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Original Article

Factor Structure of Persian General Health Questionnaire-28 in Dermatologic Patients: A Confirmatory Factor Analysis

Amin Ghanbarnejad [1], Habibollah Turki [2], Banafsheh Golestan [3], Mohammad Arbabi [4], Saharnaz Nedjat [3]

1. Research Center for Social Determinants for Health Promotion, School of Health, Hormozgan University of Medical Sciences (HUMS), Bandar Abbas, Iran
2. Research Center for Infectious and Tropical Disease, Hormozgan University of Medical Sciences (HUMS), Bandar Abbas, Iran
3. Dept. Of Epidemiology & Biostatistics, Tehran University of Medical Sciences (TUMS), Tehran, Iran.
4. Psychiatry and Psychology Research Center, Tehran University of Medical Sciences, Tehran, Iran

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Corresponding author: Amin Ghanbarnejad, Instructor of Biostatistics, Research Center for Social Determinants for Health Promotion, School of Health, Hormozgan University of Medical Sciences (HUMS), Bandar Abbas, Iran. Tel: +98-761-3338583. E-mail: aghanbarnejad@hums.ac.ir

Abstract

Introduction: GHQ-28 is a screening instrument for evaluating psychiatric symptoms in vast groups of individuals. This study is the first attempt to examine the factor structure of the GHQ-28 in Iranian people.

Methods: Three hundred and thirty six inpatients and outpatients who suffered from skin disease referred to Razi hospital in Tehran fully completed the GHQ-28 questionnaire. Factor structure of GHQ-28 was assessed using confirmatory factor analysis. The comparison among four hypothesized models: orthogonal 4-factor, oblique 4-factor, Tau-equivalence oblique 4-factor and single second-order was done and the best model fitted to the data was obtained. The data was analyzed using SAS software.

Results: Our findings showed that the oblique 4-factor and the single second-order models had the best fit based on fit indices; however the oblique 4-factor model was the best choice due to the smaller AIC and clearer interpretation.

Conclusion: Assuming oblique factor model is a better realization of the practical situation using GHQ-28 among the dermatologic patients and show the stability and validity of the instrument in this population as a diagnostic tool.

Key words: Dermatology, Questionnaires, Psychometric, Reproducibility of Results

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Introduction:

Psychiatric disorders are common among patients with skin diseases. The prevalence of psychiatric morbidity among dermatological outpatients varies from 21% to 43% (1-4). Psychiatric morbidity not only causes extensive suffering, but also leads to poor medication adherence (5) and thereby could have an effect on the course of the skin disease itself. This is why attempts have been made to recognize this issue and to choose suitable instrument to measure it (6). However, as mental disorders are often not recognized in dermatological patients (7) as well as in so many other non-psychiatric situations (8, 9), recognizing this problem is the most important step to take. The result of a recent study indicates that dermatologists are inclined to believe psychiatric disorders are significantly less common than they truly are in many skin conditions (10), a belief which might cause certain psychiatric disorders not to be recognized and thus remain hidden. Moreover, short mean duration of visits in busy dermatological clinics, may make it difficult to diagnose psychiatric morbidity.

Many clinicians use validated screening questionnaires to diagnose psychiatric disorders. The accepted critical threshold helps them to decide if a patient does indeed suffer from a psychiatric disorder (11). In many non-psychiatric settings, the General Health Questionnaire (GHQ) (12) has shown to be a valuable tool.

A well-known practical trouble in studying psychiatric morbidity in the environment of physical illness is that symptoms of somatic disease, for example reduced appetite, lack of energy, weight changes, autonomic dysfunction or sleeplessness, may overlie with symptoms of psychiatric illness, consequently creating diagnostic difficulties. Use of the GHQ may show this problem as it contains some somatic symptoms.

Validation of factor structure of a questionnaire via Confirmatory Factor Analysis (CFA) is a well-known technique for a predefined structure. However to date, to our best knowledge, in Iran, studies conducted so far were mostly descriptive and even in analytical situations, no attempt has been made to confirm the validity of the Persian GHQ-28 for the study population.

GHQ-28 as a psychometric instrument was used through literature basically in two forms: (a) 4-factor inter-correlated model proposed by Goldberg & Hillier in 1979 (13) and (b) 4-factor uncorrelated model, routinely used in many countries like Iran.
The aim of this study was to evaluate the factor structure of Persian-translated version of GHQ-28 among a sample of skin disease patients using confirmatory factor analysis. These patients are especially prone to psychiatric disorders; therefore it is rather critical to have a valid instrument as a diagnostic criterion.

