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Reliability, validity and factor structure of the GHQ-28 used among elderly Iranians

Seyed Kazem Malakouti,[1] Paridokht Fatollahi,[2] Arash Mirabzadeh[3] and Taher Zandi[4]

[1] *Tehran Psychiatric Institute, Mental Health Research Center, Iran*
[2] *Ministry of Oil, Health Department, Iran*
[3] *Department of Psychiatry, University of Welfare and Social Sciences, Iran*
[4] *State University of New York, U.S.A.*

ABSTRACT

Background: The object of this study was to develop an Iranian version of the General Health Questionnaire-28 (GHQ-28) for use with elderly subjects.

Methods: The GHQ-28 Farsi version was evaluated for face validity among 204 elderly subjects aged 59 years or older, chosen randomly from residents of Tehran. The Composite International Diagnostic Interview (CIDI) was used to establish a gold standard diagnosis of mental disorders.

Results: The GHQ-28 was an internally consistent measure. Cronbach's α, split-half coefficients and test-retest reliability were 0.9, 0.89 and 0.58 respectively. Four factors were extracted using factor analysis: "depression," "psychosocial activity," "anxiety," and "somatic." Using receiver operating curve (ROC) analysis, the optimum cutoff score for the GHQ-28 in this group was 19/20 (sensitivity 0.83, specificity 0.76). Using a loading of 0.6 or greater, a short form of the instrument (GHQ-15) ($\alpha = 0.9$) was derived and correlated well with the longer form of the scale ($r = 0.97$). Using ROC analysis, the optimum cutoff score was 10/11 (sensitivity 0.83, specificity 0.69).

Conclusions: The short and long forms of the GHQ-28 are suitable screening instruments for elderly Iranian residents, particularly those living in urban areas.

Key words: mental disorder, elderly, screening, general health questionnaire

Introduction

According to the most recent Iranian census data (1996), 6.5% of the population is older than 60 and it is estimated that by 2020 this proportion will have grown to about 10% (Iran Ministry of Health, 1999).

Correspondence should be addressed to: Seyed Kazem Malakouti, 82, Mahyar st. Vali-e-Asr Ave., Tehran 19669 Iran. Phone and Fax: +98 21 8718914-8706306. Email: kmalakouti@iums.ac.ir. Received 19 April 2006; returned for revision 8 Aug 2006; revised version received 7 Sept 2006; accepted 7 Sept 2006. First published online 27 October 2006.

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Mental disorders, especially depression and anxiety, are common in elderly people (Blazer *et al.*, 1987; Dillip *et al.*, 1999; Alexopoulos, 2001). Various instruments have been used for screening for mental disorders in old people (Gareri *et al.*, 2002). The General Health Questionnaire (GHQ) has been used as a screening tool in many epidemiological studies in Iran. The GHQ was developed by Goldberg (Goldberg, 1972) to screen for mental disorders in primary health care. It has been translated into nearly 40 languages and used in many cultures (Werneke *et al.*, 2000). GHQ-28 is the only version that contains four subscales (Goldberg and Hillier, 1979) for different dimensions of mental problems.

To evaluate the factor structure of GHQ-28 and GHQ-12 versions, the World Health Organization carried out a study based on the general population in 15 countries. For the GHQ-28, factor variation was less and two factors (depression and social dysfunction) were consistently found across these centers (Werneke *et al.*, 2000).

To obtain the cutoff points for different versions of the GHQ, a study was undertaken among outpatients aged between 18 and 64 years in a primary care setting (Van Hemert *et al.*, 1995). The GHQ-28 with cutoff 8/9 yielded a sensitivity of 0.72 and a specificity of 0.73, and the area under the curve (AUC) was 0.81. The cutoff point was higher in internal medicine patients. The somatic subscale had the lowest AUC (0.69). Given the existence of subscales in GHQ-28 and its use in many other Iranian studies which excluded the elderly, it was decided to develop an Iranian version based on a community sample.

Methods

For this study, the Ekbatan district (south-west of Tehran), with nearly 100,000 residents, was selected on account of its social organization, and the fact that a non-government organization (NGO) has been working on behalf of the elderly in this area, with trained health volunteers available to undertake a census of the elderly residents. A door-to-door survey was carried out under the supervision of the directors of every residential block and the Health Centre. Some 1422 elderly residents agreed to register for the study.

