How Much Are Upper or Lower Extremity Disabilities Associated with General Health Status in the Elderly?

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Abstract

Background Musculoskeletal complaints influence general health status, but the relative contribution of concurrent upper and lower extremity disabilities on patient perceptions of general health is unclear.

Two of the authors (YHR, KWK) contributed equally to the work and therefore should be considered equivalent authors.

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All ICMJE Conflict of Interest Forms for authors and *Clinical Orthopaedics and Related Research* editors and board members are on file with the publication and can be viewed on request. Each author certifies that his or her institution approved the human protocol for this investigation, that all investigations were conducted in conformity with ethical principles of research, and that informed consent for participation in the study was obtained. This work was performed at Seoul National University Bundang Hospital, Seongnam, Korea.

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Questions/Purposes We evaluated whether two regional instruments (DASH and WOMAC) reflect a patient's perception of general health measured using the SF-36 and determined whether general health components are explained by upper and lower extremity disabilities.

Methods We recruited 272 randomly chosen participants 65 years or older without a history of surgery for musculoskeletal disease or trauma who participated in the Korean Longitudinal Study on Health and Aging. Upper extremity disability was determined with the DASH score and lower extremity disability with the WOMAC; as a measure of general health, we obtained SF-36 scores. Multivariate regression modeling was used to assess the relative contributions made by upper and lower extremity disabilities to general health.

Results The DASH and WOMAC each was correlated with the physical component summary (PCS) scale and with the mental component summary (MCS) scale to differing extents. Multivariate regression analyses revealed that WOMAC alone, DASH alone, and WOMAC and DASH accounted for 24%, 19%, and 26% of the variance in the PCS scale. However, only the DASH was associated with the MCS scale but accounted for only 2% of the variance.

Conclusions We found that in a community-based elderly population, perceived general physical health is associated with upper and lower extremity disabilities, whereas perceived general mental health is associated with only upper extremity disabilities, but to a small extent.

Level of Evidence Level II, prognostic study. See Guidelines for Authors for a complete description of levels of evidence.

Introduction

Musculoskeletal disorders are among the most frequently occurring chronic conditions that affect the general

population and have substantial impacts on physical activity, mental state, and quality of life (QOL) [8, 16]. The prevalence of musculoskeletal disorders increases with age, and they are the leading cause of disability, especially among those older than 65 years [15, 23]. Providing care to patients with musculoskeletal disorders no longer is limited to reducing signs and symptoms but also includes ability to function [9]. Furthermore, there is a current trend to enhance general well-being or QOL, which involves integrating patients' perspectives and comprehensive assessment of intervention outcomes [11, 12, 20].

Patient-reported health-related QOL in patients with musculoskeletal disorders can be measured using condition-specific and generic health status instruments. Condition-specific instruments measure symptoms and disabilities relevant to specific conditions and are useful for measuring clinical changes in response to treatments. However, general health status instruments measure multiple aspects of health, including physical function, mental health, and social function. Condition-specific instruments that address musculoskeletal manifestations generally correlate with general health status measurements [21, 26], which show musculoskeletal complaints influence general health status, that is, physical and mental health, and that a considerable proportion of variation in general health status can be attributed to regional musculoskeletal disability. However, the relative contribution of concurrent disabilities of upper and lower extremities on patient perceptions of general health has not been well described. Understanding this relationship between regional musculoskeletal disabilities and general health status may help us in decision-making for treatment priority or in interpretation of the treatment outcomes in patients with upper and lower extremity conditions.

Therefore, we determined (1) whether two specific regional instruments, the DASH [14] and the WOMAC [7], reflect patient perception of general health status measured using the Medical Outcomes Study SF-36 [29] in a general population 65 years or older without a history of surgery for musculoskeletal disease or trauma and (2) whether general health status components are explained by upper and lower extremity disabilities.

