

Influence of health-related quality of life on health service utilization in addition to socio-demographic and morbidity variables among primary care patients in China

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Abstract

Objectives We aimed to investigate whether health-related quality of life (HRQOL) influences health service utilization and whether such influence exists independently in addition to socio-demographic and morbidity variables.

Methods A retrospective design was carried out among 737 primary care patients in mainland China. Health service utilization was measured by the number of monthly outpatient consultations and the annual hospitalization rate. HRQOL was measured by the SF-36. A clustered regression model was adopted throughout the analysis.

Results Lower HRQOL was associated with a higher utilization rate. Three out of the eight SF-36 subscales were associated with outpatient consultation, and additional two with inpatient consultation. One subscale of the SF-36 (mental health) was associated with an independent influence of 11.8% with outpatient consultation, and another subscale of the SF-36 (general health) was associated with an independent influence of 26.0% with inpatient consultation.

Conclusions Health service utilization increased significantly with decreasing HRQOL, and the independent influence of HRQOL on health service utilization was smaller than that of socio-demographic and morbidity variables among primary care patients in mainland China.

Keywords Health-related quality of life (HRQOL) · SF-36 · Association · Clustered regression model · Health service utilization · Consultation

Introduction

Along with the development of social economics and the progress of medical treatment technology, chronic diseases (e.g., hypertension and diabetes) have become main diseases influencing human health. They constitute one of the most dominant health problems during the last century. It is well known that patients with chronic diseases use health services very frequently. Consequently, optimizing the distribution of health services becomes a top priority for health policy makers, due to the limited health service resources. The study by Dominick et al. (2004) point out that identifying and understanding the determinants of health service utilization play an important role in guiding health policy makers and health service providers to optimize health service distribution.

Nevertheless, determinants of health service utilization have not been explicitly identified and understood, though many researches have been involved in this field over the last two decades (Andersen and Newman 1973; de Boer et al. 1997; Ethgen et al. 2002). According to Andersen's behavioral model of health service utilization (Andersen and Newman 1973), determinants of health service utilization comprise socio-demographic factors (e.g., economic conditions and medical insurance, etc.), diseases factors (based on medical diagnosis) and health-related quality of life (HRQOL) factors. In recent years, interest in the impact of HRQOL on health service utilization has increased dramatically and many studies have shown that HRQOL is a fundamental determinant of health service utilization for western populations (Dominick et al. 2004; Nelson et al. 1998; Miilunpalo et al. 1997; Mols et al. 2007; Singh et al. 2005; Berra et al. 2006; Rosemann et al. 2008). Specifically, in the USA, the study by Nelson et al. (1998) indicates that physical functioning and mental

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health are the two major predictors of both clinic consultations and hospitalizations for chronic patients. Furthermore, Dominick et al. (2004) identifies that HRQOL, especially pain frequency, can be an invaluable tool for estimating future health service utilization among old patients with osteoarthritis. In northern Europe, the study by Miilunpalo et al. (1997) proves that HRQOL has associations with annual outpatient consultation rates for a working-age population in Finland.

However, there are very few reports on the associations between HRQOL and health service utilization for Asian populations. One of these reports refers to the study performed by Matsumura et al. (2000) in Japan, which shows that subjects with bad physical and mental HRQOL (i.e., SF-36 physical and mental summary scores below 40) are more inclined to use outpatient and inpatient health service than those with good physical and mental HRQOL (i.e., SF-36 physical and mental summary scores over 50). For the Chinese population, there is only one relevant study (Lam et al. 2002), which was performed in Hong Kong. In this study, a linear association between the scores of the SF-36 subscales and health service utilization was identified. Five of the eight SF-36 subscales were independent determinants of the clinic consultation rate, whereas other two of these subscales, i.e., role limitation by physical problems and body pain, had a significant impact on the hospitalization rate. However, because of great differences between the health-care systems in China and in Hong Kong, we do not know whether these results can be generalized to the Chinese population in mainland China. To answer this question, it is necessary to perform an equivalent research in mainland China.

