Factor Structure of the World Health Organization's Quality of Life Questionnaire-BREF in Patients with Coronary Artery Disease

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Original Article

ABSTRACT

Background: The World Health Organization Quality of Life Questionnaire (WHOQOL)-BREF is one of the most known general questionnaires for assessment of quality of life (QOL) in both healthy populations and in various diseases subgroups. The aim of the present study was to examine the construct validity of this questionnaire in patients with coronary artery disease (CAD) using factor analysis.

Methods: Two hundred and seventy-five patients aged 35-80 years old with the diagnosis of CAD admitted to the Tehran Heart Center operating room for coronary artery bypass were consecutively entered into the study. QOL was assessed using the WHOQOL-BREF. To estimate the reliability of the QOL questionnaire, Cronbach's α coefficient was measured. To assess the structure of the questionnaire, we firstly performed confirmatory factor analysis to test the hypothesized factor models. Exploratory factor analysis was then performed using the principal component method with varimax rotation.

Results: Reliability of the questionnaire was low (Cronbach's α for different domains ranged from 0.24 to 0.74). In confirmatory factor analysis, only the 1-factor model indicated a good fit to the data. The exploratory factor analysis indicated a five-factor solution that jointly accounted for 55.7% of the variance observed. Also, the pattern of item loading was very different from the original structure of the questionnaire.

Conclusions: The findings suggest that the WHOQOL-BREF might only be a measure of the overall QOL in patients with CAD, and is not a suitable instrument for measuring the different QOL dimensions as expected in this population.

Keywords: Coronary artery disease, factor analysis, quality of life, WHOQOL-BREF questionnaire

INTRODUCTION

Measuring quality of life (QOL) in patients with coronary artery disease (CAD) is an important primary outcome and could be a useful determinant of therapeutic benefit.[1,2]

A number of questionnaires have been designed to examine, specifically, the QOL in patients with heart diseases, such as the Seattle Angina Questionnaire,[3] the Quality of Life after Acute Myocardial Infarction[4] and the Minnesota Living with Heart Failure[5] questionnaires. However, some general questionnaires would also be applicable in QOL assessment in CAD patients, especially those questionnaires that are proven cross-culturally. The World Health Organization Quality of Life Questionnaire (WHOQOL)-BREF is one of the well-known general questionnaires for assessment of QOL in both healthy populations and in various diseases subgroups. It defines QOL as the participants' perceptions of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns. Recognition of the multidimensional nature of QOL in the WHOQOL-BREF is based on four domains, namely: Daily living, psychological bodily image and appearance, social and personal relationships and environmental–financial resources.[6] Although it is believed that the WHOQOL-BREF could be used for epidemiological surveys, studies have indicated that the WHOQOL-BREF questionnaire was inappropriate for evaluating the QOL in CAD patients.[7-12]Also, on the basis of our similar experience, it seems that the WHOQOL-BREF questionnaire has less application than some other general tools such as the SF-36 questionnaire or special questionnaires for evaluating the QOL in CAD patients.[13] Therefore, it appears that the assessment of the factor structure of this questionnaire in CAD patients is necessary. The present study aimed to examine the construct validity of the WHOQOL-BREF in CAD patients using both confirmatory and exploratory factor analyses.

METHODS

Study population

A consecutive sample of patients with CAD and candidate for isolated coronary artery bypass surgery (CABG) were recruited to enter in a cross-sectional study at the Tehran Heart Center from April to September 2006. Patients who had undergone valvular surgeries and/or non-cardiac procedures were excluded. Sociodemographic characteristics and clinical data were extracted from hospital records and also collected by face-to-face interview before operation. The research committee at the Tehran University of Medical Sciences approved the study. The following data were included for analysis: General characteristics, pre-operative risk factors for CAD and pre-operative cardiac and hemodynamic status.[14]

QOL assessment

QOL was assessed using the WHOQOL-BREF before CABG. This is a 26-item instrument consisting of four domains: Physical health (seven items), psychological health (six items), social relationships (three items) and environmental health (eight items); and two overall QOL and general health items that are used to measure an individual's overall satisfaction with life and general sense of personal well-being.[15] A summation and calculation of the mean score for each domain was carried out according to the WHOQOL transformation table to yield a score ranging from 0 to 100 for each domain.[16,17] A higher score on this questionnaire represents a better QOL.

