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DETERMINANTS OF HEALTH STATUS AMONG PATIENTS WITH KNEE OR HIP OSTEOARTHRITIS: THE ROLE OF DEMOGRAPHIC, CLINICAL AND HEALTH RELATED QUALITY OF LIFE VARIABLES

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ABSTRACT

Osteoarthritis (OA) is a common chronic disease especially among older adults and has a considerable negative impact on health status (HS). This study investigated associations between demographic, clinical and health related quality of life (HRQOL) factors and the HS of patients with knee or hip OA. We surveyed a convenience sample of 356 patients from two general hospitals in Tehran, Iran. The short form health survey (SF-12), EuroQol (EQ-5D) and a demographic questionnaire were administered. Clinical variables such as body mass undex (BMI), duration of disease and radiographic evidence of the severity of OA were also collected. Two hierarchical regression models identified independent factors related to HS. The mean age of participants was 63.0 (SD, 12.3) and majority were female (90.7%). More than three-quarters were overweight or obese and over two-thirds had an OA severity grade of 3 or 4 based on Kellgren–Lawrence scale. The mean score on the physical and mental components of the SF-12 were 30.50 (SD, 9.63) and 44.38 (SD, 8.64), respectively. The mean scores for HS were 0.47 (SD, 0.34) on the EQ-5D and 63.23 (SD 17.58) on the EQ-VAS. Residence, duration of disease, BMI, OA joint, pain, vitality and mental health (MH) were identified as significant predictors of HS. Future studies are needed to better understand factors that may affect the HS of patients with knee or hip OA.

Keywords: Health status; Health related quality of life; Osteoarthritis.

INTRODUCTION

Osteoarthritis (OA) is a growing public health problem that affects many older people in the world.[45] It has been estimated that nearly 75% of those aged 65 or older suffer from OA.[8] Studies indicate that almost 20 million people in the United States have the disease, and the prevalence exceeds 60% in people over age 70.[2,11] Knee and hip OA are among the most common types of OA.[9,39] In France, knee OA ranges from 2.1% to 10.1% in men and 1.6% to 14.9% in women according to a population-based survey of people aging 40 to 75 years.[18] Investigators have found higher rates of OA in developing countries. In a study from Turkey, the prevalence of knee OA was nearly 15% among those aged 50 years or over,[26] and in Iran knee OA has been reported in more than 25% of women age 60 or over.[22]

The OA is a chronic progressive musculoskeletal disorder that affects daily activities of patients and often results in severe disability.[29] The health care costs for management of the disease are great and largely attributed to the inability to work due to symptoms such as pain and limited mobility.[10,37] Since OA negatively affects health status (HS), patients with this disease experience a diminished quality of life (QOL).[29]

Previous studies have been shown that a number of factors may influence the HS in patients with OA.[12,17] These include demographic, clinical, physical and mental factors. For example, age and sex appear to affect the status of health in such patients. Older patients usually report lower HS and females suffer more from the disease.[35] Body mass index (BMI) and type of involved joint may be other factors related to HS.[27,42] Physical and mental health (MH) characteristics as measured by QOL scales may also contribute to HS.[31]

HS, QOL and health related quality of life (HRQOL) are the primary outcomes of interest in OA.[29] Although these outcomes are often used interchangeably, each has a different meaning.[30,41,43] According to the WHO definition, health is "a state of complete physical, mental and social well-being and not merely the absence or

infirmity".[46] HS, then, could be described in terms of an individual's physical, mental and social functioning. QOL is defined as an individual's perception of his/her situation in life, including cultural and value systems that influence his/her concerns, goals and expectations.[40] HRQOL is defined as a person's satisfaction or happiness with domains of life as far as they influence on or are influenced by health.[21] In other words, HRQOL goes beyond direct measures of population health and primarily emphasizes the impact of HS on QOL.[20] HS involves the degree to which an illness is manifested in a patient. The difference between actual and optimal functional capacity is related to the HRQOL.[36] The effectiveness of medical interventions may differ depending on whether HRQOL or HS is the research outcome.[41]

The aim of this study is to examine HS and HRQOL in Iranian patients with knee or hip OA and to explore factors that may affect the health of these patients.