Therefore, the main goal of this study is to investigate whether the results found by Lam et al. (2002) in Hong Kong can be generalized to mainland China. Correspondingly, two objectives were pursued through the investigation. The first objective was to explore associations between HRQOL and health service utilization among primary care patients in mainland China. The second objective was to investigate whether HRQOL has an independent influence on health service utilization, in addition to the socio-demographic and morbidity variables. To be comparable to the results obtained by Lam et al. (2002), we adopted the same statistical methods and the same instrument (SF-36) for the HRQOL assessment. Additionally, the SF-36 is a reliable, valid and widely accepted HRQOL instrument among the western population (Ware and Sherbourne 1992; Ware and Gandek 1998; Ware 2000), and the Chinese population includes mainland China (Li et al. 2003; Chen and Li 2005; Wang et al. 2006), Hong Kong (Lam et al. 1998) and Taiwan (Fuh et al. 2000).

Methods

Study design and sample subjects

A retrospective design was carried out among patients consulting in the two convenient primary care clinics in the city of Hangzhou, Zhejiang Province, mainland China. All eligible subjects were asked to fill in a basic questionnaire and either an electronic version or a paper version of the Chinese SF-36. It depended on the respondents' preference to choose either the electronic or the paper version of SF-36. The investigation lasted for about 1 month (December 2005) and was terminated when at least 700 valid questionnaires had been completed.

Patients were included when they were older than 14 years of age, could read and agreed to participate in the study. Patients younger than 14 years of age or who refused to cooperate with our investigators were excluded.

The protocol of this study was approved by the Ethics Committee of the College of Medicine of Zhejiang University, China.

Measurement tools

The measurement tools consisted of (1) a basic questionnaire and (2) the Chinese SF-36, both in the electronic and in the paper version.

The basic questionnaire was applied for acquiring information regarding socio-demographic aspects, chronic diseases and health service utilization. The socio-demographic variables were age, gender, education level, marital status, occupation, medical insurance and average monthly income. The chronic diseases considered in the questionnaire were hypertension, diabetes, any kind of cardiopathy, stroke, asthma or other respiratory diseases (COPD), chronic arthropathy, any type of psychological diseases and other diseases lasting for over 4 weeks. Health service utilization variables were the number of monthly outpatient consultations and the number of annual hospitalizations.

The Chinese version of the SF-36 was applied for acquiring HRQOL. Depending on the subjects' choice, either the electronic or the paper version was used. Moreover, the SF-36 has 36 items comprising eight subscales, namely, physical function (PF), role limitations due to physical problems (RP), body pain (BP), general health (GH), vitality (VT), social functioning (SF), role limitations due to emotional problems (RE) and mental health (MH).

The electronic version of the SF-36 was realized by means of the quality-of-life-recorder (QL-Recorder) (Sigle and Porzolt 1996). The recorder is a platform for the

electronic recording of HRQOL data. It can provide high-quality data and get scores of subscales automatically. Through cooperation with the original inventor (Sigle and Porzolt 1996), we transferred the validated Chinese SF-36, developed by Li et al. (2003), into the QL-Recorder. Its scoring was automatically performed according to the scoring algorithm of the SF-36 manual. Once the electronic version was completed, the scores of the eight SF-36 subscales were immediately available. The electronic version could thereby provide scoring results immediately and data collected by the QL-Recorder could be directly transferred to data analysis software, such as EXCEL and SPSS for further usage.

Though the study by Chen et al. (2007) had identified the feasibility and reliability of the electronic version of the Chinese SF-36 and its advantages over the paper version, we provided both the electronic and the paper version of the Chinese SF-36 as instruments for assessing HRQOL. When the respondents chose the paper version, the data were first checked and then manually entered into the electronic SF-36 to get scores of subscales automatically. All data were finally exported into the SPSS software for further analysis.

Statistical methods

For treating the first objective, i.e., exploring the associations between HRQOL and health service utilization, two dependent variables representing health service utilization were applied: (1) the number of monthly outpatient consultations and (2) the number of annual hospitalizations. Because there were only a few annual hospitalizations, the dependent variable 'number of annual hospitalizations' was reconstructed as a binary variable with the two categories 'no annual hospitalization' and 'at least one annual hospitalization'. Accordingly, this dependent variable was analyzed with binary logistic regression analysis, as in Lam's paper (Lam et al. 2002). In contrast, for the dependent variable 'number of monthly outpatient consultations', a linear regression was applied. In both analyses, all eight SF-36 subscales were treated together in one single multivariate analysis as independent variables.

