Internal consistency and factor structure of the Chinese Health Questionnaire

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The internal consistency and factor structure of the Chinese Health Questionnaire (CHQ) were investigated in 2 samples in Taiwan, one from 3 communities (n = 1023) and the other from consecutive attenders for health screening in a general hospital (n = 386). Cronbach's alpha coefficients were calculated to be 0.84 and 0.83 for the 12-item and 0.90 and 0.92 for the 30-item CHQ version. Four factors similarly extracted for the CHQ-30 in both samples include somatic symptoms, anxiety and worrying, social dysfunction, and depression and poor family relationship. The implications of these findings were discussed from a cross-cultural perspective.

Key words: health questionnaire; internal consistency; factor structure; screening; Taiwan

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Over the past 2 decades, psychiatric screening questionnaires have been much refined and widely used in both hospital and community studies of nonpsychotic mental disorders in Western societies. The incorporation of such instruments in the 2-stage case-finding strategy has also become a well established method in psychiatric epidemiological studies.

In view of the vivid cultural difference between the Western and the Chinese societies, a Chinese Health Questionnaire (CHQ) was designed and developed in Taiwan, primarily for the screening of minor psychiatric morbidity in the community and primary care settings. The synthesis and development of the CHQ have been described in detail elsewhere (1, 2). In brief, all the GHQ-30 items and 30 newly designed items (thought to have taken into account the Chinese ways of expressing emotional distress) were combined into a primary item pool. This item pool was then treated with discriminant function analysis to develop a 30-item version (the CHQ-30) in a community sample (n = 150), with a case criterion defined by the Clinical Interview Schedule (CIS) (3). A further discriminant analysis was performed on this CHQ-30 to derive a 12-item version (the CHQ-12). In this development study, the overall classification power of the CHQ-12 was found to be 98%.

The validity of the CHQ has subsequently been tested in two studies in Taiwan with a Chinese version of the CIS (4) as the second stage case identification tool. One study was conducted in a sample (n = 1023) from 3 communities (5), the other in a patient sample drawn from consecutive attenders admitted for general health screening in a medical centre (6). The weighted classification rate, sensitivity and specificity of the CHQ-12 were found to be 89%, 70% and 95% respectively in the community study. Using a relative operational characteristic (ROC) analysis in the hospital study, the sensitivity figures of the CHQ-30 and CHQ-12 at the optimum cut-off scores were 76 and 78% respectively, and the specificity of both was 77%.

Although the criterion validity of the CHQ was found to be acceptable in these assessment studies, the internal consistency and factor structure of this instrument have not yet been studied. The purpose of this study was to conduct such an investigation in the 2 samples previously described. Similarities and differences in the factor structure between different settings were compared. Implications of the findings regarding psychopathology and illness expression of minor psychiatric morbidity, as well as the psychometric property of the CHQ for use in Chinese communities are discussed.

Material and methods

The 1023 sample subjects who completed the CHQ-30 were drawn from the 3 communities of equal size. Since the total population in Taiwan is also equally distributed across rural, suburban and urban communities, it was decided to conduct analyses on the total sample, judged to be representative of the whole population in Taiwan. The results thus

derived would be relevant and applicable to any Chinese community in Taiwan. The characteristics of the hospital sample (n = 386) have been reported elsewhere (6).

Among the 30 items of the CHQ, 15 have come from the GHQ-30. The corresponding GHQ items of them have been specified in the Appendix. They are questions related to anxiety, depression, insomnia, fatigue, poor concentration and memory, and social functioning. The other 15 came from those newly designed. They have included 9 items on physical health, 3 on family relationship, 2 on anxiety, and 1 on social function. Many of the physical items can similarly be found in the original 140-item pool of the GHQ (7). They were excluded for being endorsed by 12% of patients with entirely physical illness in the preparation of the GHQ-30. The 3 items on family relationship might reflect the importance of Chinese kinship tie in relation to social support (8) and psychological well-being. The other 3 items mainly involve the Chinese psycholinguistic expression over anxiety and social dysfunction.

A 0–1 scoring method was applied on the 30 items of the CHQ in these 2 studies. The factor structure of the CHQ was investigated on the scores of all respondents of the 2 samples. A principal component analysis with varimax rotation was then performed separately on the 2 data sets of the CHQ-30. Cattell's scree test was used for selection of factors to be rotated and a threshold of >0.5 was applied for retention of items in factor scales (9).

Results

Internal consistency of the CHQ-30 and CHQ-12

The Cronbach's alpha coefficients of the CHQ-30 in the community and hospital groups are calculated to be 0.90 and 0.92 respectively. The corresponding figures for the CHQ-12 are 0.84 and 0.83. They are satisfactory with slightly lower figures for the short CHQ version. Figures for the same version are comparable for community and hospital respondents.