Participants

From the 1422 participants, 300 subjects were chosen at random. During the six months between taking part in the census and completing the questionnaire, 54 subjects were unable to participate having either died or moved out of the district, and 42 subjects were unwilling to take part. Eventually, 204 subjects were enrolled in the study and completed the GHQ-28. From the study sample, 104 subjects were selected randomly and interviewed with the Composite

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International Diagnostic Interview (CIDI) to determine the cutoff score. No significant differences were seen in gender and age between enrolled and omitted groups.

The project was described briefly to the subjects by telephone and after obtaining their consent, appointments were made to visit their homes.

Instruments

CIDI

The CIDI has proven to have excellent validity and reliability in 20 countries (World Health Organization, 1990; Andrews and Peters, 1998) and satisfactory diagnostic agreement with clinical diagnosis (Janca *et al.*, 1992).

In a study in Iran, the validity indices of the CIDI, in terms of agreement with diagnoses made by clinicians using diagnostic checklists, showed a sensitivity of 0.91 and specificity of 0.53 with positive negative likelihood ratio of 1.94 and 0.17 respectively. The reliability indices for test-retest evaluation (kappa = 0.55, Yule's Y = 0.56) were acceptable (Ahmadi *et al.*, 2003).

After making an appointment, the interviewing team, which included two psychiatrists and one psychologist, administered the instruments. In this study the lifetime version of CIDI was used to provide the number of subjects who were suffering from somatoform disorders (Somatization dis.-C51, Body dysmorphic dis. C56, Somatoform pain dis. C14, Conversion dis. C32, Hypochondriac dis. C56), depressive disorders (Major depressive dis.- E27, Dysthymic dis.-E34, Anxiety disorders), and phobias (D7- D15- D23- D31- D41- D52, Generalized Anxiety dis.-D69, Post Traumatic Stress dis.-K42, Obsessive Compulsive dis.-K8-K18, Panic dis.- D61). In making a diagnosis, those questions which were compatible with the time frame of the DSM-IV criteria for any of the above mentioned disorders were considered. For example, only items 1 and 2 of question E27 were considered to confirm the presence of a major depressive disorder over the previous four weeks, while for hypochondriasis, items 1–3 of question C56 were considered in making a diagnosis.

GHQ

Some 204 subjects, of whom 104 were interviewed using the CIDI, completed the GHQ-28. Because some of them were illiterate, the interviewers completed the GHQ by reading out the items to all interviewees regardless of their literacy status. For some subjects, the questions had to be repeated in order to obtain an answer. After two weeks, 28 subjects were selected for test-retest reliability measurement. Different versions of the GHQ have been translated and used in previous studies in Iran (Kalafi *et al.*, 2002; Montazeri *et al.*, 2003; 2005). In this study we used the available Farsi version of the GHQ-28 which was not translated and back translated by the investigators. The Farsi version of the

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Table 1. Demographic features of the sample (n = 204)

DEMOGRAPHIC VARIABLES	NUMBER	%
Gender		
Female	109	53.4
Male	95	46.6
Age		
59–74	128	62.7
75–84	68	33.3
85+	8	3.9
Living with:		
Partner	71	34.8
Partner and children	64	31.4
Children and others	43	21.1
Alone	26	12.7
Employment status		
Retired and pensioner	124	60.7
Unemployed	75	36.8
Employed	5	2.5
Educational status		
Illiterate	29	14.2
Primary school	54	26.5
Middle school	49	24
Diploma/Higher	72	35.2

GHQ-28 was introduced to 25 subjects in the 13th district of Tehran and to 26 subjects in Ekbatan district, all of whom were aged 60 years or more, in joint meetings to evaluate the face validity.

The Human Subject Committee of Tehran Psychiatric Institute approved this project.

Analyses

Descriptive statistics, Cronbach's α, split-half and test-retest method of reliability were conducted. Exploratory factor analysis (Eigenvalues greater than 1) and criterion validity were used for validity study. A factor loading of 0.4 or greater was considered. A diagnosis of a mental disorder, as indicated by the CIDI, was the gold standard. ROC was generated to visualize the sensitivity and specificity of depression scores.

Results

The demographic features of the sample (n = 204) are presented in Table 1.

GHQ scores in women (M = 21.06, SD = 11.6) were higher than in men (M = 15.89, SD = 9.88) (t = 3.39, $p < 0.001$). With Kruskal-Wallis analysis, the

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Table 2 The mean, SD and item-total correlation of GHQ-28.