Methods:

Data were derived from a study assessing the mental health of inpatients and outpatients who suffered from dermatologic diseases, referred to Razi hospital, the largest academic center of skin disease patients, in Tehran, Iran in 2009. The study objectives were explained for all participants and they were included in the study only if they had completed an informed consent as well as if they had enough level of education to be able to read and understand the questionnaire. The GHQ-28 was then administered for four hundred thirteen such patients.

GHQ-28 is a popular 28-item questionnaire specially designed to detect a wide range of psychiatric symptoms. The General Health Questionnaire has been used in more than 30 languages throughout the world as a powerful screening test. It has also been translated to Persian. In a National study, GHQ has been validated in a sample of 35014 Iranian individuals(14). This instrument is a self-administrative questionnaire and is capable to detect minor, non-psychotic psychiatric disorders in general practice. For the present study, it has been used in dermatologic patients as a valid and reliable instrument(3).
The questionnaire comprises four subscales of Somatic Symptoms, Anxiety and Insomnia, Social Dysfunction and Severe Depression. Each subscale consists of seven questions. The questions were to be answered on a Likert scale. The subjects would get 0 point if they chose “not at all”, to 3 points for “much more than usual” responses. We use GHQ-28 rather than GHQ-12 due to more application of this version in Iran and also due to the more extended aspect.

In the present study, CFA was conducted on data using PROC CALIS in SAS statistical software for evaluating factor structure of GHQ-28 among skin disease patients.

In this study, we hypothesized if GHQ-28 data from patients conforms to a four-factor interrelated model or a four-factor uncorrelated model. In most studies using GHQ-28, total scores in each domain is usually calculated, simply by adding the score of each question in a certain domain, hence assuming equal burden of single question on that domain. For this, we also checked the suitability of the Tau-equivalence model. Finally due to possible correlation among factors we also investigated if a higher-order model on which subscales load onto a single second-order factor would better describe the underlying structure.

Four models were tested and compared: (1) Oblique 4-factor model, (2) Orthogonal 4-factor model, (3) Oblique Tau-equivalence model and (4) single second-Order model.
The two most common methods of estimation in confirmatory factor analysis are maximum likelihood (ML) and weighted least square (WLS). The former is particularly based on the assumption of multivariate normality whereas for the latter this assumption can be relaxed (15).

Goodness of fit indices, presented here, included chi-square test of model fit, ratio of chi-square to degrees of freedom, which measures absolute fit indicating how model-implied covariance matrix

matches to sample covariance matrix. Simulation studies show that Chi-square test is sensitive to sample size, therefore although it has been reported in the results; it has not been used for evaluation of model fit. Two relative fit indices, comparative fit index (CFI; Bentler, 1990) and Adjusted Goodness-of-Fit Index (AGFI; Joreskog & Sorbom) have also been reported. The first index, CFI evaluates the incremental fit by comparing hypothesized models to an independent model whereas the second index, AGFI evaluates the incremental fit by comparing the hypothesized model to a null model. Root Mean Square Error of Approximation (RMSEA; Browne & Cudeck, 1992), a persimmons correction index has been obtained for the four models (16-18). RMSEA less than 0.05 indicate good fit. CFI, GFI and AGFI must be greater than 0.9 to represent model good fit (16, 18).

To compare models that were not nested within each another, we used Akaike Information Criterion (AIC; Akaike, 1987), the smaller the AIC, the better the model fit. For the models that were nested, Satorra-Bentler chi-square difference test was used. Another fit index that suitable for choosing best model between several models and comparing alternative model is Expected Cross-Validation Index (ECVI) and model with smaller ECVI is better model.(19-21)

Results:

Out or 414 patients, 336 responded to the questionnaire completely (response rate: 81.3%). The mean age of patients was 36.45 ± 18.3; and 141 (42%) of them were male. Nearly half of them (41.1%) were single. Also, 191 (54%) patients had an education level higher than high school.

The initial analysis suggested that the assumption of normality does not hold for this data set (the relative kurtosis was 1.25, P<0.001). As the data of the present study did not follow multivariate normal distribution, we used WLS as the method of estimation.

The descriptive statistics for 28 items of GHQ-28 questionnaire is presented in table 1, result of which implies that 28 items didn't follow multivariate normal distribution.