METHODS

Study Design and Participants

This cross-sectional study was conducted during May and June of 2013. The sample size was calculated based on a formula suggested by Hsieh *et al.* to achieve a power of 95%, two-tailed significance level of 5%, P1 of 0.5 and P2 of 0.6.[24] In addition, we wanted a sample size that exceeded 200 subjects so that an adequate number of variables could be included in a multiple regression analysis.[5] A total of 356 patients were recruited by a convenient sampling method from two general hospitals located in Tehran, Iran. Inclusion criteria were: having knee or hip OA based on current criteria of American College of Rheumatology,[3,4] and age greater than 40 years. Patients with the following criteria were excluded from the study: cognitive disability, other inflammatory rheumatic disorders, presence of severe metabolic or circulatory conditions, presence of both knee and hip OA, and history of previous knee or hip surgery. Participation was voluntary and all patients signed a written informed consent. An interviewer administrated the questionnaire to participants since many were illiterate. The study was approved by the Ethical Review Board of the Baqiyatallah University of Medical Sciences.

Measures

EuroQol (EQ-5D)

HS was assessed using the EQ-5D. This is a standard measure of HS developed by the EuroQol group. It provides a health index value that assesses health in clinical and community populations. Respondents were asked to complete two parts. The first part includes five items related to mobility, self-care, pain or discomfort, usual activities, and anxiety or depression. Each item has three response options: 1-no problem, 2-moderate problem and 3-severe problem. There is a descriptive system for scoring that can be converted to a single summary index. The index ranges from −0.594 to 1.0 and higher scores indicate better health states. When the value set for a country does not exist, a set of weighted values from a UK population may be used. The second part of the EQ-5D is the EQ-VAS. This is a visual analogue scale on which participants report their health state by marking their answer on a vertical line from 0 (best imaginable HS) to 100 (worst imaginable HS).[34] The scale has been previously used in OA patients.[29]

Short form health survey (SF-12)

HRQOL was measured using the SF-12. This includes 12 items that cover 8 dimensions: physical

functioning (PF), role limitations because of physical problems (RP), role limitations because of emotional problems (RE), MH (each with 2 items), and bodily pain (BP), general health (GH), vitality (VT), social functioning (SF) (each with 1 item). The response categories for each item ranges from 2 to 6. The raw score for each dimension is transformed to standards scores ranging from 0 (worst state) to 100 (best state). Two summary scores, physical component summary (PCS) and mental component summary (MCS) are produced using a norm-based scoring algorithm. This algorithm is based on data from the US general population. Both summaries have a mean score of 50 with a standard deviation of 10, where lower scores indicate poorer health.[28] The psychometric properties of the scale among OA patients are well documented.[15]

Demographic and Clinical Variables

Demographic data collected in the study were age, sex, marital status, education level, work status, residence and number of children. Clinical variables included duration of disease, height, weight, BMI, joint involved in OA (knee or hip), and severity of OA based on the Kellgren–Lawrence (KL) scale. The KL is a radiographic scale with 5 grades from 0 (normal) to 4 (large osteophytes and narrowed joint space). This is the most frequently used scale to assess severity of OA.[32]

Statistical Analysis

We used SPSS for windows version 17 (SPSS Inc. Chicago, IL) for data analyses. Descriptive statistics were expressed as means and standard deviations (SD). Categorical variables were presented as numbers and frequencies. The student *t*-test and Pearson correlation were used to identify bivariate associations between independent and outcome variables. The primary dependent variables were EQ-5D and EQ-VAS, which were used as a proxy for "health status." The Leven's test was performed to assess the homogeneity of the variances. The normality of data was determined using Kolmogorov–Smirnov test. After identifying significant or trend variables in bivariate analyses ($p < 0.15$) two hierarchical multiple linear regression analyses were performed with those variables included. In the first block, demographic variables were entered into the model. In the second block, clinical variables were entered. In the third block, HRQOL dimensions were included. Finally, two summary scores (PCS and MCS) of the HRQOL were entered. Dummy coding was used for all binary variables. The significance level was set at the $p < 0.05$ (two-tailed) for all tests.