ITEMS	MEAN IF ITEM DELETED	VARIANCE IF ITEM DELETED	ITEM-TOTAL CORRELATION	α AFTER OMITTING THE ITEMS
1	17.5	2.116	55.0	93.0
2	18	7.114	52.0	94.0
3	18	1.111	67.0	93.0
4	18	3.111	69.0	93.0
5	18.2	9.116	4.0	94.0
6	18.5	2.118	43.0	94.0
7	18	8.114	45.0	94.0
8	17.8	2.12	54.0	94.0
9	17.6	115	45.0	94.0
10	18.1	2.111	76.0	93.0
11	18	6.115	59.0	94.0
12	18.2	8.113	64.0	93.0
13	18	3.111	72.0	93.0
14	18.1	7.112	66.0	93.0
15	5.17	8.117	59.0	93.0
16	1.18	4.114	56.0	93.0
17	4.17	116	70.0	93.0
18	4.17	4.117	58.0	93.0
19	4.17	4.117	59.0	93.0
20	4.17	8.115	65.0	93.0
21	4.17	7.116	63.0	93.0
22	3.18	2.113	69.0	93.0
23	3.18	9.111	73.0	93.0
24	3.18	7.111	66.0	93.0
25	6.18	123	14.0	94.0
26	3.18	7.114	64.0	93.0
27	4.18	4.114	64.0	93.0
28	6.18	7.122	21.0	94.0

GHQ score was higher in lower educational levels ($\chi^2 = 21$, $p < 0.001$). Other demographic parameters did not have any significant effect on GHQ score.

Reliability

Cronbach's coefficient and inter-items correlation were 0.94 and 0.35 respectively (Table 2). The split-half coefficient was 0.86 and test-retest reliability after two weeks was 0.59 ($p < 0.001$). Student's t test showed no significant differences between the scores of the two stages.

Validity

The KMO coefficient was 0.89 and Barttelet analysis yielded a satisfactory result ($\chi^2 = 3581.76$, $p < 0.001$). Using factor analysis, four factors emerged:

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Table 3 Factor structure of the GHQ-28 using exploratory factor analysis.

ITEMS	1ST FACTOR	2ND FACTOR	3RD FACTOR	4TH FACTOR
1			0.41	
2				0.43
3	0.47			
4	0.61			
5				0.76
6				0.78
7				0.68
8			0.7	
9			0.65	
10	0.53		0.58	
11			0.58	
12			0.53	
13		0.56		
14			0.60	
15	0.41	0.63		
16			0.64	
17		0.76		
18		0.84		
19		0.85		
20	0.53	0.40		
21	0.40	.64		
22	0.71	0.42		
23	0.75			
24	0.84			
25	0.42			
26	0.60			
27	0.77			
28			0.56	

(1) depression, which accounted for 39.24% of the variance in the model (Eigenvalue = 1); (2) psychosocial activities, 7.7% of the variance; (3) anxiety, 6.8% of the variance; and (4) somatic symptoms, 5.26% of the variance. Together, these accounted for 58.86% of the variance (Table 3). Cronbach's α for the four factors was 0.89, 0.89, 0.85 and 0.71 respectively and the correlation was 0.5 ($p < 0.001$).

The items of the subscales were the following:

Depression: 3, 4, 20, 22, 23, 24, 25, 26, 27
Social function: 13, 15, 17, 18, 19, 21
Anxiety: 1, 8, 9, 10, 11, 12, 14, 16, 28
Somatic: 2, 5, 6, 7

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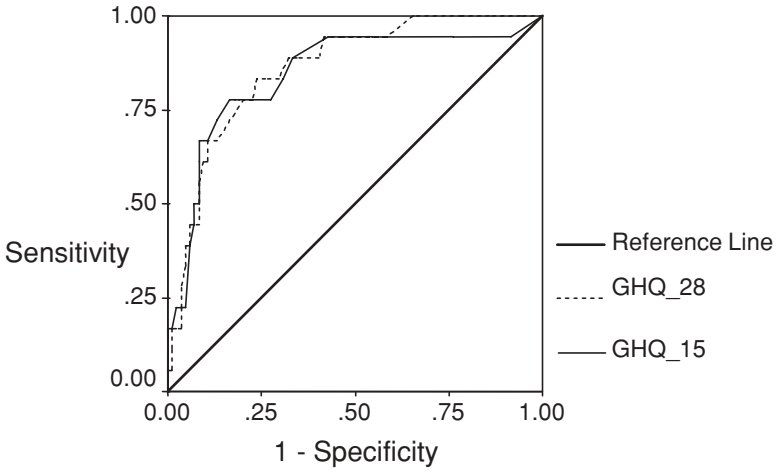