Statistical analysis

Descriptive statistics were presented as mean and standard deviation (SD) or by absolute frequencies and percentages. Reliability was assessed using the Cronbach's α coefficient, and values of 0.7 or higher were considered satisfactory.[18] To examine construct validity, only 24 items of this questionnaire were used and the two items relating to overall QOL and general health were excluded. At the first step, we performed confirmatory factor analysis to test the hypothesized 1-factor, 2-factor and 3-factor models separately. The objective of the confirmatory factor analysis was to explore to what degree the correlations between the original WHOQOL-BREF domains could be explained by each of the factors of the above models. Confirmatory factor analysis was performed using the CALIS procedure (Covariance Analysis of Linear Structural Equations), which estimates parameters and tests the appropriateness of structural equation models using covariance structural analysis. List-wise deletion was applied to the missing values under the assumption of

missing at random. To assess the adequacy of models fit to the data, the following indices were considered: The goodness-of-fit index (GFI),[19] the root mean square residual (RMSR),[20] the minimum fit function Chi-square (χ^2) test,[21] the root mean square error of approximation (RMSEA),[22] the comparative fit index (CFI)[23] and the non-normed fit index (NNFI).[24] The cut-off values for GFI, NNFI and CFI range between 0 and 1, with values closer to 1 indicating a better model fit. The Chi-square test indicates the amount of difference between the expected and the observed covariance matrices. A Chi-square value close to zero indicates a small discrepancy between the structure of the observed data and the hypothesized model. In addition, the probability level must be greater than 0.05 when Chi-square is close to zero. With regard to the RMSR and RMSEA as measures of good fit, cut-off values close to 0.08 and 0.06 show good fit, respectively.

Exploratory factor analysis was performed using principal-component factor method with un-rotated solution. The number of QOL factors was determined by eigenvalues greater than 1.0 and review of scree plot (eigenvalue represents amount of variance accounted for by each factor in factor analysis of a questionnaire).[15] Those items with factor loadings of 0.40 or greater were considered satisfactory.

Both confirmatory and exploratory factor analyses were undertaken using the statistical software SAS version 9.1 for windows (SAS Institute Inc., Cary, NC, USA).

RESULTS

In all, 275 patients were studied. The mean age of the patients was 59.78 (SD = 9.01) years, and most were men (n = 215, 78.2%). The most prevalent risk factors for CAD were hypercholesterolemia (68.0%), recent myocardial infarction (49.5%) and hypertension (49.1%). Most patients had three defected coronary vessels and over two-third of all participants had functional class II or III. Table 1 shows the patients' characteristics.

The results of the QOL scores as measured by the WHOQOL-BREF are presented in Table 2. In all measures, men scored higher than women. Cronbach's α for the different domains ranged from

Table 1: Demographic characteristics and clinical data of patients (n=275)

	No. (%)
Gender	
Male	215 (78.2)
Female	60 (21.8)
Age, mean (SD)	59.78±9.01
Body mass index (kg/m^2), mean (SD)	27.22±4.36
Education level	
Primary	159 (60.7)
Secondary	62 (23.7)
Higher	41 (15.6)
Family history of coronary artery disease	
Yes	126 (46.0)
No	148 (54.0)
Current cigarette smoking	
Yes	103 (37.5)
No	172 (62.5)
Diabetes mellitus	
Yes	116 (42.8)
No	159 (57.8)
Opium addiction	
Yes	41 (14.9)
No	234 (85.1)
Hypercholesterolemia	
Yes	187 (68.0)
No	88 (32.0)
Hypertension	
Yes	135 (49.1)
No	140 (50.9)
Cerebrovascular disease	
Yes	12 (4.4)
No	263 (95.6)
Peripheral vascular disease	
Yes	56 (20.4)
No	219 (79.6)
Recent myocardial infarction	
Yes	136 (49.5)
No	139 (50.5)
Ejection fraction	
Mean (SD)	49.30±9.72
Functional class	
I	92 (33.5)
II	141 (51.3)
III	42 (15.2)
Euroscore	
Mean (SD)	2.36±2.28
Coronary vessels involvement	
Single-vessel disease	10 (3.6)
Two-vessel disease	64 (23.3)
Three-vessel disease	201 (73.1)

