Physical Function and Quality of Life in Older Adults: Sex Differences

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Objectives: Age is associated with deterioration in physical function (PF) and health-related quality of life (HRQL).

Methods: We examined sex differences in the association between PF and HRQL among older adults. One hundred eight adults (ages 60 to 98 years) completed the Continuous Scale-Physical Function Performance test (CS-PFP10), Functional Status Index (FSI), and SF-36. Effects of sex and fitness group on SF-36 scores were examined by using linear and nonparametric techniques. Regression techniques were used to model HRQL indexes with CS-PFP10 and FSI scores.

Results: Males had better PF as indicated by higher CS-PFP10 scores and lower FSI scores. CS-PFP scores were positively associated with several SF-36 scores in both males and females, but the strength of the association appeared greatest in males. The residual scores for the females were directly related to self-reported pain.

Conclusions: These data are consistent with reports indicating that females report symptoms more often than males and rely more on feelings of discomfort during physical activity in reporting HRQL as compared with males. Thus, researchers designing interventions to enhance health-related quality of life among older adults should be aware of these potential sex differences and aim to improve actual physical functioning in males and the discomforts associated with performance of physical activities in females.

Key Words: aging, pain, physical fitness, well being

Research indicates the existence of sex disparities in health-related quality of life (HRQL) among older adults, with females reporting poorer HRQL as compared with age-matched male peers.[1,2] In 1991, Kaplan et al[2] reported a faster rate of decline in the quality of well-being in older females and further indicated that after adjusting life expectancy for years of "well-living," the gap between females and males decreases by more than 50%. This sex difference is consistent with the observation that females tend to live with more chronic illnesses, report greater problems with physical function (PF), and have a higher incidence of disablement as compared with males.[1,2]

It is clear that PF is an important determinant of HRQL in older males and females (eg, References 3 through 6).[3–6] Interestingly, available data suggest that poorer HRQL in older females might be a consequence of a faster deterioration in perceived physical function but not actual physical functional ability.[1,2,7,8] For example, Rahman and Liu[8] report that at the same level of physical performance, older females were more likely to report that they had difficulty in performing activities of daily living (ADLs) in comparison to their age-matched male counterparts. Of additional interest are data from Merrill et al,[9] who reported a high accuracy of perceived

Key Points

- Older males score higher on tests of physical function than age-matched females with similar health histories, perhaps due to greater muscle mass.
- The degree of association between physical function and health-related quality of life is markedly greater in older males compared with females of the same age and health history.
- Pain occurring during performance of activities of daily life accounts for a considerable amount of variance in the health-related quality of life scores of older females but less so in older males.

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abilities among elderly males and females but also observed that among those who reported inaccurately, more males than females underreported disability and more females than males overreported disability. Furthermore, Merrill et al also suggested that such sex differences might be attributed to the greater likelihood that females interpret physical discomforts as symptoms and that they have a greater tendency to recall and report those symptoms.

Thus, the purpose of this investigation was to examine relations among performance-based and self-reported physical function and HRQL among older males and females. Based on the results of Deck et al[1] and Kaplan et al,[2] we hypothesized that males would score higher on physical function tests and HRQL scores and that sex differences would exist in the regression of functional scores against HRQL. Based on studies by Merrill et al,[9] we predicted that the pain scales in the HRQL and ADL inventories would explain more of the variation in physical components of HRQL in females than in males.

Materials and Methods

The procedures described herein were approved by the institutional review boards of Louisiana State University, the Louisiana State University Health Sciences Center, Pennington Biomedical Research Center, and St. James Place Continuing Care Retirement Community in Baton Rouge, LA.

Participants

One hundred eight independent-living older adults (77.3 ± 8.0 years of age) provided informed consent to participate in this study. Seventy-one participants (35 males, 36 females) were from the population-based Louisiana Healthy Aging Study and 37 participants (13 males, 24 females) were residents of St. James Place Continuing Care Retirement Community. The participants in the population-based study were identified and recruited at random by way of the 2,000 voter registration roles. The 37 residents of St. James Place responded to an on-site invitation to participate. Participant medical histories were obtained and reviewed for incidence of disabling diseases and conditions and their current medication use. Inclusion criteria were adults 60 years of age and older. Participants deemed to be at high risk for adverse responses during exercise in accordance with the guidelines set forth by the American College of Sports Medicine[10] were excluded from the study.