Figure 1 ROC curve of GHQ-28 and GHQ-15 for mental disorders

For criterion validity, GHQ-28 mean scores of the non-mentally ill subjects ($M = 15.87$, $SD = 12.8$) were compared with those of the mentally ill subjects ($M = 32.11$, $SD = 12.8$) ($t = -5$, $p < 0.001$) according to the CIDI diagnosis. Moreover, the GHQ-28 score was correlated significantly with the number of mental disorders criteria ($r = 0.48$, $p < 0.05$) (DSM-IVTR criteria) that emerged from the CIDI. Correlation coefficients between the factors were within the range 0.46 to 0.7 ($p < 0.001$).

The area under the curve (AUC) values for GHQ-28 were 0.86 ($p < 0.0001$). The optimum cutoff score for GHQ-28 was 19/20, with a sensitivity of 0.83 and specificity of 0.76 (Table 4). Positive predictive value (PPV) was 43%.

GHQ-15 (SHORT FORM)

By taking a loading factor of 0.6 or greater, a questionnaire with 18 items was derived. After omitting items 5, 6, 7, which describe somatic symptoms (items relating to somatic complaints could reduce the ability of GHQ to differentiate somatic and mental diseases) (Van Hemert *et al.*, 1995), a set of 15 items was derived as a short form. The items are: 4, 8, 9, 14, 15, 16, 17, 18, 19, 21, 22, 23, 24, 26, 27 5.

Cronbach's α and correlation coefficients with the GHQ-28 were 0.9 and 0.97, respectively. The GHQ-15 score was correlated significantly with the number of mental disorders criteria ($r = 0.46$, $p < 0.05$) (DSM-IVTR criteria) that emerged from the CIDI. The area under the curve (AUC) values for GHQ-15 was 0.845 ($p < 0.001$). The optimum cutoff score for GHQ-15 was 10/11 with a sensitivity of 0.83 and specificity of 0.69. Positive predictive value was 40.5%.

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Table 4 Cutoff scores, sensitivity and specificity of GHQ long and short forms against CIDI using ROC analysis.

GHQ VERSIONS	CUTOFF POINTS	SENSITIVITY	SPECIFICITY
GHQ_15	9.50	.889	.666
	10.50	.833	.69
	11.50	.778	.73
	12.50	.778	.81
	13.50	.778	.82
	14.50	.778	.83
	15.50	.722	.87
GHQ_28	13.50	.944	.58
	14.50	.889	.6
	15.50	.889	.66
	16.50	.889	.68
	17.50	.833	.70
	18.50	.833	.74
	19.50	.833	.76
	20.50	.778	.77
	21.50	.778	.8
	23.00	.722	.83

Discussion

Using a range of statistical methods to evaluate reliability and validity, the results show that the GHQ-28 possesses excellent properties as a screening instrument for mental disorders among elderly residents of Iran. Such instruments are required when conducting national epidemiological studies of the elderly. However, it has been found that Iranian people who are suffering from mental disorders generally prefer to see their General Practitioners or other specialists in the first instance rather than go to psychiatrists (Shahmohhamadi, 1990). The Iranian version of the GHQ-28 or its subscales is likely to be helpful in primary care settings when screening or treating the elderly for mental disorders and other common psychological problems as comorbid conditions.

This study used the ROC method and a validated diagnostic gold standard in a sample of older city residents. The elderly Iranian people in the survey categorized the items in different ways. Most items on the anxiety subscale were transferred to depression and somatic sections. "Weakness" and "feel sick" were transferred to depression; "unable to make decision" was transferred to depression; "not able to do anything" was transferred from anxiety to social function. The respondents indicated that their inability to do things stemmed from their old age and should not imply an anxiety problem. "Preoccupation with suicide" was transferred from depression to anxiety. This means that according to respondents' opinions, in addition to depression, anxiety may also lead the patient to suicidal thoughts.