Table 2: Description of scores and reliability estimates of the WHOQOL-BREF

Domain	Mean (SD)			Reliability estimate	
	Total	Men	Women	Number of items	Cronbach's α
Physical domain	56.34 (10.43)	57.88 (10.24)	50.97 (9.35)	7	0.248
Psychological domain	58.05 (11.39)	59.55 (11.11)	52.72 (10.84)	6	0.260
Social relationships	59.47 (17.52)	61.13 (16.92)	52.40 (18.43)	3	0.585
Environmental domain	56.43 (14.18)	57.60 (14.09)	52.30 (13.83)	8	0.744

WHOQOL=World health organization quality of life questionnaire

0.24 to 0.74, and exceeded the cut-off value (0.7) only for the environmental domain.

The results of Confirmatory Factor Analysis (CFA) are presented in Table 3. One-, two-, three- and four-factor models were tested. Although some of the criteria such as GFI were close to the cut-off values for acceptable fit, most of the fit indices showed poor fits for the models except for the 1-factor model.

Finally, exploratory factor analysis was performed [Table 4]. There were five factors with eigenvalue greater than 1.0 that jointly accounted for 55.7% of the variance observed. The pattern of item loading was found to be very inconsistent with the original structure of the questionnaire.

Table 3: Confirmatory model fit indices for factor analyses of the WHOQOL-BREF

Index	4-factor model	3-factor model	2-factor model	1-factor model
GFI	0.69	0.81	0.91	0.99
RMSR	0.30	0.25	0.18	0.01
Chi-square	178.05	104.70	47.31	0.58
df	2	2	2	2
P value	<0.0001	<0.0001	<0.0001	0.75
RMSEA	0.60	0.45	0.30	0.00
CFI	–0.02	0.40	0.73	1.00
NNFI	–2.07	-0.79	0.20	1.02

GFI=Goodness-of-fit index, RMSR=Root mean square residual, RMSEA=Root mean square error of approximation, CFI=Comparative fit index, NNFI=Non-normed fit index

DISCUSSION

Confirmatory and exploratory factor analysis showed that the pattern of item loading is not consistent with the structure of the questionnaire and the 1-factor model probably is most fit to explain the QOL in our study.

Factor analysis is a procedure that uses mathematical models to explain the interrelationships of a set of manifest variables by a smaller number of underlying factors that cannot be observed or measured directly. This analysis can help researchers to assess various aspects of an individual's QOL both in the normal population and also in the different subgroups of diseases. In the present study, we used this type of analysis to test the construct validity of the WHOQOL-BREF in relation to its hypothesized structure.

The WHOQOL-BREF is based on the following four domains: Daily living, psychological bodily image and appearance, social and personal relationships and environmental–financial resources. We firstly tested the generalization ability of the hypothesized one-, two-, three- and four-factor models of this questionnaire in CAD patients. The fit indices showed quite poor fits for the two-, three- and four-factor models. These results confirmed that the three above hypothesized models could not be acceptably structured for assessment of QOL in CAD patients. We believe that the obtained poor fits can be explained by the substantial cross-loadings of the questions of a domain with other domains. For example, the question regarding safety and structured in environmental domain (i.e., how safe do you feel in your daily life?) can be interpreted as patient's perception of his or her mental situation. Furthermore, as shown in another study by the authors, deletion of some items of the BREF questionnaire led to an increase in Cronbach's α in each domain and improved the structure of the questionnaire.[25] However, these high cross-loadings of the questions might be observed only in the CAD group, and a four-factor structure might be achieved in the normal population or in other diseases subgroups.[8,26,27] It seems that the WHOQOL-BREF covers a very broad range of