Clustered logistic regressions (Cohen et al. 1999) were adopted in the analysis for processing the second objective, and the two health service utilization variables were regressed on three clusters of independent variables. These three clusters were (1) the socio-demographic variables, (2) the information concerning the chronic diseases and (3) the eight subscales of the SF-36. There are possible multidirectional associations between the three clusters of independent variables and the dependent variables in this study (Fig. 1), i.e., the first cluster can

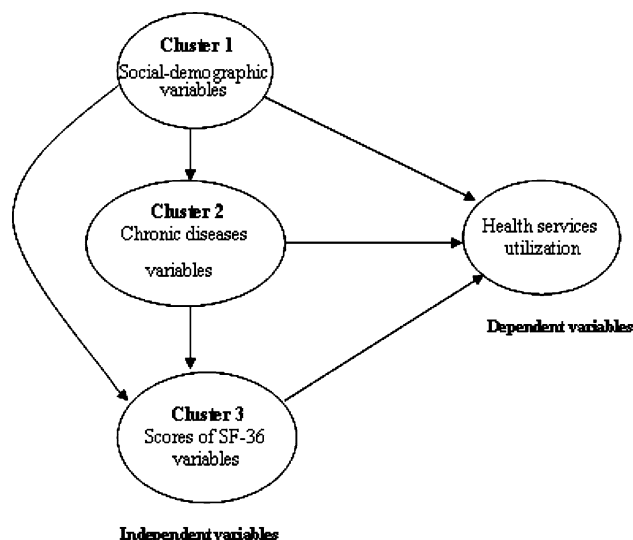


Fig. 1 The clustered model and associations (the direction of the arrows indicate the direction of the impact)

affect the second cluster, the third cluster and the dependent variables. Similarly, the second cluster can have impacts on the third cluster and the dependent variables. However, the third cluster can only affect the dependent variables. Thereby, variables in the preceding clusters can affect the variables in the succeeding clusters, but not vice versa.

We determined the final regression equation in three steps:

- (1) A stepwise forward regression for the socio-demographic variables.
- (2) A stepwise forward regression for the morbidity variables with the equation resulting from the first step as a fixed part of the new regression equation.
- (3) A stepwise forward regression for the eight subscales of the SF-36 with the equation resulting from the second step as the fixed part of the new regression equation.

The criterion for including variables into the regression analyses was a probability of 0.05 and a probability of 0.10 for excluding cases. The independent effect of each cluster on dependent variables was determined by calculating the corresponding R^2 change. The independent contribution of each cluster was then calculated by $(\text{individual } R^2 \text{ change} / \text{total } R^2) \times 100\%$. Those of the independent variables, which only possess ordinal level, were represented by dummy variables with the lowest category as the reference level. These reference levels were 'primary school' for the variable 'education level' and 'no' for the variable 'average monthly income'.

Table 1 Characteristics of sample subjects

Variables	Mean \pm SD	<i>N</i> (percentage)
First cluster (social–demographic variables)		
Age (years)	52.16 \pm 16.29	
Sex: (male)		353 (47.9%)
Marital status (married)		617 (83.7%)
Occupation (employed)		332 (45.0%)
Medical insurance (having)		686 (93.1%)
Average monthly income		
No (reference level)		31 (4.2%)
Below 1,600 RMB		347 (47.1%)
Minimum 1,600 RMB		359 (48.7%)
Education level		
1 = Primary school and lower (reference-level)		99 (13.4%)
2 = Junior high school		158 (21.4%)
3 = High school		188 (25.5%)
4 = College		267 (36.2%)
5 = Masters and above		25 (3.4%)
Second cluster (chronic diseases variables)		
Hypertension		323 (43.8%)
Diabetes		79 (10.7%)
Cardiopathy		157 (21.3%)
Stroke		22 (3.0%)
Respiratory disease (COPD)		59 (8.0%)
Chronic arthropathy		96 (13.0%)
Psychological diseases		18 (2.4%)
Other diseases that lasted over 4 weeks		59 (8.0%)
Total number of chronic diseases		
0		290 (39.3%)
1		233 (31.6%)
2		119 (16.1%)
≥ 3		95 (12.9%)
Third cluster (SF-36 subscales' scores) ^a		
PF	79.96 \pm 20.81	
RP	70.93 \pm 40.64	
BP	76.67 \pm 21.12	
GH	56.48 \pm 19.57	
VT	60.50 \pm 16.67	
SF	81.65 \pm 18.02	
RE	79.20 \pm 36.34	
MH	70.56 \pm 14.98	
Dependent variable		
Number of monthly outpatient consultations	1.61 \pm 1.53	
Annual hospitalization rate		
0		650 (88.2%)
≥ 1		87 (11.8%)

PF physical function; *RP* role limitations due to physical problems; *BP* body pain; *GH* general health; *VT* vitality; *SF* social functioning; *RE* role limitations due to emotional problems; *MH* Mental health

^a With regard to its scoring algorithm, higher values mean higher quality

Following this approach, the betas of the single dummy variables reflect how the corresponding categories affect the criterion variable in comparison with the reference level.