Instruments

Health-related quality of life. The SF-36 version 2.0 Health Survey (Health Assessment Lab, Boston, MA) was used to assess HRQL in the study sample.[11,12] This measure has been validated for assessing HRQL in persons over 65 years of age.[11,12] The SF-36 contains eight subscales, including physical function, role physical, bodily pain, general health, vitality, social function, mental health, and role emotional, as well as physical and mental health summary scores.

Self-reported physical function. Self-reported physical function was assessed with the Functional Status Index (FSI).[13] The FSI provides a continuous scale measure of self-reported need for assistance, pain, and difficulty with the performance of basic and instrumental ADLs. The construct and criterion validity of the FSI has been established against objective measures of physical function,[13,14] and the test-retest reliability coefficients of the various test items are reported as being in the range of $r = 0.64$ to 0.82.[13,14]

Physical function performance. A reduced version of the continuous-scale physical function performance test (CS-PFP)[3,15] was used to assess performance-based physical function. The CS-PFP requires the participant to perform a series of ADL-based activities in a standard fashion. The time taken to complete the tasks, distance covered, and/or weight carried are recorded and converted to a set of continuous-scale scores. The test battery provides scores in five physical domains: upper body strength, lower body strength, upper body flexibility, balance and coordination, endurance, and a total PFP score.[3] The test has been validated for use in this population,[3] and the reproducibility of the CS-PFP scores and subscales are very good, with intraclass correlation coefficients in the range of $r = 0.79$ to 0.94. Participants were given specific directions for each task, and they were instructed to perform each task safely but to work at maximal effort. For more information regarding the administration of the CS-PFP, please see Cress et al[3] or the World Wide Web at http://www.coe.uga.edu/cs-pfp/cspfp_test.html.

Procedures

Participants reported to the laboratory on two occasions separated by approximately 1 week. The first session included obtaining written informed consent, a review of medical history, and the SF-36 and FSI questionnaires. The second session involved the CS-PFP10.

Statistical analysis

All data were analyzed using SPSS 11.0 system (SPSS, Inc., Chicago, IL) for Windows.

Participant characteristics. Participant medical history information was coded for history of cardiovascular diseases, orthopedic diseases or problems, neurologic diseases or conditions, and/or “other” conditions known to influence physical function. Sex differences in prevalence of cardiovascular, neurologic, orthopedic, and other diseases were analyzed by using Pearson χ^2 test for homogeneity. Linear models (one-way analysis of variance [ANOVA]) were used to examine sex differences in age, height, weight, waist-hip ratio, total number of disease categories, number of medications, CS-PFP10 items (subscales and total score), and all SF-36 indexes. The α level was set a priori at 0.05, and the Satterthwaithe approximation for group means was selected for use a priori in the event of unbalanced groups. Mann-Whitney *U* tests were used to test for sex differences in mean ranks of FSI subscales (assistance [FSA], pain [FSP], and difficulty [FSD]). The α level was set a priori at $P < 0.05$. In this case, Bonferroni corrections were not made as each parameter is conceptualized as having a unique meaning.

Group differences in HRQL according to sex and physical function. The CS-PFP10 total physical function scores were used to assign participants to one of the following three physical function categories (PFCAT): low, moderate, or high. Although specific criteria for grouping participants according to CS-PFP scores do not yet exist, we arbitrarily grouped participants as follows: Cress and Meyer[16] suggest that CS-PFP10 total scores of 57 and higher are associated with low risk of increased dependent-care needs, whereas scores below 57 are indicative of functional limitations that may contribute to loss of independence. Furthermore, data from Cress and Meyer also indicate that participants living in assisted-care environments have CS-PFP scores of approximately 47 or lower. Therefore, we grouped the participants accordingly: the low function category (low) included participants with CS-PFP scores less than 47; participants with scores between 47 and 56 were assigned to the moderately functional category (moderate); and participants with scores greater than 56 were assigned to the highly functional (high). A 2 $\times$ 3 ANOVA (sex versus PFCAT) was used to examine sex differences in the SF-36 physical and mental component scores (PCS, MCS). ANOVA was selected over multivariate analysis of variance because each HRQL construct was of interest. The α level was set at *P* less than 0.05, and the Satterthwaithe approximation for group means was selected for use a priori in the event of unbalanced groups.

Association between function and HRQL by sex. The data for males and females were treated separately. The Pearson correlation was used to assess associations among SF-36 subscales and CS-PFP total scores. Spearman rank order correlation coefficients were derived for describing associations among SF-36 scales and FSI scores. In each case, the α level was corrected to *P* less than 0.005.

Multiple regression was used to model the PCS component of the SF-36 using the CS-PFP total score, the pain scores from the SF-36, and FSI inventories. An α level of *P* less than 0.05 was required for statistical significance.