Table 4: Factor structure of the WHOQOL-BREF derived from principal component analysis with varimax rotation*

Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Q3	–0.430	–0.012	–0.604	0.022	0.048
Q4	–0.003	–0.271	–0.728	–0.016	0.016
Q5	0.453	0.589	0.048	–0.137	0.257
Q6	0.654	0.430	0.077	–0.111	0.206
Q7	0.660	0.215	0.129	0.074	0.073
Q8	0.097	0.762	0.130	0.069	0.061
Q9	–0.051	0.630	0.029	0.159	0.107
Q10	–0.064	0.484	0.627	0.116	0.021
Q11	–0.065	0.434	0.485	0.095	0.083
Q12	0.648	0.069	0.128	0.383	–0.031
Q13	0.699	–0.105	0.066	0.359	0.180
Q14	0.460	0.059	0.135	0.607	0.017
Q15	0.272	–0.059	0.529	0.218	0.332
Q16	0.464	–0.105	0.341	0.098	0.311
Q17	0.109	0.120	0.608	0.208	0.299
Q18	0.310	–0.080	0.549	0.254	0.343
Q19	–0.273	0.496	0.315	0.113	0.429
Q20	0.218	0.167	0.155	0.018	0.768
Q21	0.192	0.128	0.118	0.135	0.665
Q22	0.519	–0.063	–0.030	0.227	0.279
Q23	0.115	0.462	–0.061	0.382	0.342
Q24	0.121	0.229	0.106	0.635	0.187
Q25	0.134	0.082	0.199	0.753	0.038
Q26	–0.140	–0.617	–0.184	–0.053	0.082
Eigen value	6.62	2.62	1.64	1.28	1.20
% Variance	13.7	12.7	12.1	8.7	8.5

*Values of 0.4 or above (indicated in bold) considered satisfactory. Factors are named based on the domain they most fit to. Factor 1=Psychological-environmental, Factor 2=Psychological, Factor 3=Physical health, Factor 4=Environmental, Factor 5=Social

QOL aspects, and some items did not discriminate well between domains. It is believed that the identification of a particular item with its intended domain can be improved by changing the wording and semantics of the translation to reinforce the intended concept. For example, some items on safety and energy can be more strongly associated with the psychological domain than their intended domains – environment and physical, respectively, so the conceptualization of these issues appears to depart from the theoretical concept.[12]

In our study, according to the results of exploratory factor analysis, five factors with eigenvalues greater than 1.0 were obtained. This result indicated that the WHOQOL-BREF could probably describe the patients' overall QOL, and not the special aspects of QOL. Similarly, Huang *et al*. showed that the WHOQOL-BREF could describe global QOL, including both health-related and non-health-related QOL. They believe that the WHOQOL-BREF measures self-reported subjective QOL such as satisfaction with individual capacities and functioning.[28] Also, Skevington *et al*. showed that the WHOQOL-BREF was classified as a measure of inner life satisfaction or global subjective enjoyment of life. Some studies have shown that the variance in overall QOL explained by subscales of the WHOQOL-BREF was large, ranging from 42%[29] to 62%.[30] However, some studies could obtain a domain structure that included two factors of "personal relations" and "environment" in a general population.[31] Gill and Feinstein also highlighted the need for two global ratings, one on overall QOL and the other on health-related QOL. They noted that overall QOL encompassed not only health-related factors but also many non-medical phenomena, such as employment, family relationships and spirituality.[32]

CONCLUSIONS

Overall, our study indicated that the present structure of the WHOQOL-BREF could measure global QOL in CAD patients. Thus, it seems that the WHOQOL-BREF questionnaire might describe the general perception of patients about their well-being and satisfaction and not measure four separate domains.

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