RESULTS

The mean age of participants was 63.0 (SD, 12.3) and majority (90.7%) were female. Most of patients were married (66.6%) and unemployed (91.0%). Many participants were illiterate (39%) or only had primary education level (44.7%). Most respondents (88.5%) lived in urban areas. Only 22.2% were in the normal weight category (BMI $\leq$ 25) and remaining were overweight (BMI, 25–30) or obese (BMI $\geq$ 30). Knee was the most commonly affected joint (85.4%). The most common reported severity grades were 3 (39.6%), 2 (30.3%) and 4 (28.1%), respectively. The sample characteristics are summarized in Table 1.

HRQOL and HS scores are presented in Table 2. The MH component of the SF-12 had a mean of 61.48 (SD, 17.35). The PF component had a mean of 23.59 (SD, 29.09). The mean scores on the PCS and MCS summary indices were 30.50 (SD, 9.63) and 44.38 (SD, 8.64), respectively.

Tables 3 and 4 provide the bivariate associations between independent and dependent variables

Table 1 Demographic and Clinical Variables of the Sample ($n = 356$).

Variables	N(%)/(M ± SD)
Age (M,SD)	63.0 ± 12.3
Sex	
Male	33 (9.3)
female	323 (90.7)
Marital Status	
Single	7 (2.0)
Married	237 (66.6)
Widowed	111 (31.2)
Divorced	1 (0.3)
Occupation	
Employed	32 (9.0)
Unemployed	324 (91.0)
Education	
Illiterate	139 (39.0)
Primary	159 (44.7)
Secondary	38 (10.7)
University	20 (5.6)
Residence	
Urban	315 (88.5)
Rural	41 (11.5)
Number of Children	4.5 ± 2.3
Height (cm)	160.4 ± 8.5
Weight (kg)	74.3 ± 12.9
BMI (kg/m^2)	
≤ 25	79 (22.2)
25 to 30	142 (39.9)
≥ 30	135 (37.9)
OA Joint	
Knee	304 (85.4)
Hip	52 (14.6)
Duration of the Disease (years)	8.4 ± 6.6
Severity (KL grade)	
I	7 (2.0)
II	108 (30.3)
III	141 (39.6)
IV	100 (28.1)

(EQ-5D and EQ-VAS). Correlations were significant between the EQ-5D score and age ($p < 0.05$), number of children ($p < 0.05$), duration of disease ($p < 0.001$), severity of disease ($p < 0.001$), and all HRQOL's dimensions and summary indices ($p < 0.001$). Significant correlations with the EQ-VAS were residence, number of children, PF, RP, BP ($p < 0.05$), duration of disease, GH, VT, MH, PCS and MCS ($p < 0.001$).

In hierarchical multiple regression models (Table 5), no demographic variables were significant predictors of EQ-5D score. Demographic variables, however, did significantly predict EQ-VAS score. The ΔR^2 for the two next stages (clinical and HRQOL variables) was significant ($p < 0.001$) for both the EQ-5D and EQ-VAS. The ΔR^2 did not indicate considerable change in the last stage of the models. The final regression model explained 42% of the variance in EQ-5D score and 22% of the variance in EQ-VAS score. Variables such as BMI, duration of disease, OA joint, BP, GH, VT, RE, MH were significant in the first model as predictors of EQ-5D, whereas residence, duration of disease, GH and VT were significant in the second regression model as predictors of EQ-VAS score.

DISCUSSION

Patients with knee or hip OA frequently report that their health state is affected by this disease.[9,29] In the present study, we assessed factors related to HS among such patients. We found associations between HS and a number of demographic (age, residence, number of children), clinical (disease duration, BMI, severity of disease, joint type involved) and HRQOL's variables. However, only variables such as residence, BMI, disease duration, OA joint type, BP, GH, VT, RE and MH were independently related to the HS of participants.

Many studies have examined HRQOL and HS among patients with OA. Authors have reported a reduction in health outcomes among OA patients compared to those without OA.[1,8] Few investigators reported that this reduction is not significant.[23] To our knowledge, however, the present study is the first to distinguish between these relatively similar health concepts (HRQOL and HS) in OA patients. In a systematic review

Table 2 Dimensions Scores of HRQOL (SF-12) and the Scores of HS (EQ-5D, EQ-VAS).