We used the QL-Recorder and the SPSS software. Scores of the SF-36 subscales were directly obtained via the QL-Recorder and the rest of the statistical analyses were conducted by the SPSS version 13.0.

Table 2 Association among the eight SF-36 subscales and the number of monthly outpatient consultations by linear regression

Variables entered	Unstandardized coefficients (<i>B</i>)	Standardized coefficients (β)	<i>P</i> value
PF	-0.012	-0.160	0.001*
RP	0.000	-0.011	0.822
BP	-0.009	-0.125	0.005*
GH	-0.008	-0.104	0.039*
VT	0.002	0.021	0.709
SF	-0.001	-0.006	0.894
RE	0.000	-0.010	0.817
MH	0.004	-0.034	0.481

All the eight SF-36 subscales were treated together in one single multivariate analysis

PF physical function; RP role limitations due to physical problems; BP body pain; GH general health; VT vitality; SF social functioning; RE role limitations due to emotional problems; MH mental health

* $P < 0.05$

Table 3 Association among the eight SF-36 subscales and the annual hospitalization rate by logistic regression

Variables entered	Unstandardized coefficients (<i>B</i>)	Exp (<i>B</i>)	<i>P</i> value
PF	-0.016	0.985	0.020*
RP	0.005	0.995	0.176
BP	-0.002	0.998	0.805
GH	-0.032	0.969	0.001*
VT	0.003	1.003	0.770
SF	-0.001	0.989	0.183
RE	0.002	1.002	0.654
MH	0.006	1.006	0.582

All the eight SF-36 subscales were treated together in one single multivariate analysis

PF physical function; RP role limitations due to physical problems; BP body pain; GH general health; VT vitality; SF social functioning; RE role limitations due to emotional problems; MH mental health

* $P < 0.05$

Results

Characteristics of sample subjects

A total of 737 subjects consulting a physician in the primary care clinics in mainland China were eventually recruited for the analyses. The independent variables are separated into three clusters and the dependent variables are presented in Table 1. For the dependent variables, the number of monthly outpatient consultations was 1.61 ± 1.53 (minimum 0 and maximum 10), whereas the annual hospitalization rate was 11.8%. For the independent variables, detailed information is shown in Table 1. It

should be pointed out that 60.7% participants had at least one chronic disease. Of these participants, 31.6% had one, 16.1% two, and 12.9% more than two chronic diseases. Interestingly, the percentage of participants with at least one chronic disease is very close to the percentage of 62% found by Lam et al. (2002) in Hong Kong.

Association between the eight SF-36 subscales and health service utilization

For three (PF, BP and GH) of the eight subscales of the SF-36, the number of monthly outpatient consultations increased significantly with decreasing HRQOL (see Table 2). For two (PF and GH) of the eight subscales, the annual hospitalization rate increased significantly with decreasing HRQOL (see Table 3).

Independent influence of the eight SF-36 subscales on health service utilization

As shown in Table 4, in the first cluster, outpatient consultation increased significantly with both age and possession of a medical insurance, and the independent contribution of socio-demographic variables was 58.9%. Moreover, in the second cluster, four morbidity variables (hypertension, diabetes, respiratory disease and other diseases over 4 weeks) were all positively associated with the outpatient consultation, and the independent contribution of morbidity variables was 29.3%. In addition, the number of monthly outpatient consultations increased significantly with decreasing scores of one (MH) of the eight subscales of the SF-36 ($P = 0.017$). Its influence on outpatient consultation in addition to socio-demographic and morbidity variables was 11.8%.

As shown in Table 5, in the first cluster, age was positively associated with inpatient consultation, whereas inpatient consultation decreased significantly with the "marital status" of having married. The independent contribution from socio-demographic variables was 47.6%. Moreover, in the second cluster, three morbidity variables (diabetes, cardiopathy and stroke) were all positively associated with the inpatient consultation, and the independent contribution from morbidity variables was 26.4%. Furthermore, the annual hospitalization rate increased significantly with decreasing scores of one (GH) of the eight subscales of the SF-36 ($P = 0.005$), and its impact on outpatient consultation in addition to socio-demographic and morbidity variables was 26.0%.