Patients and Methods

This study was conducted as a part of the Korean Longitudinal Study on Health and Aging (KLoSHA) [22]. The KLoSHA study was a population-based cohort study of 696 people on health, aging, and common geriatric diseases in elderly Koreans and was conducted from September 2005 to August 2006. The data set was used later for this particular cross-sectional study. The cohort was recruited from among residents (65 years or older) of Seongnam City,

South Korea, a large satellite city of Seoul. Candidates were randomly selected using resident registration numbers obtained using a computer-generated list of random numbers. One thousand one hundred eighteen residents were invited to participate in the KLoSHA study by letter or telephone, and of these, 696 residents agreed to participate (response rate of 62.3%). The respondents had a mean age of 71.8 years, and 396 (58.3%) were women. However, we excluded 72 with a history of recent trauma, a diagnosis of a major psychiatric disorder, or a neuromuscular disorder, or who had undergone orthopaedic surgery. Finally, 624 residents were enrolled. Of these, the DASH, WOMAC, and SF-36 were administered to 320 participants, who were randomly chosen using a computer-generated list. Individuals received a packet that included an informed consent form approved by our institutional review board, SF-36 Version 2 (SF36V2) [28], and DASH and WOMAC questionnaires. Our study was approved by the institutional review board at our hospital and informed consent was obtained from all participants.

All returned questionnaires were checked for completion by investigators, and the participants were assisted in completing missing items. Of the 320 subjects 272 (85%) submitted adequate data that allowed complete scoring of the three instruments. Participants also were surveyed for demographic data such as age, gender, and BMI. The mean subject age (and SD) was 71.5 years (range, 65–91 years), and 137 of the 272 (50.4%) subjects were women. Women were shorter than men, had a lower mean body weight, but a slightly greater mean BMI (Table 1).

The SF-36 is the most widely used, patient-reported generic health status measure [29]. The 36 items in the questionnaire are grouped on eight health subscales that are designed to represent the WHO definition of health, that is, physical function (PF), role limitations attributable to physical problems (RP), bodily pain (BP), general health (GH), vitality (VT), social function (SF), role limitations attributable to emotional problems (RE), and mental health (MH). These eight scales can be combined into two summary measures that provide overall estimates of physical health (physical component summary [PCS]) and mental health (mental component summary [MCS]). The SF36V2 uses norm-based scores, and the two summary scores use

Table 1. Participants' demographics

Variables	Male (n = 135)	Female (n = 137)	p value*
Age (years)	74.8 ± 7.1	74.0 ± 6.3	0.30
Height (cm)	165.0 ± 6.1	150.9 ± 6.0	< 0.001
Weight (kg)	65.4 ± 9.9	56.0 ± 8.5	< 0.001
BMI (kg/m ²)	24.0 ± 3.2	24.7 ± 3.2	0.04

* p using Student's t-test.

the sum of the eight subscale z-scores weighted by factor score coefficients [28]. The SF-36 is commonly used to represent broad aspects of health for questionnaire validation and reportedly is more responsive than other general health instruments regarding musculoskeletal disorders [6].

The DASH and WOMAC are the most widely used condition- and region-specific instruments to represent QOL related to upper or lower extremity manifestations and are well correlated with general health status measurements such as the SF-36 [4, 17]. The DASH is a self-administered, upper extremity-specific questionnaire and consists of 30 questions: 21 on physical function, five on symptoms, and four on social role functions. Each question has five response choices that range from 1 (without difficulty or no symptom) to 5 (unable to engage in activity or very severe symptom). The DASH provides a best possible score of 0 and a worst possible score of 100. It is applicant-friendly, reliable, and valid for a range of upper extremity disorders [13, 27].

The WOMAC is a self-reported, lower extremity-specific questionnaire and contains 24 questions: 17 on physical function, five on pain, and two on stiffness. Each question has five response options that range from 0 (no, without difficulty or no symptom) to 4 (unable to engage in activities or extreme symptom). Subtotal scores for pain, stiffness, and function range from 0 to 20, 0 to 8, and 0 to 68, respectively. Global WOMAC scores were defined as the unweighted sums of all 24 items and ranged from 0 to 96. A low score indicates less difficulty, whereas a high score means greater difficulty. The WOMAC is reportedly valid and reliable for defining function in various lower extremity disorders [2, 10].

The 272 study subjects had a PCS scale value of 39, which was approximately 1 SD below the mean of healthy subjects. In contrast, the mean MCS scale score of 50 was equivalent to the reference value for healthy patients (Table 2). Women had higher DASH and WOMAC scores and lower PF, RP, BP, and RE subscales and PCS summary scores than men (all $p < 0.001$). Subjects older than 75 years had higher DASH scores ($p = 0.029$) and lower PCS scores ($p = 0.042$) than subjects 65 to 75 years old.

