Variables Explaining Health-Related Quality of Life in Community-Dwelling Older Adults

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ABSTRACT

Background and Purpose: Although health-related quality of life (HRQL) has been linked to numerous factors in older adults, limited or conflicting studies have investigated variables explaining HRQL in healthy, community-dwelling older adults. The purpose of this study was to determine whether physical activity, gait speed, balance, strength, endurance, and flexibility were associated with HRQL in healthy, community-dwelling older adults.

Methods: Participants of this cross-sectional, correlational research design study included residents of a senior living community, aged 60 years and older who were independent in at least unlimited household ambulation. These residents participated in tests of physical activity, gait speed, balance, strength, endurance, flexibility, and HRQL (Medical Outcomes Study Short-Form Health Survey, SF-36). The physical (PCS) and mental (MCS) component summary scores of the SF-36 were calculated.

Results: Data were collected on 84 participants (mean [SD] age = 78.6 (5.9) years, 54.8% women). Significant correlations were found between the PCS and fast gait speed (FGS) ($r = 0.43$; $p < .001$), the Fullerton Advanced Balance Scale ($r = 0.44$; $p < .001$), 8-ft up-and-go ($r = -0.34$; $p = .002$), and chair stand ($r = 0.37$; $P = .001$). Only body mass index (BMI) ($r = 0.30$; $p = .007$) was significantly correlated with MCS. Forward stepwise linear regression analyses were conducted, controlling for age, sex, and BMI, to identify factors associated with the PCS and MCS. In the model using PCS as the dependent variable, FGS accounted for 26% of the variance (R^2 change) in PCS over and above age, sex, and BMI (R^2 change = 0.03); for the full model, $F = 5.37$, $p = .001$. In the regression analysis using MCS as the dependent variable, only the 8-ft up-and-go was retained (R^2 change = 0.06) over and above age, sex, and BMI (R^2 change = 0.16); for the full model, $F = 3.71$, $p = .01$.

Discussion: Fast gait speed, balance, and lower body strength were associated with the PCS of the SF-36; however, FGS was the only variable that uniquely contributed to the variance in the PCS. Body mass index was associated with the MCS; however, only balance uniquely contributed to the variance in the MCS. Physical activity was not associated with the PCS or MCS.

Conclusions: The results of this study support the assessment of FGS in community-dwelling older adults to gain insight into physical health status. Interventions directed toward FGS, balance, and BMI may contribute to optimum HRQL in this population.

Key words: gait speed, geriatrics, health-related quality of life

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INTRODUCTION

In 2010, there were 40.4 million individuals aged 65 years or older (13.1% of the population) in the United States.[1] By 2030, this number is expected to rise to 19.3%.[1] The growth of this population has focused attention and research toward preserving and enhancing the health, independence, and quality of life (QOL) of older adults. Older adults value independence,[2,3] and the Administration on Aging believes that older adults should have the opportunity to participate in society and the community, maintain health and independence, and remain in their homes and community as long as possible.[4]

In medical research, the term "QOL" may be replaced by the term "health-related quality of life (HRQL)" or "health status."[5] Health-related quality of life encompasses physical, mental, emotional, and social functioning and focuses on the influence of health status on QOL.[6] In older adults, Stewart and King[7] proposed a framework that integrates health and

QOL to study QOL outcomes in older adults. The authors used 2 factors: function and well-being.

Health-related quality of life in community-dwelling older adults has been linked to numerous factors, including risk of disability,[8] history of falls,[9] physical activity,[5,10-12] grip strength,[13] and gait speed in individuals aged 85 years.[14] However, the relationship between walking speed and HRQL does not seem to have been studied directly in healthy, community-dwelling older adults. In addition, Alexandre et al[9] found that physical function (including balance) and physical activity level were not correlated with HRQL in active adults; rather psychological and sociodemographic characteristics had more impact on HRQL. The authors recommended further study of factors associated with QOL in healthy older adults.

Health-related quality of life research on older adults has yielded conflicting results, therefore resulting in incomplete evidence of factors associated with HRQL in healthy, community-dwelling older adults.