Discussion

Our study, for the first time, identified that the outpatient and inpatient consultation increased significantly with

Table 4 Influence of the eight SF-36 subscales on the number of monthly outpatient consultations in addition to socio-demographic and morbidity variables by the clustered linear regression model

Variables entered	Unstandardized coefficients (<i>B</i>)	Standardized coefficients (β)	<i>P</i> *	<i>R</i> ²	Independent contribution explained within the model (%)
First cluster					
Age	0.033	0.354	0.000		
Medical insurance	0.589	0.097	0.005		
Total				0.145	58.9
Second cluster					
Hypertension	0.539	0.172	0.000		
Diabetes	0.406	0.104	0.002		
Respiratory disease (COPD)	0.823	0.161	0.000		
Other diseases that lasted over 4 weeks	0.516	0.099	0.003		
Total				0.217	29.3
Third cluster					
MH	-0.011		0.017		
Total				0.246	11.8

* *P* < 0.05**Table 5** Influence of the eight SF-36 subscales on the annual hospitalization rate in addition to socio-demographic and morbidity variables by the clustered logistic regression model

Variables entered	Unstandardized coefficients (<i>B</i>)*	Exp (<i>B</i>)	95% CI for Exp (<i>B</i>)	<i>P</i> *	<i>R</i> ^{2a}	Independent contribution explained within the model (%)
First cluster						
Age	0.046	1.047	(1.031, 1.063)	0.000		
Marital status	-0.618	0.539	(0.306, 0.950)	0.033		
Total					0.112	47.6
Second cluster						
Diabetes	0.862	2.367	(1.306, 4.28)	0.001		
Cardiopathy	0.885	2.422	(1.435, 4.090)	0.001		
Stroke	0.966	2.626	(1.005, 6.860)	0.049		
Total					0.174	26.4
Third cluster						
GH	-0.028	0.973	(0.954, 0.992)	0.005		
Total					0.235	26.0

* *P* < 0.05^a *R*² based on Nagelkerke *R*²

decreasing scores of SF-36 subscales among primary care patients in mainland China. Moreover, our results suggest that the independent influence of the SF-36 subscales on health services utilization was smaller than that of socio-demographic and morbidity variables in mainland China.

Our results are consistent with the results of Lam's study (Lam et al. 2002). In both studies, health service utilization increased with decreasing HRQOL, as measured with some of the SF-36 subscales. Nevertheless, in contrast to the studies of Lam et al. (2002), Dunlop et al. (2000) and Hornbrook and Goodman (1996), in our study the independent influence of the SF-36 subscales on health service

utilization is smaller than that of social-demographic and morbidity variables. This difference resulted from the following three reasons. The first reason arises from differences in the selected socio-demographic variables. To be specific, we applied medical insurance as a socio-demographic variable, whereas Lam's study did not. The second reason is that, compared with Lam's study (Lam et al. 2002), we did not use the total score of chronic diseases together with the statements concerning the single disease as predictors in the regression analyses, because it would cause adverse consequences if a sum and its summands were to be applied in the same regression analysis.

The third reason is probably the differences in the sample size (2,410 subjects in Lam's paper vs. 737 subjects in our study).

Self-reported information is limited in validity, e.g., Nelson et al. (1998) points out that 5% of respondents overestimate the clinic consultation rate over the last 1 month and that the self-reported health service utilization cannot be taken as actual health service utilization, but only as a kind of pattern for health services utilization. We expected that errors from the self-reported data are random as declared by Sutton et al. (1999) and will not seriously affect the statistical results of the clustered model.

Moreover, our study was a retrospective cross-sectional design and cannot prove causal associations among variables. Therefore, prospective, longitudinal studies are needed to prove the complicated association among the four elements, i.e., social-demographic variables, morbidity variables, scores of the SF-36 subscales and health service utilization.

In conclusion, there were two major findings of our study, which both refer to primary care patients in mainland China: first, lower HRQOL was associated with higher health service utilization (outpatient consultations and inpatient consultation); second, HRQOL was an independent determinant of health service utilization, but the independent influence of HRQOL on health service utilization was smaller than that of socio-demographic and morbidity variables. Our findings may have an essential implication, i.e., the population who will be at a greater risk for elevated health service utilization can be easily identified, because convenient tools like the SF-36 and its electronic version can be used to identify the population with lower HRQOL. Consequently, SF-36 and its convenient electronic version can play an important role in guiding health policy makers and health service providers to optimize health service distribution.

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