Descriptive statistics were calculated to determine the demographics and clinical characteristics of the 272 study subjects. Univariate analysis was conducted to determine associations between independent variables (patient age, sex, DASH, and WOMAC scores) and dependent variables (eight SF-36 clinical subscales and the two summary scales). Associations between continuous explanatory variables and response variables were evaluated using Pearson's correlation analysis, and associations between dichotomous explanatory variables and response variables were evaluated using the Student's t-test. Multiple linear regression analyses with stepwise variable selection were used to assess the relative contributions of upper extremity (measured using DASH) and lower extremity manifestations (measured using WOMAC) on general health state (measured using SF36V2). Multiple linear regression models assess the abilities of explanatory variables to account for variations in response variables while accounting for any confounding between explanatory variables and produce a statistic called adjusted R^2 , which reflects the percentage of overall variability in the dependant variable that can be explained or accounted for by the explanatory variables included in a multiple linear

Table 2. Summary and comparison of the DASH, WOMAC, and SF-36 clinical scales by sex and age*

Scales	Total (n = 272)	Male (n = 135)	Female (n = 137)	p value	Age 65–75 years (n = 175)	Age > 75 years (n = 97)	p value
DASH	21.41 ± 17.92	15.67 ± 13.34	27.07 ± 20.00	< 0.001	19.60 ± 17.20	24.68 ± 18.80	0.029
WOMAC	20.37 ± 19.80	13.51 ± 12.80	27.13 ± 22.96	< 0.001	19.78 ± 19.90	21.44 ± 19.70	0.506
PCS	38.57 ± 5.00	39.91 ± 4.52	37.24 ± 5.10	< 0.001	39.05 ± 4.67	37.70 ± 5.45	0.042
MCS	50.43 ± 6.70	50.44 ± 5.99	50.43 ± 7.34	0.983	50.05 ± 6.09	51.12 ± 7.64	0.237
PF	38.81 ± 11.36	43.04 ± 10.05	34.64 ± 11.06	< 0.001	39.78 ± 11.60	37.07 ± 10.75	0.055
RP	45.69 ± 10.66	48.68 ± 9.56	42.74 ± 10.91	< 0.001	45.48 ± 10.65	46.08 ± 10.72	0.659
BP	33.43 ± 11.21	30.86 ± 10.42	35.96 ± 11.42	< 0.001	33.59 ± 11.81	33.13 ± 10.11	0.733
GH	45.54 ± 6.09	44.90 ± 6.21	46.17 ± 5.92	0.085	45.57 ± 5.61	45.49 ± 6.90	0.925
VT	56.86 ± 8.07	57.11 ± 8.21	56.62 ± 7.94	0.620	56.70 ± 7.20	57.15 ± 9.46	0.687
SF	35.30 ± 4.79	35.38 ± 4.67	35.22 ± 4.92	0.783	35.24 ± 4.50	35.41 ± 5.30	0.784
RE	48.43 ± 10.45	50.71 ± 9.28	46.18 ± 11.04	< 0.001	48.34 ± 10.56	48.59 ± 10.25	0.845
MH	47.33 ± 6.69	47.22 ± 6.11	47.45 ± 7.24	0.780	46.86 ± 6.36	48.18 ± 7.21	0.133

* Values are expressed as means ± SDs. Statistical differences with respect to sex and age were determined using the Student's t-test. DASH = Disability of Arm Shoulder and Hand questionnaire; WOMAC = Western Ontario and McMaster Universities Osteoarthritis Index; PCS = physical component summary; MCS = mental component summary; PF = physical function; RP = role-physical; BP = bodily pain; GH = general health; VT = vitality; SF = social function; RE = role-emotional; MH = mental health.

regression model. We tested three stepwise regression models: (1) a model with only one of either the DASH or WOMAC explanatory variable expected to be related to the SF-36 clinical scales; (2) a model with the DASH and WOMAC explanatory variable; and (3) a model based on the DASH, WOMAC, age, and sex. Comparisons of the variabilities accounted for by models (adjusted R^2) provide measures of the relative influence of explanatory variables on overall variation of the response variable.

Results

The two specific regional instruments, the DASH and WOMAC, correlated with patient perception of general health status components measured using the SF-36 to differing extents. The DASH and WOMAC scores correlated with the PCS scale with correlation coefficients of 0.34 ($p < 0.001$) and 0.43 ($p < 0.001$) and with the MCS scale with coefficients of 0.18 ($p = 0.004$) and 0.11 ($p = 0.083$) (Table 3). Furthermore, the DASH score correlated with the WOMAC, PF, RP, BP, and RE scores, whereas the WOMAC scores correlated with the DASH, PF, RP, BP, and RE scores.