The purpose of this study was to determine whether physical activity, gait speed, balance, strength, endurance, and flexibility were associated with HRQL in healthy, community-dwelling older adults. We hypothesized that physical activity, gait speed, balance, strength, endurance, and flexibility would contribute to HRQL. Determining which variables are most associated with HRQL may assist physical therapists in prioritizing interventions for optimizing HRQL.

METHODS

Study Design, Setting, and Participants

This study was a cross-sectional, correlational research study investigating the relationship between the independent variables of physical activity, gait speed, balance, strength, endurance, and flexibility and the dependent variable of HRQL (Table 1). The research was conducted from June 2010 to May 2011 at Sagewood, a continuing care retirement community, where therapy services were provided through contract with the Mayo Clinic, Arizona. There were approximately 200 residents living in a private residence at Sagewood during the study period. All residents in the Sagewood community were invited to participate in functional assessments and the HealthyLife Services program through notices in the community newsletter and community activity calendar. Convenience sampling was used, and residents were recruited via group sessions that provided orientation to the functional assessment process and information regarding the study. Those individuals who attended the group sessions and who were interested in participating in the study were screened for the inclusion criteria. To be included in the study, residents had to be 60 years or older, living in a private residence without caregivers, able to consent to, and participate in the full functional testing protocol, at least an "unlimited household walker" according to the Modified Functional Walking Categories,[15] and English speaking. The researchers selected unlimited household walker on the Modified Functional Walking Categories as the minimal level that someone would need to be to complete the majority of the tests included in this study. This walking classification has been validated in individuals with stroke,[15] and although validity and reliability of the measure has not been tested in healthy adults, the measure was chosen so that individuals who might not have met the other inclusion criteria and were not appropriate for the study could still undergo the functional testing as part of the community's HealthyLife Services program. Criteria of unlimited household walker included walking for all household activities and independence (or supervision) with bathroom mobility,[15] and all of the participants were independent with these 2 criteria. Individuals were excluded if they had chest pain, dizziness or exertional angina, congestive heart failure or uncontrolled high blood pressure (>160/100 mm Hg) or demonstrated vitals that did not meet the American College of Sports Medicine safety standards for exercise.[16] In addition, individuals who had either not been cleared for exercise or a medical condition that prevented exercise were excluded. The A.T. Still University Arizona Institutional Review Board and the Mayo Clinic Institutional Review Board approved the study, and written informed consent was obtained from all participants.

Table 1. Assessments Used to Measure Independent and Dependent Variables

Independent Variables	Dependent Variables
Physical activity (Physical Activity Scale for the Elderly)	Health-related quality of life (Short Form-36 mental component summary and physical component summary)
Gait speed (30-ft walk test: fast gait speed and comfortable gait speed)	
Balance (Fullerton Advanced Balance Scale; 8-ft up-and- go[a])	
Lower body strength (30-s chair stand[a])	
Upper body strength; grip strength (arm curl[a]; grip dynamometry)	
Endurance (2-min step[a])	
Lower body flexibility (chair sit-and-reach[a])	
Upper body flexibility (back scratch[a])	
Body mass index[a]	

[a]Component of functional fitness test.

Assessment Measures

The participants completed functional assessment testing, which included the functional fitness test (FFT),[17] and several additional tests were selected to gain a more comprehensive assessment of the participant's level of function (Table 1). Testing was conducted by C.S.G. and K.B., physical therapists with extensive clinical experience with older adults, and S.L., M.O., and D.R., third-year Doctor of Physical Therapy students at the time of this study. These investigators were trained in the testing procedures and practiced the procedures on 3 older individuals; data from these 3 individuals were not included in the final results. There was perfect agreement across raters for all functional measures except the 8-ft up-and-go, which differed, at most, by 7.2% across all raters. All measures were carried out in the same order.