	HRQOL Dimensions (SF-12)								HRQOL Summary Measures		HS	
	PF	Role Physical	BP	General Health	Vitality	Social Functioning	Role Emotional	MH	PCS	MCS	EQ-5D	EQ-VAS
M ± SD	23.59 ± 29.09	25.14 ± 43.03	30.33 ± 32.33	38.41 ± 14.68	40.33 ± 19.51	33.21 ± 31.35	42.13 ± 48.29	61.48 ± 17.35	30.50 ± 9.63	44.38 ± 8.64	0.47 ± 0.34	63.23 ± 17.58
Min-Max	0–100	0–100	0–100	0–75	0.100	0–100	0–100	0–100	16.13–55.06	20.61–64.09	−0.59–1.00	0–100

Note: M ± SD, mean ± standard deviation; PCS-physical component summary and MCS-mental component summary.

Table 3 Associations of Categorical Variables to HS (EQ-5D and EQ-VAS) Using Bivariate Analysis ($n = 356$).

Variables	EQ-5D		EQ-VAS	
	Mean ± SD[a]	*p* Value	Mean ± SD[a]	*p* Value
Sex				
Male	0.48 ± 0.34	0.802	56.06 ± 23.57	0.069
Female	0.47 ± 0.34		63.96 ± 16.73	
Marital status				
Married	0.47 ± 0.34	0.125	64.29 ± 13.97	0.873
Other	0.27 ± 0.36		63.21 ± 17.66	
Occupation				
Employed	0.46 ± 0.34	0.953	58.13 ± 19.90	0.085
Unemployed	0.47 ± 0.34		63.73 ± 17.29	
Education				
Literate	0.48 ± 0.33	0.543	63.59 ± 17.66	0.626
Illiterate	0.45 ± 0.35		62.66 ± 17.51	
Residence				
Urban	0.46 ± 0.34	0.542	64.00 ± 17.71	0.022
Rural	0.50 ± 0.30		57.32 ± 15.49	
OA Joint				
Knee	0.49 ± 0.33	0.001	63.78 ± 16.95	0.218
Hip	0.32 ± 0.33		60.00 ± 20.77	

[a]Independent sample *t*-test.

of the literature, Smith *et al.* attempted to distinguish between the concepts of HS and QOL. Their meta-analysis of 12 studies showed that QOL and HS are quite distinct constructs. When patients rate their QOL, more emphasis is placed on MH than on PF, while when they rate HS, the situation is the reverse and PF receives more emphasis.[41] Examination of PF and MH and summary measures of the PCS and MCS on the SF-12 in our study indicated differences between these dimensions. Patients gave greater importance to MH than to PF for each of these domains.

Many of our participants were female. Studies indicate that OA is more prevalent among women than in men, and women also usually experience more severe OA.[33] Our findings revealed a positive correlation between age and EQ-5D score. However, age did not significantly predict HS in regression models. In elderly people, health state is regularly lower than in younger people and this is largely due to decreasing PF among older people. Several studies have reported that elderly patients with OA have diminished HS when compared to healthy controls.[9,35] However, some studies have not found a significant relationship between age and HS among OA patients.[16]

Previous findings regarding the correlation between OA severity and health outcomes have been contradictory. Some studies reported no associations between radiographic severity and symptoms of pain.[44,49] Likewise, we found little relationships between radiographic severity and HS, once other factors were controlled for, although pain was associated with HS. Participants from urban or rural areas, however, indicated different HS. Considering that medical and health care facilities are more available in cities compared to rural areas and outlying regions, HS

Table 4 Associations of Quantitative Variables to HS (EQ-5D and EQ-VAS) Using Bivariate Analysis ($n = 356$).

Variables	EQ-5D		EQ-VAS	
	R^a	p Value	R^a	p Value
Demographic and Clinical				
Age (M,SD)	0.106	0.046	0.099	0.061
Number of children	0.114	0.031	0.116	0.029
Duration of the disease	−0.294	< 0.001	−0.225	< 0.001
Body Mass Index (BMI)	−0.141	0.008	−0.021	0.687
Severity grade (KL)	−0.195	< 0.001	0.011	0.843
HRQOL's Dimensions				
Physical functioning (PF)	0.352	< 0.001	0.167	0.002
Role physical (RP)	0.362	< 0.001	0.123	0.020
Bodily pain (BP)	0.288	< 0.001	0.134	0.011
General health (GH)	0.477	< 0.001	0.361	< 0.001
Vitality (VT)	0.401	< 0.001	0.307	< 0.001
Social functioning (SF)	0.248	< 0.001	−0.006	0.908
Role emotional (RE)	0.440	< 0.001	0.095	0.074
Mental health (MH)	0.404	< 0.001	0.244	< 0.001
HRQOL Summary Measures				
PCS	0.333	< 0.001	0.182	0.001
MCS	0.496	< 0.001	0.196	< 0.001