In multivariate regression analysis, the DASH and WOMAC were associated with the SF-36 PCS scale, but only the DASH was associated with the SF-36 MCS scale (Table 4). In terms of the PCS, the DASH alone accounted for 19% of the variance and the WOMAC alone accounted for 24% (Model 1). However, the DASH and WOMAC together accounted for 26% of the variance of the PCS scale (Model 2). Model 3 stepwise multiple regression analyses revealed that the DASH, WOMAC, age, and sex were associated with the PCS scale ($p = 0.001$, 0.030, 0.001, and 0.041, respectively). These four factors accounted for 31% of the total variance of the PCS scale

(Model 3). In Models 2 and 3, the WOMAC had a larger regression coefficient than the DASH. In terms of the MCS, only the DASH was associated with the MCS scale ($p = 0.017$) and accounted for 2% of the variance.

Discussion

Musculoskeletal complaints increase with age and considerably influence general health status, but the relative contribution of concurrent disabilities of upper and lower extremities on patients' perceptions of general health has not been well described. We determined whether two specific regional instruments, the DASH and the WOMAC, reflected patient perception of general health status measured using the SF-36 and determined whether general health status components are explained by upper and lower extremity disabilities.

Several limitations of this study deserve mention. First, the study was based on a cross-sectional cohort, which restricts our ability to determine the causal relationship between patients' perceptions of regional musculoskeletal status and general health status. Exploring the causal relationship would require considering complex biological and psychological factors. Second, a considerable amount of variance in the physical subscale of the SF-36 remained unexplained. In terms of the SF-36 physical subscale, only 31% of total variance was accounted for by the DASH, WOMAC, age, and sex. However, we were unable to consider all factors that potentially could influence general health because of the sample size and cross-sectional nature of this study. Thus, other potential contributors to general health perception such as lower back or neck pain, headache, gastrointestinal problems, the level of physical activity, family or financial stresses, and education, which were not measured in the current study, also might

Table 3. Correlation coefficients between assessment instruments adjusted by age and sex*

Assessment instrument	DASH	WOMAC	PCS	MCS	PF	RP	BP	GH	VT	SF	RE	MH
DASH	1	0.639 [‡] $p < 0.001$	0.343 [‡] < 0.001	0.177 [†] 0.004	0.624 [‡] < 0.001	0.579 [‡] < 0.001	0.574 [‡] $< .001$	0.149 [†] 0.044	0.078 NS	0.114 NS	0.460 [‡] < 0.001	0.173 [†] 0.004
WOMAC	0.639 [‡] < 0.001	1	0.432 [‡] < 0.001	0.106 NS	0.698 [‡] < 0.001	0.566 [‡] < 0.001	0.587 [‡] < 0.001	0.132 [†] 0.029	0.108 NS	0.079 NS	0.432 [‡] < 0.001	0.193 [‡] < 0.001
PCS	0.343 [‡] < 0.001	0.432 [‡] < 0.001	1	0.359 [‡] < 0.001	0.650 [‡] < 0.001	0.450 [‡] < 0.001	0.187 [‡] < 0.001	0.105 NS	0.012 NS	0.031 NS	0.027 NS	0.071 NS
MCS	0.177 [†] 0.004	0.106 NS	0.359 [‡] < 0.001	1	0.017 NS	0.312 [‡] < 0.001	0.282 [‡] < 0.001	0.285 [‡] < 0.001	0.640 [‡] < 0.001	0.191 [†] 0.002	0.596 [‡] < 0.001	0.750 [‡] < 0.001

* Partial correlation was conducted by controlling for age and sex; [†] $p < 0.05$; [‡] $p < 0.001$; DASH = Disability of Arm Shoulder and Hand questionnaire; WOMAC = Western Ontario and McMaster Universities Osteoarthritis Index; PCS = physical component summary; MCS = mental component summary; PF = physical function; RP = role-physical; BP = bodily pain; GH = general health; VT = vitality; SF = social function; RE = role-emotional; MH = mental health; NS = nonsignificant.