Results

Study sample characteristics

One hundred eight participants completed all tests. Tables 1 and 2 provide descriptive statistics regarding the characteristics of the study sample. Results from the ANOVA revealed sex differences in weight, height, and waist-to-hip ratio ($P < 0.05$). Although males and females appeared to report the same number of chronic diseases, Mann-Whitney *U* indicated that the females reported taking more medications than males ($P < 0.05$).

Pearson χ^2 test of homogeneity revealed no sex differences in the frequency in cardiovascular diseases, orthopedic diseases or conditions, neurologic diseases or conditions, or "other" diseases or conditions. However, there were sex differences with respect to distribution in PFCAT (see Table 2). A greater percentage of females were of low functional fitness as compared with males and a smaller percentage of females were in both the moderate and high function categories ($P < 0.05$).

Similarly, sex differences also appeared in performance-based physical function (CS-PFP10) and self-reported function (FSI) scores as reported in Table 3. Simple ANOVA revealed a significant main effect of sex on upper body strength, lower body strength, and total CS-PFP10 score ($P < 0.05$). The results indicated that males had better physical function performance and lower self-reported need for assistance or difficulty with ADLs. However, after including body weight as a covariate, sex differences in CS-PFP scores no longer achieved statistical significance ($F = 1.02$, $P = 0.27$). Mann-Whitney *U* tests revealed that females reported greater need for assistance (FSA) and greater difficulty (FSD) in performing ADLs.

Table 1. Study sample characteristics

	Women	Men	*F*	*P*
Age	77.9 ± 8.3	76.6 ± 7.7	0.65	0.42
Weight (cm)	63.4 ± 11.4	80.5 ± 10.6[a]	17.40	<0.001
Height (kg)	163.5 ± 7.6	175.1 ± 8.9[a]	15.39	<0.001
BMI	23.7 ± 4.0	26.3 ± 2.9	3.46	0.072
Waist-hip ratio	0.79 ± 0.05	0.92 ± 0.07[a]	42.21	<0.001
No. of diseases	1.93 ± 0.97	1.84 ± 1.26	0.17	0.68
No. of meds	4.47 ± 2.89	2.98 ± 2.61[b]	7.41	0.008

[a]*Different from women (simple ANOVA,* $P < 0.05$*).*

[b]*Different from women (Mann-Whitney* U*,* $P < 0.05$*).*

Table 2. Prevalence of disease and physical function category

	Women	Men
n	60	48
CVD prevalence	51%	47%
Orthopedic prevalence	33%	34%
Neurologic prevalence[1]	61%	59%
Other diseases[2]	29%	27%
Low function prevalence[3]	64%	35%[a]
Mod function prevalence[4]	17%	30%[a]
High function prevalence[5]	19%	35%[a]

[a] *$P < 0.05$ (χ^2).*

[1] *Neurologic diseases and disorders including vision and hearing loss.*

[2] *Other diseases in males primarily reflect cancer, and in women, cancer and hypothyroidism.*

[3] *Low function = CS-PFP scores <47.*

[4] *Mod function = CS-PFP scores 48–56.*

[5] *High function = CS-PFP10 scores >56.*

With respect to HRQL, ANOVA revealed no significant sex differences in the subscales of the SF-36 (see Table 4).

Effects of sex and physical function on HRQL

The results of the mixed model ANOVA revealed a main effect of PFCAT on the PCS of the SF-36 ($F = 11.3$, $P < 0.001$). However, there was no significant main effect of sex or sex by PFCAT interaction. Post hoc testing (LSD) on the main effect of PFCAT indicated moderate and high function groups had higher PCS than low function ($P < 0.017$), but moderate and high fit groups did not differ from each other (see Table 5).

Associations between performance-based and perceived physical function

Spearman rank order correlation was used to describe associations between CS-PFP10 scores and the FSI subscales, as well as a composite of the FSI (FSA + FSP + FSD) for males and females. The perceived function scores in females correlated with CS-PFP10 as follows (FSA: $r = -0.55$, $P < 0.001$; FSP: $r = -0.27$, $P < 0.05$; FSD: $r = -0.61$, $P < 0.001$; and total FSI: $r = -0.59$, $P < 0.001$). In males the correlation coefficients were as follows (FSA: $r = -0.58$, $P < 0.001$; FSP: $r = -0.38$, $P < 0.05$; FSD: $r = -0.70$, $P < 0.001$; and total FSI: $r = -0.71$, $P < 0.001$). The negative correlation coefficients indicate that higher physical function scores are associated with lower needs for assistance, pain, and difficulty with ADLs. Also of note are the stronger correlation coefficients for the males as compared with the females.