[a]Pearson correlation test.

may be appraised better by urban residents than among those in rural villages. Similarly, Chiu and Spencer in a study among rural and urban older adults in Taiwan found that functional HS was considerably higher for urban residents than for rural residents.[7] This finding has been reported in several studies among patients with other disorders and also in OA patients.[50]

Number of children was also associated with both measures of HS. This finding may be related to the availability of social support. More children in a Middle Eastern family usually means more cooperation and solidarity, and this is certainly true in Iran. Social support plays an important role in the MH component of health state and people who receive more support from family members and friends usually perceive themselves as more healthy and satisfied.[13]

Among demographic variables, education level was not associated with HS in our study, in contrast to several previous studies that have found a relationship between education level and health outcomes in OA patients.[38] This may be related to the low education level of participants in the present study, since knowledge about healthy lifestyle and self-care has been recognized as a predictor of HS.[19] The majority of our participants were illiterate or had only primary education.

Clinical parameters such as BMI, duration of disease and OA joint were correlated to HS in our study, similar to what has been reported in previous studies.[14,22,25] Overweight and obesity are predisposing factors in the development OA especially in joints affected by weight (e.g. knee and hip). Felson *et al.* has noted that BMI is a well-known risk factor for OA[14] and Wluka *et al.* also reported that BMI was a strong predictor of OA.[48] Only a few researchers have reported no association between BMI and OA.[6]

Table 5 Hierarchical Regression Summaries of Factors Predicting HS (EQ-5D and EQ-VAS), ($n = 356$).

Factors	DV: EQ-5D				DV: EQ-VAS			
	B	**Beta**	**SE B**	**ΔR^2**	**B**	**Beta**	**SE B**	**ΔR^2**
Stage 1: Demographics				0.018				0.046*
Age	0.002	0.055	0.002		0.070	0.049	0.091	
Sex (female = 1, male = 0)	NS	NS	NS		6.440	0.106	4.055	
Marital status (married = 1, other = 0)	0.103	0.042	0.139		NS	NS	NS	
Occupation (employed = 1, unemployed = 0)	NS	NS	NS		0.730	0.012	4.316	
Residence (urban = 1, rural = 0)	NS	NS	NS		7.432	0.135*	2.946	
Number of children	0.11	0.76	0.009		0.790	0.106	0.459	
	Adjusted $R^2 = 0.010$		F change = 2.142		Adjusted $R^2 = 0.033$		F change = 3.400	
Stage 2: Clinical Variables				0.151**				0.052**
Body Mass Index (BMI)	−0.010	−0.155*	0.003		NS	NS	NS	
Duration of disease (year)	−0.015	−0.291**	0.003		−0.620	−0.232**	0.138	
Severity grade (KL)	−0.033	−0.093	0.018		NS	NS	NS	
OA Joint (knee = 1, hip = 0)	0.176	0.182**	0.050		NS	NS	NS	
	Adjusted $R^2 = 0.152$		F change = 15.772		Adjusted $R^2 = 0.083$		F change = 20.247	
Stage 3: HRQOL's Dimensions				0.274**				0.146**
Physical functioning (PF)	−6.34E-5	−0.005	0.001		0.011	0.018	0.050	
Role physical (RP)	0.001	0.096	0.001		0.010	0.025	0.032	
Bodily pain (BP)	−0.002	−0.174*	0.001		−0.018	−0.033	0.045	
General health (GH)	0.007	0.290**	0.001		0.334	0.279**	0.064	
Vitality (VT)	0.002	0.123*	0.001		0.178	0.198*	0.060	
Social functioning (SF)	0.000	−0.033	0.001		NS	NS	NS	
Role emotional (RE)	0.001	0.190*	0.000		−0.047	−0.129	0.025	
Mental health (MH)	0.004	0.199**	0.001		0.088	0.086	0.062	
	Adjusted $R^2 = 0.418$		F change = 20.920		Adjusted $R^2 = 0.216$		F change = 9.470	
Stage 4: HRQOL Summary Measures				0.003				0.010
PCS	−0.030	−0.851	0.029		−1.773	−0.972	1.694	
MCS	−0.004	−0.108	0.009		−0.662	−0.325	0.452	
	Adjusted $R^2 = 0.418$		F change = 0.848		Adjusted $R^2 = 0.223$		F change = 2.378	