Table 4. Results of multivariate analysis of variance

Model/entered variables	Physical component summary scale					Mental component summary scale				
	Included variable*	Adjusted R ²	F	Beta	p value	Included variable*	Adjusted R ²	F	Beta	p value
Model 1										
DASH or WOMAC alone	DASH	0.193	64.6		0.001	DASH	0.021	5.8		0.017
	WOMAC	0.244	87.3		< 0.001	†				
Model 2										
DASH and WOMAC	DASH	0.264	48.1	0.191	< 0.001	DASH‡	0.021	5.8	0.145	0.017
	WOMAC			0.364						
Model 3										
DASH, WOMAC, age, and gender	DASH	0.306	38.2	0.114	0.001	DASH§	0.021	5.8	0.145	0.017
	WOMAC			0.358						
	Age			0.192						
	Gender			0.120						

* Variables were selected by backward stepwise multiple regression models. (It includes all of the entered variables initially and then iteratively removes variables from the model until the significant best-fit model is achieved according to set criteria.) †WOMAC alone was not found to be associated with the mental component summary; ‡WOMAC was excluded in the final best-fit regression model; §WOMAC, age, and sex were excluded in the final best-fit regression model; R² = variance explained by the independent variable; Beta = standardized regression coefficient; DASH = Disability of Arm Shoulder and Hand questionnaire; WOMAC = Western Ontario and McMaster Universities Osteoarthritis Index.

contribute to general health status. Third, our cohort was limited to one ethnic population drawn from an urban area, which means their characteristics may not be representative of other elderly populations. Furthermore, the subjects were participants who did not seek medical treatment for their musculoskeletal complaints, which means that their personal characteristics (coping mechanism or depressive symptoms), associated health condition, and level of illness may differ from those of hospital-based participants [19]. The relative importance described is likely to depend on the relative severity of any underlying disease. Therefore, future studies should focus on particular patient cohorts with specific disability or disease to determine the concurrent associations of upper and lower extremity disabilities on general health. Finally, we used only two regional and one general health measurement. The findings reported could be explained by the relative properties of the DASH and the WOMAC, and using another tool may result in a different relative importance. Further studies using different tools should confirm our findings.

We found the DASH and WOMAC scores correlated with physical and mental subscales of the SF-36 to differing extents. The strengths of correlations between the DASH or WOMAC scores and subscales of the SF-36 reported in previous studies have tended to vary with demographic or clinical differences (underlying disease), and the correlation coefficients between the DASH and PCS scale ranged from 0.50 to 0.78, whereas those between the DASH and MCS ranged from 0.04 to 0.62 [1, 3, 5, 24, 26] (Table 5). In addition, we found the DASH and WOMAC correlated with one another. The strength of this

association could have been the result of the prevalence of degenerative musculoskeletal disorders such as osteoarthritis and rotator cuff disease in our cohort. In individuals older than 65 years, osteoarthritis of the knees or hands and rotator cuff disease are the most prevalent causes of musculoskeletal pain. A high prevalence of these degenerative musculoskeletal diseases has been reported [23], and prevalence of concurrent upper and lower extremity pain in patients older than 65 years is reportedly greater than 40% [25]. Furthermore, musculoskeletal pain or disability is reportedly more prevalent [18] and more severe in women [8], which concurs with our findings. This sex effect was not confined to a specific physical subscale but rather involved all physical components of the SF-36, DASH, and WOMAC. This sex difference could be explained by a higher physical vulnerability [30] or sensitivity to pain [31] in women.

Our data showed that upper (DASH) and lower extremity disabilities (WOMAC) were associated with SF-36 physical subscales. However, the WOMAC accounted for more variance than the DASH in the PCS scale in Model 1 (24% versus 19%), and the WOMAC had a larger regression coefficient (relatively larger importance as an independent variable) than the DASH in Models 2 and 3. However, only the DASH was associated with the MCS scale but accounted for only 2% of the variance.

We found that perceived general physical health is associated with upper and lower extremity disabilities, whereas perceived mental health is associated with only upper extremity disabilities to a small extent in a community-based general elderly population. Information on this relationship between regional musculoskeletal

Table 5. Literature review of correlation strengths between the DASH or WOMAC and SF-36 summary scales