The FFT (previously named the senior fitness test)[17] is a valid and reliable test, designed specifically for the community-dwelling older adult population to provide a standard measure of overall physical parameters, functional ability, and activity goals.[18,19] Components of the FFT include 8-ft up-and-go test, 30-second chair stand test, arm curl test, 2-minute step test, chair sit-and-reach test, back scratch test, and body mass index (BMI).[17] Each test item assesses specific parameters of function required for older adults to live independently and has been tested for criterion validity (r = 0.73–0.83) and test–retest reliability (R = 0.80–0.98).[18] The 8-ft up-and-go test measures motor agility and dynamic balance of the individual.[18] In addition, it can discriminate among various older age groups.[18] For simplicity, this study classifies the 8-ft up-and-go test as a balance test. The 30-second chair stand and arm curl are valid and reliable tests for older adults to establish lower body and upper body strength, respectively.[17,18] To test the overall cardiovascular endurance,[18] the FFT includes a clinically feasible 2-minute step test or an alternative 6-minute walk test. The 2-minute step test adequately measures cardiovascular fitness of the individual,[16] has a moderate correlation (r = 0.73) with the 1-mile walk test,[18] and a fair correlation (r = 0.36) to the 6-minute walk test in older women with hypertension.[20] The chair sit-and-reach and back scratch tests assess lower body (primarily hamstring) flexibility and upper body flexibility, respectively.[17,18] Measurement of height and weight to determine BMI is commonly used to identify health risks of the individual and is validated by the American College of Sports Medicine.[16] Body mass index sufficiently identifies risk factors for mortality and morbidity[16]; however, other variables such as the amount of body fat in the older adult should be considered when interpreting BMI.[21]

Additional tests included the Physical Activity Scale for the Elderly (PASE),[22] 30-ft walk test,[23] the Fullerton Advanced Balance Scale (FAB),[24,25] grip dynamometry,[26,27] and the Medical Outcomes Study Short-Form Health Survey (SF-36).[28]

The PASE is a valid questionnaire designed to assess amount, type, and duration of physical activity performed within a 1-week period.[29,30] Scores on the PASE can range from 0 to 400 or more.[30] It has been associated with peak oxygen uptake (r = 0.20) and systolic blood pressure (r = −0.18),[22] and has a test–retest reliability of 0.75 (95% confidence interval = 0.69–0.80) and internal consistency (Cronbach α = 0.69).[29] The PASE was developed for community-dwelling older adults and includes questions regarding regular exercise patterns and participation in functional activities such as gardening, household chores, volunteer work, or leisure activities.[29]

The 30-ft walk test measures preferred and maximum gait speed.[23,31] Test–retest reliability (r = 0.96 for preferred speed and r = 0.98 for maximum speed)[31] has been established, and differences in mean gait speed scores between various older adult age groups have demonstrated discriminative validity as a function of age and sex.[23] This study uses the terms "comfortable gait speed (CGS)" for preferred speed and "fast gait speed (FGS)" for maximum speed. Gait speed was measured as the time to walk the middle 30 ft of 50 ft and was timed with a stopwatch. The first 10 ft and last 10 ft were considered acceleration and deceleration phases,[32] so were not included in the calculation. Participants began the test on the word "go" and were instructed to "walk at a pace which is safe and comfortable for you" for the test of CGS and to "walk as quickly as possible but safe for you" for the test of FGS. Each participant performed 2 consecutive trials at each speed (CGS and FGS), and the final score was the average time in seconds of the 2 trials for each speed. The score was converted to meters/second for data analysis and reporting of the results.

The FAB, which includes 10 items each scored 0 to 4, was developed to provide a sensitive assessment of changes in balance for the active, independent older adult.[24,25] The FAB (0–40; 40 = good balance) has displayed high test–retest reliability for the total FAB score (r_s = 0.96), interrater reliability for total score (r_s= 0.94–0.97), and validity when compared with Berg Balance Scale scores (r_s = 0.75; $p < .01$).[25] According to Newton,[33] the FAB may detect subtle balance deficits in active older adults better than the Berg Balance Scale.

A Jamar Plus digital hand dynamometer was used to measure grip strength (lb). Test–retest reliability of grip strength measurement using grip dynamometry is good (intraclass correlation coefficient ≥0.85).[34] Decreased hand grip strength is a marker of frailty.[35] A systematic review of studies addressing measurement of grip strength, many of which used a Jamar dynamometer and were conducted with middle-aged and older adults, demonstrated that low grip strength was associated with mortality, disability, and complications or increased length of stay after hospitalization or surgical procedures.[36] Sayer et al[37] reported that older men and women with a history of falls had lower grip strength than nonfallers (P = .009 and P = .01, respectively).

