d=0.03; α is the design significance level (with α=0.05). We had 1763 participants.

2.3. Data collection

The data was collected online via a structured questionnaire on Microsoft Form. This study used the Vietnamese version of the General Health Questionnaire (GHQ-12), which includes 12 items [11] and it was done according to the Likert scale with 4 points (0-1-2-3). Each item was scored, and the GHQ-12 score was the sum of the 12 component items, ranging from 0-36 points. The cutoff point is 12 points [5].

2.4. Statistical analysis

Analyze for reliability and validity using SPSS 20.0 software. Exploratory Factor Analysis (EFA) was carried out to explore the underlying factor structure of GHQ-12 using the principal component method with varimax rotation.

2.5. Ethics approval

The subject's personal information and research data will be encrypted after data collection to ensure privacy for study participants. This study was approved by the Ethics Committee in Biomedical Research of Can Tho University of Medicine and Pharmacy.

III. RESULTS

Table 1. Study population characteristics (n=1763)

Variables		Frequency	Percentage (%)
Gender	Male	754	42.8
	Female	1009	57.2
Age	18-29	1687	95.7
	30-39	70	4.0
	≥40	6	0.3
Year of study	Year 1	207	11.7
	Year 2	230	13.0
	Year 3	331	18.8
	Year 4	470	26.7
	Year 5	137	7.8
	Year 6	388	22.0
Majors	Medicine	1525	86.5
	Traditional medicine	142	8.1
	Preventive medicine	96	5.4

Table 1 shows that there are 1763 respondents, out of which male respondents were 42.8%, and female respondents were 57.2%. In terms of age, the highest proportion is in the age group 18-29 years old (95.7%). In our study, fourth-year students accounted for the highest proportion with 26.7%, our research subjects are mainly studying medicine (86.5%).

Table 2**.** Descriptive statistics for GHQ-12 items (n=1763)

GHQ-12 items	Mean	Standard deviation	Response frequencies			
			0	1	2	3
1. Able to concentrate	1.47	0.798	162 9.2%	794 45.0%	627 35.6%	180 10.2%
2. Loss of sleep over worry	1.37	0.901	326 18.5%	637 36.1%	617 35.0%	183 10.4%
3. Playing a useful part	1.38	0.765	154 8.7%	936 53.1%	520 29.5%	153 8.7%
4. Capable of making decisions	1.23	0.731	208 11.8%	1059 60.1%	387 22.0%	109 6.2%
5. Felt constantly under strain	1.74	0.834	120 6.8%	537 30.5%	781 44.%	325 18.4%
6. Couldn’t overcome difficulties	1.38	0.823	233 13.2%	777 44.1%	597 33.9%	156 8.8%
7. Able to enjoy day-to-day activities	1.29	0.833	260 14.7%	895 50.8%	439 24.9%	169 9.6%
8. Able to face problems	1.15	0.731	263 14.9%	1069 60.6%	335 19.0%	96 5.4%
9. Feeling unhappy and depressed	1.49	0.862	208 11.8%	702 39.8%	627 35.6%	226 12.8%
10. Losing confidence	1.42	0.884	254 14.4%	725 41.1%	565 32.0%	219 12.8%
11. Thinking of self as worthless	1.04	0.876	532 30.2%	739 41.9%	382 21.7%	110 6.2%

GHQ-12 items		Mean	Standard deviation	Response frequencies			
				0	1	2	3
12. Feeling reasonably happy		1.24	0.725	199 11.3%	1036 58.8%	427 24.2%	101 5.7%
Mean overall score	Overall	16.22	6.644				
	Male	15.86	6.682	p=0.654			
	Female	16.49	6.605				
Classified as cases (score ≥12), n (%)		1345 (76.3%)					

Table 2 shows an overall mean score of 16.22 (SD=6.644) was obtained, higher than the cut-off point of 12. A total of 1345 participants (76.3%) scored higher than the cutoff score. The mean score obtained on item 5 (1.74) was the highest, indicating that most students were under strain. The female respondents obtained a mean score of 16.49 (SD=6.605) higher than the male respondents obtained a mean score of 15.86 (SD=6.682), however, this difference was not statistically significant (p=0.654).