Factor structure of the CHQ-30 among community respondents

A principal component analysis was first performed on data of the CHQ-30 among community respondents. Six factors were found with eigenvalues exceeding unity, accounting for 50.9% of the total variance. The first 4 factors, accounting for 43.5% of the total variance, were retained on the basis of the scree test. This 4-factor solution was then applied in a further principal axis factor analysis with varimax rotation for interpretation. Table 1 shows the factorial structure from this analysis with items of significant loadings on each of the factors (greater than 0.5).

Table 1. Factorial structure of the CHQ-30 after varimax rotation of the 4-factor solution: community respondents (n = 1023)

Factor I Somatic symptoms	Factor II Anxiety and worrying	Factor III Social dysfunction	Factor IV Depression/poor family relation
CHQ 03 (0.72)	CHQ 06 (0.77)	CHQ 27 (0.75)	CHQ 12 (0.75)
CHQ 14 (0.70)	CHQ 19 (0.69)	CHQ 28 (0.68)	CHQ 10 (0.69)
CHQ 02 (0.67)	CHQ 26 (0.68)	CHQ 24 (0.67)	CHQ 08 (0.57)
CHQ 01 (0.67)	CHQ 21 (0.63)	CHQ 25 (0.58)	CHQ 07 (0.54)
CHQ 04 (0.58)	CHQ 18 (0.58)		
CHQ 16 (0.57)	CHQ 11 (0.54)		
CHQ 17 (0.50)			

Cumulative variance = 43.5%.

It was possible to construct four distinguishable factors defined as follows: somatic symptoms (Factor I), anxiety and worrying (Factor II), social dysfunction (Factor III) and depression and poor family relationship (Factor IV). All the items retained were found to have high loads only on a single factor. For the 15 new items, 7 of the 9 physical items loaded high on Factor I. Two of the 3 concerning family relationship have high loads, one (CHQ07 – getting along well with family members or close relatives) on Factor IV, and the other (CHQ11 – worrying about your family) on Factor II. It is understandable that, in a Chinese culture, depression is often associated with a poor relationship with family members (such as marital conflicts, conflicts between mother- and daughter-in-law or parents and children) (10). The 2 anxiety items also loaded high on Factor II.

Factor structure of the CHQ-30 among hospital respondents

The factor structure of the CHQ-30 was similarly investigated among the hospital respondents. Six factors were also found with eigenvalues exceeding unity, accounting for 53.1% of the total variance. The first 4 factors, accounting for 46.0% of the total variance, were similarly retained on the basis of the scree test. A further principal axis factor analysis was then performed on this 4-factor solution with varimax rotation. Table 2 shows the factor structure from this analysis with items of significant loadings.

It was interesting to find that the 4 distinguishable factors derived from this hospital group were exactly the same as those from the community group. The first and second factors were, however, different in order between the 2 factor structures. A few minor differences were also observed at the item level between them. More detailed inspections have revealed that some items, though with considerable factor loading in one group, have not reached the threshold of 0.5 for retention in the other group. For example, CHQ22 had a load of 0.41 on social dysfunction factor in the community group. Further-

Table 2. Factorial structure of the CHQ-30 after varimax rotation of the 4-factor solution: hospital respondents (n = 386)

Factor I Anxiety and worrying	Factor II Somatic symptoms	Factor III Social dysfunction	Factor IV Depression/poor family relation
CHQ 21 (0.66)	CHQ 01 (0.69)	CHQ 28 (0.68)	CHQ 12 (0.71)
CHQ 18 (0.61)	CHQ 03 (0.64)	CHQ 22 (0.67)	CHQ 29 (0.61)
CHQ 06 (0.60)	CHQ 02 (0.64)	CHQ 27 (0.53)	CHQ 10 (0.58)
CHQ 13 (0.57)	CHQ 16 (0.59)	CHQ 25 (0.52)	CHQ 08 (0.54)
CHQ 26 (0.57)	CHQ 04 (0.54)	CHQ 24 (0.51)	CHQ 07 (0.53)
CHQ 09 (0.56)	CHQ 17 (0.53)		CHQ 11 (0.52)
CHQ 19 (0.56)			
CHQ 20 (0.54)			
CHQ 14 (0.53)			

Cumulative variance = 46.0%.

more, some items were found to have considerable loads on more than one factor. For instance, CHQ20 had factor loadings of 0.40 on somatic factor and 0.38 on anxiety factor in the community sample, and the corresponding figures in the hospital group were 0.54 and 0.38. These items might have either represented more than one dimension of psychopathology of minor psychiatric morbidity, or been interpreted differently by respondents as referring to different symptoms.