Study	Study subjects	Number	Age (years)*	Female/male	Correlation coefficients			
					DASH		WOMAC	
					With PCS	With MCS	With PCS	With MCS
Aktekin et al. [1]	Patients with rheumatoid arthritis	166	52.5 ± 12.6	130/36	0.785 [†]	0.619 [†]		
Angst et al. [3]	Patients after total elbow arthroplasty	79	64.1 ± 13.3	56/23	0.76 [‡]	0.04 [‡]		
Raven et al. [24]	Patients with rheumatoid arthritis	102	57.5 (22.6–86.4)	65/37	0.70 [†]	0.27 [†]		
SooHoo et al. [26]	Patients from outpatient clinic	90	40	50/40	0.50 [†]	0.59 [†]		
Basaran et al. [5]	Patients from outpatient clinic	134	61.5	102/32				
	(1) Hip osteoarthritis	50	64.7 ± 9.3	36/14			0.57 [†]	0.33 [†]
	(2) Knee osteoarthritis	84	59.6 ± 9.6	66/18			0.48 [†]	0.32 [†]

* Mean with SD or range, [†]Pearson's correlation coefficients, [‡]Spearman's correlation coefficients; DASH = Disabilities of the Arm, Shoulder and Hand; WOMAC = Western Ontario and McMaster Universities Osteoarthritis Index; PCS = physical component score; MCS = mental component score.

disabilities and general health status may help us in decision-making for treatment priority or in interpretation of the treatment outcomes in patients with upper and lower extremity conditions.

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References

- Aktekin LA, Eser F, Baskan BM, Sivas F, Malhan S, Oksuz E, Bodur H. Disability of Arm Shoulder and Hand Questionnaire in rheumatoid arthritis patients: relationship with disease activity, HAQ, SF-36. *Rheumatol Int*. 2011;31:823–826.
- Angst F, Aeschlimann A, Steiner W, Stucki G. Responsiveness of the WOMAC osteoarthritis index as compared with the SF-36 in patients with osteoarthritis of the legs undergoing a comprehensive rehabilitation intervention. *Ann Rheum Dis*. 2001;60:834–840.
- Angst F, John M, Pap G, Mannion AF, Herren DB, Flury M, Aeschlimann A, Schwyzer HK, Simmen BR. Comprehensive assessment of clinical outcome and quality of life after total elbow arthroplasty. *Arthritis Rheum*. 2005;53:73–82.
- Bae SC, Lee HS, Yun HR, Kim TH, Yoo DH, Kim SY. Cross-cultural adaptation and validation of Korean Western Ontario and McMaster Universities (WOMAC) and Lequesne osteoarthritis indices for clinical research. *Osteoarthritis Cartilage*. 2001;9:746–750.
- Basaran S, Guzel R, Seydaoglu G, Guler-Uysal F. Validity, reliability, and comparison of the WOMAC osteoarthritis index and Lequesne algofunctional index in Turkish patients with hip or knee osteoarthritis. *Clin Rheumatol*. 2010;29:749–756.
- Beaton DE, Bombardier C, Hogg-Johnson SA. Measuring health in injured workers: a cross-sectional comparison of five generic health status instruments in workers with musculoskeletal injuries. *Am J Ind Med*. 1996;29:618–631.
- Bellamy N, Buchanan WW, Goldsmith CH, Campbell J, Stitt LW. Validation study of WOMAC: a health status instrument for measuring clinically important patient relevant outcomes to antirheumatic drug therapy in patients with osteoarthritis of the hip or knee. *J Rheumatol*. 1988;15:1833–1840.
- Bingefors K, Isacson D. Epidemiology, co-morbidity, and impact on health-related quality of life of self-reported headache and musculoskeletal pain: a gender perspective. *Eur J Pain*. 2004;8:435–450.
- Dieppe PA. Relationship between symptoms and structural change in osteoarthritis: what are the important targets for osteoarthritis therapy? *J Rheumatol Suppl*. 2004;70:50–53.
- Ethgen O, Bruyere O, Richy F, Dardennes C, Reginster JY. Health-related quality of life in total hip and total knee arthroplasty: a qualitative and systematic review of the literature. *J Bone Joint Surg Am*. 2004;86:963–974.
- Furner SE, Hootman JM, Helmick CG, Bolen J, Zack MM. Health-related quality of life of US adults with arthritis: analysis of data from the behavioral risk factor surveillance system, 2003, 2005, and 2007. *Arthritis Care Res (Hoboken)*. 2011;63:788–799.
- Gruber G, Zacherl M, Giessauf C, Glehr M, Fuerst F, Liebmann W, Gruber K, Bernhardt GA. Quality of life after volar plate fixation of articular fractures of the distal part of the radius. *J Bone Joint Surg Am*. 2010;92:1170–1178.
- Gummesson C, Atroshi I, Ekdahl C. The disabilities of the arm, shoulder and hand (DASH) outcome questionnaire: longitudinal construct validity and measuring self-rated health change after surgery. *BMC Musculoskelet Disord*. 2003;4:11.
- Hudak PL, Amadio PC, Bombardier C. Development of an upper extremity outcome measure: the DASH (disabilities of the arm, shoulder and hand). The Upper Extremity Collaborative Group (UECG). *Am J Ind Med*. 1996;29:602–608.
- Lawrence RC, Felson DT, Helmick CG, Arnold LM, Choi H, Deyo RA, Gabriel S, Hirsch R, Hochberg MC, Hunder GG, Jordan JM, Katz JN, Kremers HM, Wolfe F; National Arthritis Data Workgroup. Estimates of the prevalence of arthritis and other rheumatic conditions in the United States: Part II. *Arthritis Rheum*. 2008;58:26–35.
- Lawrence RC, Helmick CG, Arnett FC, Deyo RA, Felson DT, Giannini EH, Heyse SP, Hirsch R, Hochberg MC, Hunder GG, Liang MH, Pillemer SR, Steen VD, Wolfe F. Estimates of the prevalence of arthritis and selected musculoskeletal disorders in the United States. *Arthritis Rheum*. 1998;41:778–799.
- Lee JY, Lim JY, Oh JH, Ko YM. Cross-cultural adaptation and clinical evaluation of a Korean version of the disabilities of arm, shoulder, and hand outcome questionnaire (K-DASH). *J Shoulder Elbow Surg*. 2008;17:570–574.
- Leveille SG, Zhang Y, McMullen W, Kelly-Hayes M, Felson DT. Sex differences in musculoskeletal pain in older adults. *Pain*. 2005;116:332–338.