Table -1: Descriptive Statistics for 28 items of General Health Questionnaire-28

Variable	Mean	Standard Deviation	Skewness	Kurtosis
q1	2.33	.700	.445	.174
q2	1.96	.795	.528	-.133
q3	2.02	.971	.466	-.930
q4	2.16	.787	.571	.203
q5	1.74	.868	1.072	.457
q6	1.28	.674	2.614	6.349
q7	1.91	.896	.656	-.443
q8	2.21	.981	.263	-.994

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q9	2.38	.967	.186	-.910
q10	2.19	.903	.282	-.728
q11	2.40	.843	.215	-.500
q12	1.79	.758	.645	-.143
q13	1.72	.645	.334	-.697
q14	2.12	.874	.340	-.629
q15	2.23	.638	.642	.876
q16	2.22	.613	.673	1.056
q17	2.23	.587	.096	-.060
q18	2.26	.713	.107	-.217
q19	2.09	.589	.736	2.041
q20	2.04	.588	.937	2.929
q21	2.28	.704	.642	.500
q22	1.47	.710	1.523	1.949
q23	1.70	.825	1.230	1.202
q24	1.53	.817	1.613	2.055
q25	1.43	.707	1.676	2.375
q26	2.02	.815	.391	-.461
q27	1.42	.814	2.099	3.636
q28	1.52	.683	1.188	1.101

Table -2: Comparative fit indices for four measurement models

Model	χ^2	df	χ^2/df	RMSEA	ECVI	CFI	AIC
oblique 4-factor model	560.85	344	1.63	0.043	2.04	0.91	-127.1518
orthogonal 4-factor model	1451.07	350	4.15	0.097	4.66	0.56	751.0676
oblique 4-factor model with tau-equivalence	726.27	350	2.07	0.056	2.50	0.84	26.272
Single second-order model	573.58	342	1.67	0.045	2.09	0.91	-110.4214

The result of the CFA for each of the four models is summarized in Table 2. Based on our findings:
The oblique 4-factor model, has an acceptable fit based on appreciable low RMSEA=0.043, an excellent comparative fit of: AGFI=0.99 and CFI=0.91. The model has also a good $\chi^2/df = 1.63$, a very low ECVI=2.04 and the least AIC.

For orthogonal 4-factor model, fit indices were as follows: $\chi^2(350) = 1451.07$, p<0.001, RMSEA=0.097, that was not good, AGFI=0.99, an excellent and acceptable fit, CFI=0.56,that indicating bad model fit, $\chi^2/df = 4.146$ and ECVI=4.66 were so high that we could not accept this model as a good model.

For oblique 4-factor model with tau-equivalence, fit indices were as follows: $\chi^2(368) = 763.23$, p<0.001, a good RMSEA=0.056, a high AGFI=0.99, CFI=0.84 did not have reasonable value, $\chi^2 / df = 2.07$ and ECVI=2.50 were not high in comparison with oblique 4-factor model and single second-order model.

For single second-order model, fit indices were as follows: $\chi^2(342) = 573.5786$, (p<0.001), an acceptable and good RMSEA=0.045, a very good AGFI=0.99, a reasonable CFI=0.91, and two low indices: $\chi^2 / df = 1.67$, ECVI=2.09 indicated a good model fit relative to orthogonal 4 factor model and oblique 4 factor model with tau-equivalence.

Based on AGFI, all models had comparatively good fit, but the most accurate conclusion can be obtained by taking into account the goodness of fit indices in combination. Thus, with regard to CFI, oblique 4-factor model and single second-order model both indicated an acceptable fit.

To evaluate the difference between orthogonal 4-factor model and oblique 4-factor model, Satorra-Bentler chi-square difference test for nested models was conducted and its value was $\chi^2 = 890.22$ (df=6, p<0.001). Based on these results, the difference between orthogonal 4-factor model and oblique 4-factor model was significant. Thus, oblique 4-factor model had a better fit and was therefore superior to orthogonal 4-factor model.

The comparison between oblique 4-factor model and oblique 4-factor model with tau-equivalence model was based on AIC as these two models were nested within one another. We thereby concluded that oblique 4-factor model was better than oblique 4-factor model with tau-equivalence model with the lower AIC, the results are shown in Table 2. Both oblique 4-factor model and model single second-order model had good fit to our data based on goodness of fit indices, nevertheless, oblique 4-factor model had a smaller AIC compared to single second-order model.

Factor loadings of oblique 4-factor model from CFA, is presented in Table 3. High factor loadings indicate that the model is good.
From Table 3, it can be seen that observed variables have high loadings on factors and thereby can be considered to be a good model (Orthogonal 4-Factor) to data.
Moreover, as in Table 4, there are high correlations among factors, indicating that domains of GHQ-28 questionnaire are in fact inter-correlated. Based on our results, a single factor higher-order model is also not a bad candidate for the factor structure of our data.