Associations between physical function and HRQL according to sex

Associations among age, physical function, and SF-36 subscales are presented in Tables 6 and 7 for females and males, respectively. Pearson correlation coefficients were derived except where associations with FSI scores are described. In these instances, Spearman rank order correlation coefficients were derived. There were several significant associations ($P < 0.005$) among variables as denoted in the tables. Of interest was the appearance of associations between age and performance-based function (CS-PFP) but not between age and self-reported function (FSI). Also noteworthy is the consistent appearance of associations between physical function scores and the SF-36 General Health subscale among females but not among males. Last, associations between physical function indicators and the social function subscale of the SF-36 were present among males but not among females.

Regression curves are presented for the purposes of illustrating the associations between age and physical function in males and females (Fig. 1, a and b) and the associations between physical function and the PCS subscale of the SF-36 (Fig. 2, a and b).

Inspection of the regression curves in Figure 1, a and b, reveals that age was significantly and inversely related to performance and the CS-PFP10 in both males and females ($P < 0.005$). Furthermore, the slope of the linear trendline appears somewhat steeper in males; however, this may be due to their higher CS-PFP10 scores. Interestingly, the percent variance in physical function accounted for by age is roughly the same for females and males ($R^2 = 0.33$ and 0.32, respectively). Inspection of the regression curves in Figure 2, a and b, reveals a significant and positive association between CS-PFP10 scores and the PCS subscale of the SF-36 for both males and females ($P < 0.005$). The nature of the association was linear for females, but a power curve provided the best fit for the males. It is important to note that the CS-PFP10 score only accounted for 18% ($R^2 = 0.18$) of the variance in the SF-36 PCS subscale; however, in males, the CS-PFP10 score accounted for 60% ($R^2 = 0.60$) of the variance in the SF-36 PCS.

Post hoc tests

As a result of the large proportion of variance unaccounted for in the SF-36 PCS scores in females, we elected to compute the magnitude of the residuals and examine their association with number of medications taken and with pain indexes from the FSI and the SF-36. The results indicated significant associations between the residuals and the FSP ($r = 0.31$, $P = 0.02$) as well as the bodily pain (BP) index of the SF-36 ($r = -0.37$, $P = 0.005$). In each case, the direction

Table 3. Sex and physical function

CS-PFP/FSI subscales	Women	Men	*F*	*P*
Upper strength	30.4 ± 16.6	45.8 ± 20.7[a]	12.7	<0.001
Upper flexibility	59.7 ± 19.5	57.3 ± 19.6	0.7	0.410
Lower strength	31.8 ± 16.8	43.7 ± 21.3[a]	8.1	0.011
Balance and coord	43.1 ± 19.3	51.3 ± 21.7	3.5	0.061
Endurance	42.9 ± 19.1	51.2 ± 21.7	3.4	0.063
Total CS-PFP	39.9 ± 17.5	48.9 ± 20.9[a]	5.4	0.022
FSIA raw (*rank score*)	22.7 ± 7.6 (59.4)	21.0 ± 7.1 (44.4)[b]	1.6	0.007
FSIP raw (*rank score*)	22.7 ± 7.6 (56.3)	19.9 ± 4.2 (48.6)	0.3	0.148
FSID raw (*rank score)*	22.7 ± 6.1 (59.2)	21.9 ± 7.9 (44.7)[b]	1.4	0.014

[a]*Different from women (simple ANOVA,* P < *0.05).*

[b]*Different from women (Mann-Whitney* U, P < *0.05).*

Table 4. Sex and HRQL[a]

SF-36 subscale	Women	Men	*F*	*P*
Physical function	66.9 ± 27.4	76.4 ± 23.3	3.30	0.070
Role physical	73.7 ± 33.9	77.8 ± 32.9	0.38	0.538
Bodily pain	70.2 ± 25.1	77.5 ± 20.2	2.50	0.117
General health	74.2 ± 16.1	75.5 ± 15.4	0.15	0.698
Vitality	66.8 ± 17.1	65.9 ± 18.0	0.07	0.797
Social function	91.4 ± 15.7	90.6 ± 16.0	0.06	0.812
Role emotional	92.0 ± 21.0	87.9 ± 25.0	0.80	0.374
Mental health	85.0 ± 12.7	84.9 ± 10.8	0.01	0.958
PCS	43.7 ± 10.3	47.1 ± 8.5	3.11	0.079
MCS	57.8 ± 6.6	56.0 ± 5.1	2.17	0.144