19. Masi AT. Potential uses and limitations of hospital data in epidemiologic research. *Am J Public Health Nations Health*. 1965;55:658–667.
20. Menz HB, Roddy E, Thomas E, Croft PR. Impact of hallux valgus severity on general and foot-specific health-related quality of life. *Arthritis Care Res (Hoboken)*. 2011;63:396–404.
21. Ostendorf M, van Stel HF, Buskens E, Schrijvers AJ, Marting LN, Verbout AJ, Dhert WJ. Patient-reported outcome in total hip replacement: a comparison of five instruments of health status. *J Bone Joint Surg Br*. 2004;86:801–808.
22. Park JH, Lim S, Lim J-Y, Kim K-I, Han M-K, Yoon IY, Kim J-M, Chang Y-S, Chang CB, Chin HJ, Choi EA, Lee SB, Park YJ, Paik N-J, Kim TK, Jang HC, Kim KW. An overview of the Korean longitudinal study on health and aging. *Psychiatry Investig*. 2007;4:84–95.
23. Picavet HS, Hazes JM. Prevalence of self reported musculoskeletal diseases is high. *Ann Rheum Dis*. 2003;62:644–650.
24. Raven EE, Haverkamp D, Siersevelt IN, van Montfoort DO, Poll RG, Blankevoort L, Tak PP. Construct validity and reliability of the disability of arm, shoulder and hand questionnaire for upper extremity complaints in rheumatoid arthritis. *J Rheumatol*. 2008;35:2334–2338.
25. Scudds RJ, Robertson JM. Pain factors associated with physical disability in a sample of community-dwelling senior citizens. *J Gerontol A Biol Sci Med Sci*. 2000;55:M393–399.
26. SooHoo NF, McDonald AP, Seiler JG 3rd, McGilivray GR. Evaluation of the construct validity of the DASH questionnaire by correlation to the SF-36. *J Hand Surg Am*. 2002;27:537–541.
27. Szabo RM. Outcomes assessment in hand surgery: when are they meaningful? *J Hand Surg Am*. 2001;26:993–1002.
28. Ware JE Jr. SF-36 health survey update. *Spine (Phila Pa 1976)*. 2000;25:3130–3139.
29. Ware JE Jr, Sherbourne CD. The MOS 36-item Short-Form health survey (SF-36): I. Conceptual framework and item selection. *Med Care*. 1992;30:473–483.
30. Wijnhoven HA, de Vet HC, Picavet HS. Prevalence of musculoskeletal disorders is systematically higher in women than in men. *Clin J Pain*. 2006;22:717–724.
31. Wolfe F, Ross K, Anderson J, Russell IJ. Aspects of fibromyalgia in the general population: sex, pain threshold, and fibromyalgia symptoms. *J Rheumatol*. 1995;22:151–156.