Table 3. Correlation between items and the overall GHQ-12 scale (n=1763)

GHQ-12 items	Correlation of item with overall scale	Cronbach's alpha if the item is eliminated
1. Able to concentrate	0.551	0.888
2. Loss of sleep over worry	0.511	0.890
3. Playing a useful part	0.581	0.886
4. Capable of making decisions	0.579	0.886
5. Felt constantly under strain	0.628	0.884
6. Couldn't overcome difficulties	0.650	0.882
7. Able to enjoy day-to-day activities	0.603	0.885
8. Able to face problems	0.472	0.891
9. Feeling unhappy and depressed	0.689	0.880
10. Losing confidence	0.701	0.879
11. Thinking of self as worthless	0.651	0.882
12. Feeling reasonably happy	0.636	0.884
Cronbach's alpha	0.893	

Table 3 shows each item's reliability and correlation with the overall scale and Cronbach's alpha after eliminating the corresponding item. A Cronbach's alpha of 0.893 was observed for the GHQ-12's overall score. Correlations with the overall scale ranged from 0.472 to 0.701, with item 8 ("Able to face problems") having the lowest correlation coefficient and item 10 ("Losing confidence") having the highest correlation coefficient. When an item was deleted, Cronbach's alpha coefficients ranged from 0.879 to 0.891.

Table 4. Factor loadings

GHQ-12 items	Factor Loadings	
	Factor I	Factor II
1. Able to concentrate		0.624
10. Losing confidence	0.650	0.431
11. Thinking of self as worthless	0.547	0.480
12. Feeling reasonably happy	0.457	0.553
2. Loss of sleep over worry	0.740	

GHQ-12 items	Factor Loadings	
	Factor I	Factor II
3. Playing a useful part		0.787
4. Capable of making decisions		0.768
5. Felt constantly under strain	0.821	
6. Couldn't overcome difficulties	0.680	0.324
7. Able to enjoy day-to-day activities	0.525	0.432
8. Able to face problems		0.657
9. Feeling unhappy and depressed	0.726	0.328
KMO	0.923	
sig Bartlett's Test	<0.001	
% of variance	46.418	9.864
Cumulative % of the variance	46.418	56.282
Eigenvalue	5.570	1.184

Table 4 shows the result of exploratory factor analysis. First, sampling adequacy was assessed by Kaiser-Meyer Olkin (KMO=0.923) and Bartlett's test of sphericity p<0.0001); the result indicated that the sample size was adequate to run factor analysis. Next, a two-factor structure emerged based on the eigenvalue (>1) and factor loadings observed in the rotated component matrix obtained through varimax rotation with Kaiser normalization. As shown in Table 4, a two-factor solution emerged. Factor 1 explained 46.418% of the variance, and factor 2 explained 9.864%. Overall, the cumulative variance of 56.282% was accounted for by both factors. In addition, item numbers 6, 7, 9, 10, 11, and 12 showed cross-loadings on both factors. In this study, we used a factor loadings of 0.3.

Table 5**.** Factor loadings after eliminating items with cross-loadings

GHQ-12 items	Factor Loadings	
	Factor I	Factor II
5. Felt constantly under strain	0.830	
2. Loss of sleep over worry	0.757	
9. Feeling unhappy and depressed	0.735	
6. Couldn't overcome difficulties	0.687	
10. Losing confidence	0.648	
3. Playing a useful part		0.791
4. Capable of making decisions		0.785
8. Able to face problems		0.665
1. Able to concentrate		0.652
KMO	0.890	
sig Bartlett's Test	<0.001	
% of variance	47.099	13.076
Cumulative % of the variance	47.099	60.175
Eigenvalue	4.239	1.177

Table 5 shows after eliminating items with cross-loading [12], a nine items two-factor structure of the GHQ-12 emerged. Factor I (items 2, 5, 6, 9, and 10) accounted for 47.099% of the variance, and Factor II (items 1, 3, 4, and 8) for 13.076%. The two factors accounted for the cumulative variance of 60.175%.

IV. DISCUSSION

The overall mean GHQ-12 score was 16.22 points. Females with an average GHQ-12 score of 16.49 were higher than male with an average GHQ-12 score of 15.86, however, this difference was not statistically significant (p=0.654). The average score obtained in item 5 of 1.74 points is the highest, indicating that almost all students show signs of stress. Our results are similar to those of Rathore D. et al. The author recorded a mean total GHQ-12 score of 15.26 points. The study subjects were males with a mean GHQ-12 score of 15.20 and females, similarly, with a mean GHQ-12 score of 15.29. The average score achieved in item 5 (1.54 points) is the highest [8]. The average GHQ-12 score in the study of Sánchez-López et al was lower than ours, with a GHQ-12 score of 8.52 points. In which, the mean score for females is 9.30, and for males is 7.34. The difference was statistically significant (p<0.001) [13]. The research results of Liang Y. et al. show that the average GHQ-12 score is higher than ours. Liang Y. et al. announced that the average score of GHQ-12 is 23.62 points, of which, the highest mean score belongs to item 9 with 2.14 points [7]. This difference may be due to differences in sample size, causes, and methods of coping with stress.