[a]*HRQL, health-related quality of life; PCS, physical component scale of the SF-36; MCS, mental component scale of the SF-36.*

Table 5. Effects of sex and functional fitness on health-related quality of life

	SF-36 MCS		SF-36 PCS	
PFCAT	Women	Men	Women	Men
Low	58.2 ± 6.8	54.9 ± 5.7	40.3 ± 10.4	41.1 ± 9.1
Mod	55.5 ± 7.6	57.0 ± 4.3	48.1 ± 7.8[a]	47.8 ± 7.4[a]
High	58.4 ± 5.7	56.4 ± 5.2	50.5 ± 7.0[a]	52.5 ± 3.7[a]

[a]P < *0.05 compared with low.*

MCS, mental component of the SF-36; PCS, physical component of the SF-36.

of the association suggests that among females, the greater the magnitude of the residuals, the greater the reports of pain with performing ADLs.

Multiple regression

Stepwise multiple regression was planned a priori and further supported by the finding that females perceived pain during performance of ADLs (FSP scores) contributes significantly to their perceived physical aspects of HRQL. Therefore, CS-PFP10 and FSP scores were used to model the PCS subscale of the SF-36. In females, FSP score was entered into the equation first, with partial and part correlations of $r = -0.54$ and -0.45, respectively. The CS-PFP total score was then entered with partial and part correlation coefficients of $r = 0.42$ and 0.34, respectively. The complete model [PCS = 53.8 to 0.86 (FSI) + 0.20 (CS-PFP10)] accounts for 48% of the variance in PCS scores ($F = 24.7$, $P < 0.001$). Among males, the CS-PFP10 score was entered into the equation first with partial and part correlations of $r = -0.64$ and 0.49, respectively. The FSP score was then entered with partial and part correlation coefficients of $r = -0.37$ and -0.24, respectively. The complete model for males [(PCS = 45.7 + 0.26 (CS-PFP10) − 0.58 (FSI)] accounts for 65% of the variance in PCS scores ($F = 35.9$, $P < 0.001$).

Discussion

The purpose of this investigation was to determine if sex influences the association between physical function and health-related quality of life among older adults. This was accomplished by examining health-related quality of life among older males and females with various physical function capabilities and by assigning participants to fitness categories. Sex by fitness category interactions on health-related quality of life and the physical component score (PCS) of the SF-36 health-related quality of life inventory were analyzed. Moreover, we plotted physical function scores (CS-PFP10 total score) against SF-36 PCS scores to examine the linearity of the regression and the variance accounted for by the models.

The study population included 108 older adults (48 males and 60 females). The distribution of males and females is

Table 6. Relations among age, physical function, and HRQL in women

	Age	PFP	FSA[2]	FSP[2]	FSD[2]	PF	RP	BP	GH	VT	SF	RE	MH	PCS	MCS
Age	—	−0.58[a]	0.27	0.22	0.31	−0.31	−0.29	0.26	−0.09	−0.32	−0.03	0.09	−0.18	−0.17	−0.03
PFP		—	−0.54[a]	−0.26	−0.60[a]	0.62[a]	0.45[a]	−0.02	0.36[a]	0.40[a]	0.05	−0.03	−0.26	0.46[a]	−0.09
FSA[1]			—	0.64[a]	0.87[a]	−0.67[a]	−0.63[a]	−0.34	−0.51[a]	−0.55[a]	−0.26	−0.24	−0.29	−0.68[a]	−0.09
FSP[1]				—	0.70[a]	−0.56[a]	−0.45[a]	−0.56[a]	−0.21	−0.47[a]	−0.33	−0.38[a]	−0.17	−0.58[a]	−0.11
FSD[1]					—	−0.65[a]	−0.64[a]	−0.35	−0.47[a]	−0.64[a]	−0.29	−0.39[a]	−0.41[a]	−0.64[a]	−0.20
PF						—	0.50[a]	0.32	0.38[b]	0.33	0.28	0.03	0.18	0.82[a]	−0.23
RP							—	0.45[a]	0.43[a]	0.45[a]	0.28	0.13	0.11	0.80[a]	−0.09
BP								—	0.31	0.30	0.40[b]	0.30	0.13	0.66[a]	0.06
GH									—	0.38[b]	0.40[b]	0.04	0.36[b]	0.58[a]	0.14
VT										—	0.30	0.30	0.45[a]	0.40[b]	0.40[b]
SF											—	0.41[b]	0.40[b]	0.34[b]	0.56[a]
RE												—	0.21	0.02	0.63[a]
MH													—	0.07	0.72[a]
PCS														—	0.28
MCS															—

Values are Pearson correlation coefficients.