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The study results show that the GHQ-28 is not able to differentiate mentally ill patients from those with somatic illnesses or suggests that a higher cut off score is required. The results of the GHQ-28 obtained with patients attending pain clinics indicate that somatic complaints and anxiety do not differentiate between pain patients in pain services with and without psychological illness (Merskey *et al.*, 1987). In a study using the GHQ-28 on patients referred to gastro-enterology clinics, the results showed a cutoff of 8/9 with a sensitivity of 77% and specificity of 75%, a positive predictive value of 67% and misclassification rate of 24%. In this study the GHQ-28 was able to differentiate patients with anxiety and depressive disorders from alcoholics (Morris and Goldberg, 1989). Although the cutoff score of the GHQ-28 is higher among internal medicine patients, its power to differentiate mentally ill patients from those with somatic problems is weak. It is therefore recommended that the somatic items of GHQ-28 be omitted from the questionnaire (Van Hemert *et al.*, 1995). On the other hand, some study results have shown that the GHQ-28 at cutoff scores of 11/12 is sufficient to differentiate patients with neurological deficits from mentally ill patients, and the instrument has been used in elderly individuals with brain diseases (Goldberg, 1986; Anderson *et al.*, 1996; House *et al.*, 2002; Patelaros and Argyriadou, 2004).

The cutoff, sensitivity, specificity and AUC scores in the current study are relatively similar to those from studies which used subjects from internal medicine services or neurological clinics (Morris and Goldberg, 1989; Goldberg, 1986; Van Hemert *et al.*, 1995; Anderson *et al.*, 1996; House *et al.*, 2002; Patelaros and Argyriadou, 2004) and, in contrast to this the study, from those which used young subjects (Bank, 1983). Since the current study sample comprises elderly subjects with naturally more somatic complaints and physical problems than young subjects, it is reasonable that the cutoff score would be higher than in the non-elderly population. Compared with the study results of Morris and Goldberg (1989), which used outpatient subjects, the positive predictive value of the Iranian version of GHQ-28 is low. This might be the result of lower rates of mental disorders in the community than in outpatient clinics. Lower rates of a disease are associated with lower PPV (Positive Predictive Value) and NPV (Negative Predictive Value) (Dawson and Trapp, 2000).

The omission of somatic symptoms may provide better screening of the mental disorders in the elderly. A separate study should be conducted using GHQ-15 to evaluate its power as a screening instrument.

It is important to address some of the methodological concerns about the interpretation of our data. This study was conducted in one district of Tehran using a relatively small sample. The demographic characteristics of the subjects in this study are different from those of elderly people in Iran as a whole. According to the most recent Iranian population census (1996), 43% of elderly people live in rural areas and more than 70% are illiterate (in this study only 14%). Although

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the prevalence of some mental disorders in rural/urban areas is controversial (Kovess-Masfety *et al.*, 2005; Rohrer *et al.*, 2005), a number of studies suggest a higher rate in rural areas (Blazer *et al.*, 1985; Elhai *et al.*, 2004; Rihmer and Angst, 2005). Furthermore, some studies indicate that illiteracy may be a risk factor for mental disorders (Noorbala *et al.*, 1999; Taylor *et al.*, 2004; Rohrer *et al.*, 2005). The results of the current study indicate a significant reverse relationship between illiteracy and GHQ scores. Therefore, these two factors (illiteracy and rural/urban setting) may affect the results in terms of psychometrics: (1) a higher rate of a disease could reduce the cutoff point, PPVs and NPVs, and (2) the phenomenology of the mental disorders may be influenced by different sociocultural conditions. Our previous factor structure study of the geriatric depression scale (GDS) in Iran showed that four items of GDS do not have a significant relationship with depression (Malakouti *et al.*, 2006).

Based on the results of this study, the GHQ-28 could be used in screening and clinical studies, particularly in urban areas, but replication studies are recommended among a mixed population and with a larger sample size.

Conflict of interest

None.

Description of authors' roles

Seyed Kazem Malakouti designed and carried out the study, supervised the data collection, and wrote the paper. Paridokht Fatollahi designed the study, was responsible for the statistical design, carried out the statistical analysis, and assisted with writing the paper. Arash Mirabzadeh designed the study, gathered data, and assisted with writing the paper. Taher Zandi: designed the study, and assisted with writing the paper.

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