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Table -3: Standardized factor loadings from confirmatory factor analysis of General Health Questionnaire-28, four-factor oblique model

	F1	F2	F3	F4
Question 1	0.493			
Question 2	0.347			
Question 3	0.745			
Question 4	0.688			
Question 5	0.539			
Question 6	0.589			
Question 7	0.623			
Question 8		0.768		
Question 9		0.673		
Question 10		0.807		
Question 11		0.769		
Question 12		0.728		
Question 13		0.754		
Question 14		0.751		
Question 15			0.690	
Question 16			0.545	
Question 17			0.766	
Question 18			0.682	
Question 19			0.693	
Question 20			0.537	
Question 21			0.751	
Question 22				0.845
Question 23				0.893
Question 24				0.816
Question 25				0.809
Question 26				0.786
Question 27				0.858
Question 28				0.782

Table -4: Correlations among 4 Factors

	Somatic Symptoms	Anxiety	Social Dysfunction	Depression
Somatic Symptoms	1.000			
Anxiety	0.893	1.000		
Social Dysfunction	0.713	0.801	1.000	
Depression	**0.655**	**0.812**	**0.716**	**1.000**

Discussion:

We investigated the factorial validity of the GHQ-28 by examining four models of GHQ-28 structure using confirmatory factor analysis. The best model was found to be the 4-factor inter-correlated model containing the dimensions of Somatic Symptoms, Anxiety and Insomnia, Social Dysfunction and Severe Depression. The results described in this paper were consistent with those already published for a 28-item GHQ by Goldberg (13) whereby the 4 subscales were correlated with each other. These results support the popularity and validity of this tool in Iran, especially among the patients with skin disease. From the result of this paper, we see significant factor loadings of the questions on the corresponding factors in addition to high correlation among factors in 4-factor inter-correlated model which shown as the best model to describe our data.

Noorbala et al achieved 4-factor structure through exploratory factor analysis for first time in Iran (14, 22), Malakouti et al in eldery Iranian (23), Rezaei et al in patients with Traumatic Brain Injury (24), Ebrahimi et al in Iranian psychiatric patients (25), Molavi (26) and Taghavi (27) among students conforms the 4 factor structure of GHQ-28 that is consistent with the present study. However, confirmatory factor analysis is the first attempt in GHQ-28.

There are also similar studies around the world for checking validity of GHQ-28. The Spanish version of GHQ-28 among Spanish samples (28) and among patients in Mexico (29), the Turkish version of GHQ-28 (30, 31), the Japanese version of GHQ-28 (32), the Greek version of GHQ-28(33) and a study among health women in Nigeria (34) are consistent with our findings i.e. support the Goldberg GHQ-28.

Anastasi (35) proposed that high interscale correlation in a questionnaire indicating good validity and internal consistency of the instrument. In this study, the correlations among 4 factors were significant and large in magnitude which shows construct validity of the Persian version of GHQ-28 questionnaire. The relationship between anxiety and somatic symptoms (0.89) was appreciable and strongest correlation that is consistent with other studies (25, 36).

The very high correlation between anxiety and other factors makes it a more considerable aspect of psychiatric disorders in GHQ-28 questionnaire, meaning a patient who screened as high anxiety is more in need for treatment. Since dermatologic patients suffer severely from its symptoms, so it's more anxious to back to usual life.

Our findings showed that orthogonal 4 factor model isn't suitable for our data due to lack of fit i.e. the four independent domains of the questionnaire don't reflect the real structure of the data. It is revealed that the GHQ-28 to be a robust screening instrument for screening mental disorders, with a extremely established factor structure when applied to an Iranian dermatologic patient sample compared to

previous findings from various cultural settings and supporting Goldberg's hypothesis of a common language of psychological distress in different cultures.

Because of high correlation between factors, we investigated a single second-order model to check if all four factors could be loaded on one single major factor. This single factor may be regarded as a General factor that could measure the overall mental health status of a patient. Here, a patient with high scores on the four domains, would score high on the General factor and thereby is considered mentally ill and would be referred for necessary treatment. Based on the results, although a single second-order model provides reasonable fit, the 4-factor inter-related model is chosen as the preferred model not only because it has lower AIC, but also it is less complicated in practice and easier to interpret. Therefore, the results showed that 4-factor inter-related model of GHQ-28 has good performance in the selected population.

We did factor analysis just in one group of patients; however we recommend repeating this analysis in other populations to show the robustness of our findings.

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Conflict of Interest: The authors of this article declare that they have no conflicts of interest.

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