Cronbach's alpha was 0.893, indicating good internal consistency. Correlations with the overall scale ranged from 0.472 to 0.701, with item 10 ("Losing confidence") having the highest correlation coefficient. When an item was deleted, the Cronbach's alpha coefficients ranged from 0.879 to 0.891, indicating that each item was necessary and equally important. Our research has similar results to several published studies around the world. Rathore D. et al. recorded Cronbach's alpha coefficient, with the closest value to us being 0.883 [8]. According to Liang Y. et al., they also recorded Cronbach's alpha coefficient of 0.844, in which item 11 has the highest correlation coefficient of 0.609 [7]. Similarly, Lee B et al. reported that a Cronbach's alpha coefficient of 0.81 was observed for the overall score of the GHQ-12 scale, which indicates an acceptable level of internal consistency with item 5 ("Felt constantly under strain") having the lowest correlation coefficient [6]. With Cronbach's alpha coefficient of 0.76, Sánchez-López et al also showed satisfactory internal consistency for all categories, in which, item 9 has the highest correlation coefficient (0.57) and item 11 has the lowest correlation coefficient (0.01) [13].

The results of the first exploratory factor analysis showed that sampling adequacy was assessed by the Kaiser-Meyer-Olkin (KMO=0.923) and Bartlett's test of sphericity (p<0.0001); the result indicated that the sample size was adequate to run factor analysis. A two-factor structure emerged based on the eigenvalue (>1) and factor loadings observed in the rotated component matrix obtained through varimax rotation with Kaiser normalization. As shown in Table 4, a two-factor solution emerged. The eigenvalue for both factors were greater than 1. Factor I explained 46.418% of the variance, and factor II explained 9.864%. Overall, the cumulative variance of 56.282% was accounted for by both factors. In addition, item numbers 6, 7, 9, 10, 11, and 12 showed cross-loadings on both factors. In this study, we use a factor loadings threshold of 0.3. There are three bad non-conforming items (numbers 7, 11, and 12) that need to be considered for removal because there is a difference in load factor in both factors <0.2 [8]. At the second exploratory factor analysis, after eliminating three bad non-conforming items (items 7, 11, and 12), a two-factor structure with nine items of the GHQ-12 emerged. Factor I (including items 2, 5, 6, 9, and 10) accounted for 47.099% of the variance, and factor II (including items 1, 3, 4, and 8) accounted for 13.076%. The sum of the

cumulative variances of both factors is 60.175%. Factor I is labeled as "negative items", and factor II is labeled as "positive items". Our results are similar to those of some other international versions. Rathore D. et al after exploratory factor analysis, proposed a seven-item two-factor model of "social dysfunction" (items 1, 3, 4, and 8) and "anxiety/depression" (items 2, 5, and 9) with a cumulative variance of 62.14% [8]. In a study, Andrich D. and van Schoubroeck L. also proposed a two-factor structure, which is "items with positive words" (items 1, 3, 4, 7, 8, and 12) and "items with negative words" (items 2, 5, 6, 9, 10 and 11) [9]. "Anxiety" (items 2, 5, 6, 9, 10, and 11) and "social dysfunction" (items 1, 3, 4, 7, and 8) are two-factor models of GHQ-12 that are proposed by Politi P.L. et al in their research work [10].

Nevertheless, our study has certain limitations. Online surveys often produce unstable response rates and the data collected is often unreliable because you have no control over the respondents. The data does not include all students of Can Tho University of Medicine and Pharmacy. Medical students are a specific occupational group at high risk of mental disorders, facing specific professional circumstances and work environments. Therefore, the results may not apply to the general population or other occupational groups.

V. CONCLUSIONS

The Vietnamese version of the 12-item general health questionnaire (GHQ-12) has sufficient reliability and validity to assess mental health for medical students at Can Tho University of Medicine and Pharmacy. The study revealed a two-factor structure with nine categories, including "negative items" and "positive items" with a cumulative variance of 60.175%. The two-factor structure explored suggests that GHQ-12 can be a multidimensional measure and that the use of GHQ-12 with a one-dimensional structure in the mental health assessment of medical students may not be appropriate.

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