[a]$P < 0.005$.

[b]$P < 0.010$.

PF, physical function subscale of the SF-36; RP, role physical subscale of the SF-36; BP, bodily pain subscale of the SF-36; GH, general health subscale of the SF-36; VT, vitality subscale of the SF-36; SF, social function subscale of the SF-36; RE, role emotional subscale of the SF-36; MH, mental health subscale of the SF-36.

[1]*Values are Spearman rank order correlation coefficients.*

FSA, assistance scale of Functional Status Index; FSP, pain scale of Functional Status Index; FSD, difficulty scale of Functional Status Index; PCS, physical component of the SF-36; MCS, mental component of the SF-36.

consistent with what would be expected in a random sample of senior adults according to the 2000 United States Census.[17] However, inferences from the present study sample may be limited to the population of white older adults because 98.1% of the participants were white.

For the purpose of this study, it was important to investigate the appearance of any sex differences in the presence of serious diseases and number of prescribed medications taken. On average, by age 75, adults have between two to three chronic medical conditions.[18] Typically, disability among older Americans results from specific age-related diseases and conditions including dementia, stroke, heart and lung disease, and muscular/skeletal disorders such as arthritis and osteoporosis (FHA). In the present investigation, the health history of the entire study sample revealed 46.8% had a history of cardiovascular diseases, 33.9% had orthopedic diseases or conditions, 63.3% had neurologic diseases or conditions (including vision and hearing loss), and 41.3% had other diseases or conditions, most of which were either cancer or hypothyroidism. Closer inspection of the study sample revealed that there were no sex differences in the prevalence of disease categories or total number of diseases. Therefore, it is not likely that the appearance of sex differences in other variables can be explained by the health characteristics of the females and males in this study.

Despite the lack of sex differences in these broad health categories, there were differences in the number of medications taken, with females reporting greater medication numbers as compared with males (4.5 ± 2.9 versus 3.0 ± 2.6, respectively) ($P = 0.008$). This finding is consistent with recent data from Deck et al.[1] Importantly, the data also indicate no significant association between number of medications and health-related quality of life constructs, although the general health component of the SF-36 approached significance ($P = 0.07$). Again, these data confirm the findings of Deck et al, who reported no association between medications and the subscales or the total score of the VITA Questionnaire.

The present study revealed no significant sex difference in the SF-36 subscales or component scores. This contrasts with recent data indicating that middle-aged to older (50 to 85 years) healthy males report better levels of well-being on most dimensions of quality of life compared with age-matched healthy females.[1] However, the participants in the present investigation were a decade older (ages 60 to 98 years) than those in the earlier study. Furthermore, the probability values

Table 7. Relations among age, physical function, and HRQL in men

	Age	PFP	FSA[1]	FSP[1]	FSD[1]	PF	RP	BP	GH	VT	SF	RE	MH	PCS	MCS
Age	—	-0.56^a	0.38	0.06	0.35	-0.26	-0.59^a	0.08	-0.22	-0.63^a	-0.36	-0.17	0.05	0.42^b	-0.17
PFP		—	-0.58^a	-0.38^b	-0.71^a	-0.74^a	0.67^a	0.18	0.19	0.65^a	0.54^a	0.51^a	0.01	0.76^a	0.17
FSA[1]			—	0.21	0.48^a	0.47^a	-0.42^b	0.01	0.06	-0.51^a	-0.26	-0.28	-0.09	-0.39	-0.14
FSP[1]				—	0.70^a	0.44^a	-0.44^a	0.63^a	-0.33	-0.38	0.42^b	0.58^a	-0.28	0.47^a	-0.30
FSD[1]					—	0.69^a	-0.69	-0.38	-0.35	-0.62^a	0.52^a	0.70^a	-0.26	0.75^a	-0.34
PF						—	0.61^a	0.31	0.16	0.56^a	0.56^a	0.63^a	0.14	0.84^a	0.14
RP							—	0.17	0.37	0.56^a	0.61^a	0.51^a	0.20	0.79^a	0.24
BP								—	0.51^a	0.38	0.39^b	0.41^b	0.22	0.58^a	0.32
GH									—	0.41^b	0.17	0.21	0.04	0.58^a	0.16
VT										—	0.43^a	0.28	0.20	0.69^a	0.38
SF											—	0.75^a	0.34	0.60^a	0.57^a
RE												—	0.40^b	0.54^a	0.63^a
MH													—	0.04	0.81^a
PCS														—	0.11
MCS															—

Values are Pearson correlation coefficients.