The SF-36[28] is the most widely used measure of health status[7] and has good evidence to support its use in older adults.[38,39] The SF-36 is a generic index of health status or HRQL with 2 summary scores (0- to 100-point scale), each with 4 individual scales.[5] The physical component summary (PCS) includes physical functioning, role-physical, bodily pain, and general health.[28] The mental component summary (MCS) includes vitality, social functioning, role-emotional, and mental health.[28] McHorney et al[40] showed that the physical functioning, role-physical, and bodily pain scales correlated most with the physical health component ($r > 0.77$), whereas the social functioning, role-emotional, and mental health scales correlated most highly with the mental health component ($r > 0.71$). In a study of adults aged 18 to 98 years, relative validity coefficients ranged from 0.20 to 0.94 for the PCS in tests involving physical criteria, such as self-reported changes in physical health, and from 0.93 to 1.45 for the MCS in tests involving mental criteria, such as self-reported changes in mental health (Cronbach α = 0.92 and 0.91 for the PCS and MCS, respectively).[41]

Assessment results were compiled on data collection forms that were prenumbered, so that the participants could not be identified once the data were transferred to spreadsheets.

Table 2. Means and Standard Deviations of Tests and Measures

Tests and Measures	N	Mean (Standard Deviation)
Physical Activity Scale for the Elderly	67	85.9 (70.1)
Fast gait speed, m/s	84	1.5 (0.3)
Comfortable gait speed, m/s	84	1.2 (0.2)
Fullerton Advanced Balance Scale	84	28.4 (6.5)
8-ft up-and-go, s	83	7.3 (2.2)
30-s chair stand, reps/30 s	84	11.3 (3.9)
Arm curl, reps/30 s	81	13.7 (3.7)
Grip strength, lb	83	52.9 (18.9)
2-min step, reps/2 min	83	71.5 (21.9)
Chair sit-and-reach, inches	80	−4.1 (5.7)
Back scratch, inches	82	−5.2 (5.8)
Body mass index	84	26.8 (5.5)
Physical component summary	81	48.9 (8.1)
Mental component summary	81	51.0 (8.8)

[a]Fullerton Advanced Balance Scale (0- to 40-point scale).
[b]Physical component summary and mental component summary (0- to 100-point scale).

Data Analysis

Data were imported into SPSS version 18 (SPSS, Inc, Chicago, IL). Descriptive statistics were calculated for all variables including means (SD), proportions, and percentages, as appropriate. Pearson correlation coefficients were calculated to estimate the strength of relationships between the independent variables and the PCS and MCS scores of the SF-36. Zero-order correlations were calculated between selected independent variables, preliminarily, to investigate potential problems associated with multicolinearity. Alpha was adjusted downward to 0.01 to accommodate the multiple tests. Forward stepwise multiple linear regression analysis was performed to further investigate which factors were most strongly associated with the PCS and MCS scores. Regression coefficients within the text are reported in unstandardized format.

RESULTS

Descriptive Statistics

Of the approximately 200 residents living at Sagewood, 87 individuals attended the group information sessions and were screened for inclusion in the study. Of the 87, 1 individual did not meet the inclusion criteria and 2 individuals volunteered to be assessed for training of the testers. Eighty-four residents participated—mean (SD) age of 78.6 (5.85) years (range 60–92), 45.2% men and 54.8% women. The mean (SD) BMI was 26.8 (5.48). Mean (SD) scores of assessment measures are provided in Table 2. Measures of FGS, CGS, FAB, and 30-second chair stand test were obtained from all participants. Several of the participants could not complete all of the tests because of upper extremity impairments, inability to follow protocol for the 2-minute step test, unwillingness to perform the test, or a history of osteoporosis. Of the 84 participants, 67 participants fully completed the PASE and 81 fully completed the SF-36.

Multicolinearity

Preliminary analysis indicated that the highest zero-order correlation among independent variables was $r = 0.76$ (FGS and 8-ft up-and-go). Only 3 other correlations exceeded $r = 0.50$. The authors concluded that multicolinearity would be adequately addressed by the stepwise, iterative approach (ie, if 2 independent variables shared overlapping variance with the dependent variable, the analysis would eliminate the one that contributed least to the equation).