CHQ20 (*shen-ching-shuai-jo*) was translated from GHQ30 (nerves were too bad...) by laypeople in the initial design. Shen-ching-shuai-jo is a term commonly used by the Chinese laypeople in Taiwan to describe a mixed state of discomforts with fatigue, insomnia, headache, and poor memory/concentration (11). Although it was previously described as a specific culture-bound neurotic syndrome in Chinese (12), it might however be regarded as a culture-specific illness expression (an idiom) clinically equivalent to minor psychiatric morbidity among psychiatric patients (13) and community cases (11). It might therefore be adequate for screening of general minor psychiatric morbidity, but not for specific psychopathology in Taiwan.

Discussion

Methodological considerations

Factor analysis was applied in the development of some well-known self-administered screening questionnaires. It is helpful in constructing main symptom components out of questionnaire items. The inclusion of items with high loads on these factors would ensure the homogeneity of the questionnaire construct.

Previous work on factor analysis of screening questionnaires, however, has been found to vary widely on factoring techniques and sample/item number ratio. It has been recommended that the Cattell's scree test is to be preferred in deciding the number of components for rotation, and a threshold of 0.5 is preferred for retention of items in factor scales. The sample size is also suggested to be ideally at least 5 times the number of items for analysis (9). This study followed all these recommendations and both samples have numbered more than 10 times the number of CHQ items. The factor structure of the CHQ has been investigated in both representative community and hospital samples for comparison.

Implications of the findings

Internal consistency. It is clear that Cronbach's alpha values for both the CHQ-30 and the CHQ-12 are satisfactory in both community and hospital samples. They are also compatible to figures generally found for various valid screening tests (9). One of the properties of the alpha coefficient is that it will increase with increasing item numbers. The fact that alpha is higher for the CHQ-30 than for the CHQ-12 is to be expected. The CHQ-12 was also applied in a community study among married couples (n = 962) drawn from 7 communities with varied degrees of urbanization in the Greater Taipei Area (14). The Cronbach's alpha coefficient was calculated to be 0.79. In general, therefore, the internal consistency of the CHQ was found to be quite acceptable in Taiwan.

Factor structures of the CHQ-30. The factor structures of the CHQ-30 in community and hospital samples have been found to be identical at the component level with some differences at the item level. The latter are quite minor, which have at least implied a consistency of the patterns of illness expression among community and hospital respondents. The fact that the first 2 factors accounting for the largest part of the total variance are different in order between factor structures in these 2 samples might have been due to some differences in the general health condition of the 2 groups. It should be pointed out that the hospital sample has been derived from health screening attenders. Some of them did not have physical illness and many of others have come at the request of their employers. It might be speculated that a relatively different factor structure might come from true patient samples. This has to be investigated in the future.

In principle, factors derived from different item pools or in different populations with the same items are likely to be relatively different. However, as Goldberg & Williams (9) have commented on various factor analytic studies of the GHQ, broad similarities between their findings are found although there are differences at the component level and considerable differences at the item level. The components generally found in factor analytic studies of

the GHQ have included general physical, depression, anxiety, sleep, somatic and social functioning factors. Shorter versions generally revealed fewer factors since factors with higher percentage of variance would take on other components.

The somatic factor found in the CHQ-30 was absent in the GHQ-30 since most of the somatic items have been withdrawn in the preparation of the latter. This factor has, however, been derived from the GHQ-60 in the United Kingdom (15) and Mexico (15). Furthermore, the 4 factors derived from the CHQ-30 are very similar to those of the GHQ-28 (15). This might very likely imply that both the GHQ and the CHQ have investigated the same dimension of minor psychiatric morbidity. Different item structure on the same component might merely reflect cultural characteristics in the expression of that particular symptom dimension. The findings in this study might have thus supported the notion that the basic psychopathology of minor psychiatric morbidity is culturally general (etic), whereas its expression is to a certain extent culturally specific (emic) (16).

It has been argued that differences in the emic aspects of psychopathology will eventually become nonsignificant as modernization continues in developing countries (17). Nonetheless, the incorporation of emic items (for example, the somatic items) in psychiatric screening instruments for community study in non-Western countries might merit a careful consideration at present (18). The development of the SRQ in the previous WHO collaborative study is a good example (19). The use of such instruments may not necessarily hamper cross-cultural studies if the operational definition and threshold of symptoms employed in the psychiatric interview for the validation of these screening tools can be standardized across cultures. A cross-cultural comparison of the symptoms of minor psychiatric morbidity between Great Britain and Taiwan has recently been carried out in this way (11).