[a]*P* < 0.005.

[b]*P* < 0.010.

PF, physical function subscale of the SF-36; RP, role physical subscale of the SF-36; BP, bodily pain subscale of the SF-36; GH, general health subscale of the SF-36; VT, vitality subscale of the SF-36; SF, social function subscale of the SF-36; RE, role emotional subscale of the SF-36; MH, mental health subscale of the SF-36.

[1]*Values are Spearman rank order correlation coefficients.*

FSA, assistance scale of Functional Status Index; FSP, pain scale of Functional Status Index; FSD, difficulty scale of Functional Status Index; PCS, physical component of the SF-36; MCS, mental component of the SF-36.

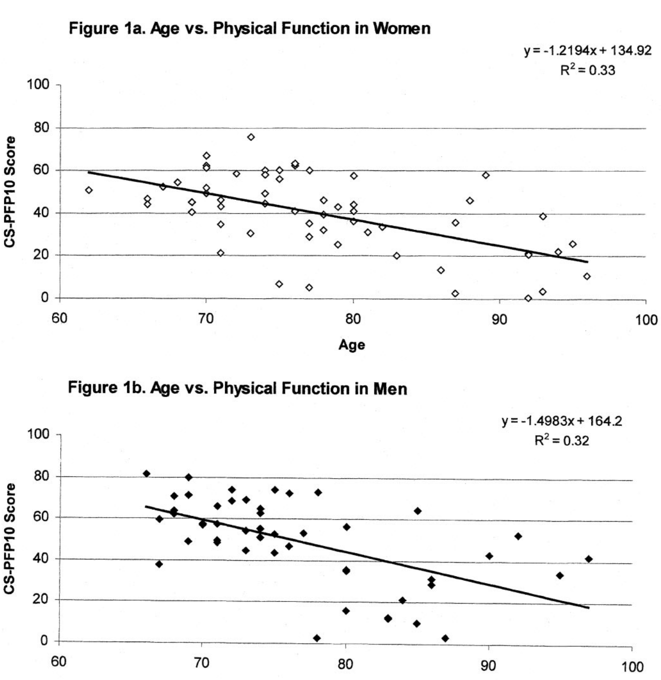

Fig. 1 **Regression curves for associations between age and physical function in males and females.**

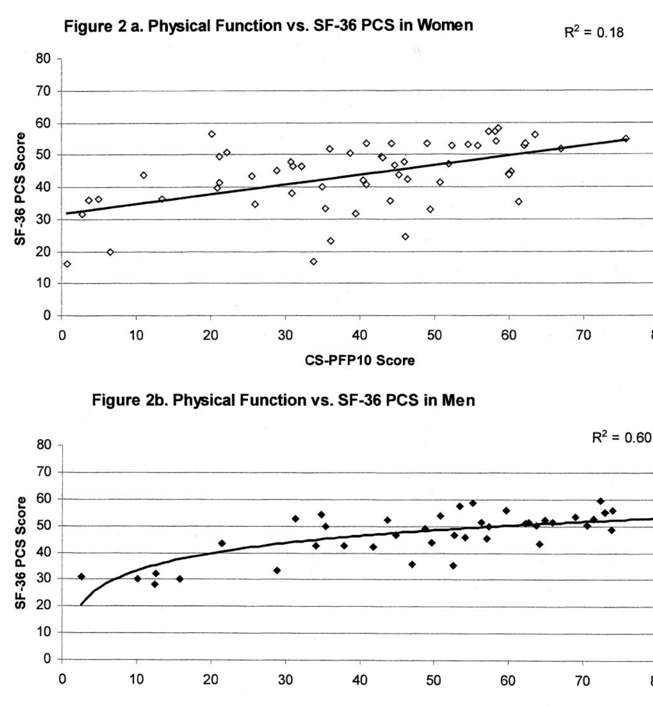

Fig. 2 **Associations between physical function and the physical component score subscale of the SF-36.**

for the main effect of sex with respect to the PF subscale and PCS component were marginal ($P < 0.10$). Thus, it is difficult to rule out the possibility that females report lower physical aspects of quality of life as compared with age-matched males with a similar health history. In consideration of these issues, it could be hypothesized that sex differences in HRQL may decrease with age in the general population of adults 50 years of age and older. Regardless, the present findings underscore the need for continued investigation of this issue.