Note: DV-dependent variable, VAS-visual analog scale and NS-nonsignificant at Bivariate analysis ($p > 0.15$); *$p < 0.05$; **$p < 0.001$.

Complications of a chronic disease like OA increase over time and this will have a negative influence on HS. The knee is a most frequent joint affected by the OA.[9] Since this joint has an important role in many body activities such as walking, running, sitting down and getting up and holds up the entire body weight, knee cartilage is exposed to more risk of inflammation and deterioration.[39] Therefore, patients with knee OA are more prevalent and their HS could be affected in different ways than people with OA in other joints.

A significant proportion of the variance explained in our models was predicted by HRQOL dimensions. After controlling for demographic and clinical variables, 27% of the variance in EQ-5D and 15% of the variance in EQ-VAS were explained by HRQOL's components. This finding stresses that while HS and HRQOL have significant overlap, they are not the same constructs.[41] Another interesting finding was that in the final regression model when the summary measures of SF-12 were entered, there was little change in the model R^2. This may indicate that the crude scores of HRQOL were largely similar to the norm-based PCS and MCS scores in the present study. Therefore, use of either crude or normalized scores may have similar results.

Comparing the results of two outcome measures of HS (EQ-5D and EQ-VAS) demonstrated notable differences between them on many independent variables. For example, in the bivariate analyses, variables such as occupation, residence, BMI, severity, OA joint, SF and RE had completely different strengths of association depending on the HS outcome variable. This may be explained by the different nature of each of these measures of HS.[34] Multi-dimensional tools usually provide more precise and accurate information than single-dimensional tools. However, a single-dimensional tool is often used as a supplemental tool to better understand results from a similar more complicated instrument. Indeed, the EQ-VAS was initially developed to generate weights for the EQ-5D scores. In the current self-report version of the EQ-5D, the EQ-VAS served more to complement the findings of the EQ-5D.[47] In some settings, short and easy tools like the EQ-VAS may be more useful.

The present study has several limitations that may affect the interpretation and generalizability of the findings. First, this was a cross-sectional study and causal relationships cannot be established. However, the results may help in the design of future longitudinal studies or clinical trials. Second, because of our non-representative sample, the current findings may not be generalizable to the OA patients from other communities. Using random samples in future studies will be necessary. Third, because the illiteracy of many patients we were forced to collect data by personal interview, which may have affected participants' responses. However, to minimize this effect we provided a private environment for data collection and ensured patients that their responses were confidential. Fourth, to differentiate HS in terms of type of involved joints we excluded the patients who had both knee and hip OA concurrently, so the findings of this study do not apply to such patients. Finally, there are several disease-specifics instruments to assess the HRQOL among OA patients; however, since such scales were not available in Persian, we chose a more generic measure. Nevertheless, the SF-12 has been identified as a suitable measure to assess the HRQOL across many populations, and using that measure in the present study will assist in comparisons with other populations.[28]

CONCLUSION

In summary, this study used validated measures of HS and QOL in a relatively large sample of OA patients. Results revealed that variables such as

place of residence (urban versus rural), BMI, duration of disease, OA joint, pain, vitality and MH may be important determinants of HS in this population. These finding may help health care providers identify factors that may be targets for intervention to promote the health of patients with OA. HRQOL and HS were found to be different constructs in this sample. However, HRQOL accounted for a substantial portion of the variance in our HS measures. Further research using random samples, self-report questionnaires and longitudinal designs will help to advance our understanding of factors related to HS in OA patients.

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We represent that this submission is original work, and is not under consideration for publication with any other journal.

CONFLICT OF INTEREST

There is no conflict of interest.

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