Comparison between the CHQ-30 and the CHQ-12. As previously described, the CHQ-12 has been developed by discriminant function analysis on the CHQ-30. A general inspection might find that certain items with high loads in the factor structure of the CHQ-30 are not found in the CHQ-12. The most obvious example is Factor III (social functioning) of the CHQ-30 and its significant loading items, which were totally absent in the CHQ-12. This difference might be related to the different function of factor and discriminant analyses.

Factor analysis is a kind of multivariate analysis without a dependent variable. Factors thus derived are able to describe the individual differences within the sample based on their questionnaire responses. Any variable other than clinical status (for example, sociodemographic factors) with a potential influence on such responses could also affect the factorial structure. Discriminant analysis is primarily aiming at finding a discriminant function that can best distinguish defined groups of respondents (such as cases and normals) as the dependent variable. Items irrelevant to this purpose, though possibly with significant differences of response among all respondents, will be insensitive to the resultant discriminant function, and vice versa. In other words, items with high loads on a factor do not necessarily have considerably different responses between defined groups intended to be classified.

One might also argue that social functioning and psychopathology, though closely related to each other, are different dimensions. Since the criterion of groups for our discriminant analysis is the latter, it is likely that items of the former were of less discriminating power than those related to the latter. It is true that the shorter version of the CHQ is less informative, particularly with regard to the dimension of social function. However, the choice of which version to be used really depends on the purpose of the investigation, i.e., screening for general or specific dimensions of psychopathology. Furthermore, the screening for social dysfunction and other dimensions of abnormal behaviour (such as alcoholic problems, personality disorders and so forth) might better be conducted with separate instruments (20, 21). In practice, a shorter version is obviously more favoured since much time can be saved for other inquiries.

Conclusions

Screening questionnaires have now been widely applied in psychiatric epidemiological surveys. The methods for developing these instruments have been much refined in the past 2 decades. The design of the CHQ has taken into account culturally specific illness expressions of the Chinese. Its development has included the use of the discriminant function technique. The factor structure of the CHQ-30 has suggested a satisfactory construct (conceptual) validity for minor psychiatric morbidity.

Similarities in the factor structure between the CHQ-30 in Taiwan and the GHQ in other countries may well imply that there are considerable similarities in psychopathology of minor psychiatric morbidity cross-culturally. These, together with the acceptable internal consistency and (criterion) validity coefficients among different settings have probably suggested that it is a feasible, reliable and valid screening tools for use in Taiwan. It might be also applicable in Chinese communities around the world, which will require further investigations.

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Appendix

The 30-item pool of the CHQ

	Have you recently:
*CHQ 01	been suffering from headache or pressure in your head?
*CHQ 02	had palpitations and worried that you might have a heart trouble?
*CHQ 03	had discomfort or a feeling of pressure in your chest?
*CHQ 04	been suffering from shaking or numbness of your limbs?
*CHQ 05	lost much sleep over worry? (GHQ 02)
*CHQ 06	been taking things hard? (GHQ 18)
*CHQ 07	been getting along well with your family and close relatives?
*CHQ 08	been losing confidence in yourself? (GHQ 23)
*CHQ 09	been feeling nervous and highstrung? (GHQ 28)
*CHQ 10	been feeling hopeful about your future? (GHQ 26)
*CHQ 11	been worrying about your family or close relatives?
*CHQ 12	been feeling that life is entirely hopeless? (GHQ 25)
CHQ 13	been having a good memory? (GHQ 01)
CHQ 14	been feeling giddy?
CHQ 15	been full of verve when you wake up in the morning?
CHQ 16	been feeling that your respiration is not smooth?
CHQ 17	been having aches and pains over your body?
CHQ 18	felt that your mind is clear without excessive worrying?
CHQ 19	felt that everything is on top of you? (GHQ 21)
CHQ 20	been feeling *shen-ching-shuai-jo* (weakness of nerves)? (GHQ 30)
CHQ 21	been feeling uneasy or irritable over trivialities?
CHQ 22	been interested in ordinary leisure activities?
CHQ 23	been outdoors as frequently as usual? (GHQ 05)
CHQ 24	been satisfied with the way you handle things? (GHQ 08)
CHQ 25	been able to show warmth or affection towards others near you? (GHQ 09)
CHQ 26	been feeling constantly under strain? (GHQ 14)
CHQ 27	felt in general things are well managed? (GHQ 07)
CHQ 28	felt that others could not do better in your place? (GHQ 06)
CHQ 29	felt that you are a burden to your family and close relatives?
CHQ 30	felt that your sexual functioning is normal?

* CHQ-12 items.