Although the current data may raise some doubts as to the existence of sex differences in the quality of life of older adults, sex differences in physical function have been consistently documented.[8,9] In a similar investigation, Merrill et al[9] reported significant sex differences for several self-reported measures of physical function items including ADL items (bathing, dressing, and so forth), gross mobility limitation items (do heavy housework, walk a half mile, walk up and down stairs, and so forth), and range of motion limitation items (lifting, stooping, reaching over head, and so forth). Specifically, females reported more disability and functional limitations than males.

The present data both confirm the existence of significant sex differences in self-reported physical function and furthermore reveal sex differences in performance-based tests of physical function. The self-reported needs for assistance and difficulty scales (FSA and FSI) and the performance based CS-PFP10 total score revealed poorer function among females. Interestingly, after including body weight as a covariate, sex differences in CS-PFP10 score were no longer evident. This suggests that the sex differences in physical function may be primarily attributed to body size and perhaps muscle mass. The finding of weaker lower body and upper body strength in the females also supports this inference. Regardless of the potential influence of body weight on physical function, the sex differences reported herein are nonetheless clinically significant.

One of the primary purposes of this investigation was to test the hypothesis that a sex by functional fitness level interaction on health-related quality of life would be found. This hypothesis was not supported by the results of the 3×2 ANOVA. That is, males and females belonging to the same functional categories, whether based on self-report or performance-based tests, reported similar health-related quality of life. However, the results of regressing health-related quality of life (PCS scores) against scores of physical function revealed some sex-specific differences in the nature of the function versus quality of life relation. In general, significant associations between function and physical constructs of quality of life were seen using linear, logarithmic, and power function approaches for both males and females. The power (log-log) model appeared to be the best for describing the data among the males. This model indicated that 60% of the variance in male physical constructs of health-related quality of life was accounted for by physical function. In contrast, the linear model was the best model for females, only accounting for 18% of the variance in SF-36 PCS score. Inspection of the SF-36 data also reveals similar findings when using only the PF subscale rather than the PCS composite. In this case, whereas the association with the total PFP score is considerably strengthened for females ($R^2 = 0.38$), the degree of association still does not approach the amount of variance accounted for by PFP total scores in older males ($R^2 = 0.54$).

Of additional importance was the observation that when using self-reported function as the independent variable (total FSI score), the results for the males did not change, but the results for the females now accounted for nearly 50% of the variance in the PCS score of the SF-36. Therefore, one may infer that the physical constructs of quality of life for females in this study are influenced more by their perceptions of function (FSI total) than their actual functional performance (CS-PFP10 total). In contrast, there appeared to be no difference in the values of self-report versus performance-based measures for the purpose of describing health-related quality of life in older males.

It is therefore important to explore other potential sources of variation that may be contributing to physical aspects of quality of life in older adults, particularly among females whose physical functional performance only accounted for 17% of the variance in PCS scores. Although several possibilities exist, of particular relevance to this study is the argument that females are more likely to interpret and report physical discomforts as symptoms.[9] It then follows that females may be more likely to incorporate physical discomforts experienced during ADLs into their assessment of physical aspects of quality of life. The current data support such an hypothesis inasmuch as the residuals from the CS-PFP10 versus SF-36 PCS scores were significantly associated with pain scores from the FSI. This inventory assesses the level of pain experienced during the performance of 18 activities of daily living.[13] Moreover, the results of the multiple regression suggest that discomforts experienced during ADLs appear to contribute significantly to physical aspects of quality of life in both males and females. However, among older females, the discomfort experienced during ADLs appears to be more important than functional performance, whereas among older males, the relative contribution of symptoms of discomfort is quite small.

Conclusion

In summary, this investigation offers several conclusions. First, self-reported (FSI) and performance-based physical function scores (CS-PFP10) revealed poorer physical function in older females as compared with males. These differences may be due to an older woman's tendency to have lower body weight and weaker upper and lower body strength. Second, although the health-related quality of life scores (SF-36) revealed no statistically significant sex differences, the somewhat low probability value observed for physical components makes it difficult to rule out the possibility that sex differences indeed exist. Most importantly, this investigation revealed that the physical constructs of health-related quality of life are more closely linked to physical function in older males than in older females with a similar health history, and that females tend to incorporate feelings of discomfort into their appraisal of health-related quality of life to a greater extent than males. Thus, researchers designing interventions to enhance health-related quality of life among older adults should be aware of these potential sex differences and aim to improve actual physical functioning in males and the discomforts associated with performance of physical activities in females.

Appendix

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Please see John Standridge's editorial on page 501 of this issue.

The man who says it cannot be done should not interrupt the man doing it.

—Chinese Proverb