Analysis of Factors Associated with the PCS

Zero-order correlations of the PCS and MCS with the independent variables are provided in Table 3. Fast gait speed, the FAB, the 8-ft up-and-go, and the 30-second chair stand were correlated to the PCS of the SF-36 ($P < .01$).

Only participants for whom complete data were available were included in the regression analyses. Complete data were obtained for 57 participants. Age, sex, and BMI were entered into the regression model as control variables, resulting in a multiple $R^2 = 0.03$, $p = .65$. Entering the remaining variables into the analysis resulted in a multiple $R^2 = 0.29$. This full model, however, retained only FGS

Table 3. Statistical Results for Pearson Correlation Analysis

Tests and Measures	PCS			MCS		
	r	*P*	95% CI	*r*	*P*	95% CI
Physical Activity Scale for the Elderly	0.05	.66	−0.02 to 0.04	0.15	.24	−0.01 to 0.05
Fast gait speed	0.43[a]	<.001	−4.70 to −1.69	0.14	.20	−2.94 to 0.64
Comfortable gait speed	0.26	.02	−2.24 to −0.20	0.07	.52	−1.51 to 0.77
Fullerton Advanced Balance Scale	0.44[a]	<.001	0.30 to 0.81	0.17	.14	−0.73 to 0.53
8-ft up-and-go	−0.34[a]	.002	−2.41 to −0.54	−0.16	.15	−1.83 to 0.29
30-s chair stand	0.37[a]	.001	0.35 to 1.25	0.19	.09	−0.07 to 0.97
Arm curl	0.25	.03	0.06 to 1.04	−0.08	.46	−0.71 to 0.33
Grip strength	0.16	.16	−0.03 to 0.17	0.09	.45	−0.07 to 0.15
2-min step	0.23	.04	0.003 to 0.16	0.09	.40	−0.05 to 0.13
Chair sit-and-reach	0.28	.01	0.09 to 0.70	0.10	.37	−0.20 to 0.52
Back scratch	0.20	.07	−0.02 to 0.60	0.10	.36	−0.18 to 0.50
Age	0.06	.59	−0.22 to 0.39	−0.12	.28	−0.51 to 0.15
Sex	−0.11	.33	−5.40 to 1.82	0.02	.85	−3.56 to 4.31
Body mass index	−0.07	.56	−0.43 to 0.24	0.30[a]	.007	0.13 to 0.83

[a]Significant at $p < .01$ level.
Abbreviations: CI, confidence interval; MCS, Short Form-36 mental component summary; PCS, Short Form-36 physical component summary.

as a significant variable; all other variables were excluded because of redundancy in explaining the dependent variable. This second model was significant ($F = 5.37$; $p = .001$), with FGS accounting for 26% of the variance in PCS (R^2 change).

The analysis was repeated, excluding the PASE, because 17 participants failed to follow the test instructions. Eliminating the PASE yielded complete data for 70 participants. Age, sex, and BMI were entered into the regression model first, resulting in a multiple $R^2 = 0.03$, $p = .57$ (Table 4). Entering the remaining variables, again, resulted in retaining only the FGS, multiple $R^2 = 0.23$ ($F = 4.97$; $p = .001$), FGS accounting for 20% of the variance (R^2 change). Fast gait speed and age significantly contributed to the PCS in this model ($\beta = 0.49$ and $\beta = 0.29$, respectively).

Because FGS was highly correlated with many of the independent variables, an additional, exploratory analysis was conducted, eliminating FGS. This regression resulted in retention of the FAB, arm curl, and back scratch tests with a multiple $R^2 = 0.34$ ($F = 5.41$; $p < .001$). In this model, the FAB, arm curl, and back scratch were important in explaining the PCS ($\beta = 0.33$, $\beta = 0.26$, and $\beta = 0.39$, respectively).

Table 4. Results of Multiple Regression Analysis of Physical Component Summary, PASE Excluded (N = 70)

Step	Variable	Unstandardized Coefficients		Standardized Coefficients				Step	
		B	SE	β	*t*	*p*	R^2	R^2 Change	*P*
1	(Constant)	42.5	18.5		2.30	.02			
	Age	0.15	0.18	0.11	0.80	.43			
	Sex	−0.70	2.07	−0.04	−0.34	.74			
	BMI	−0.14	0.20	−0.09	−0.67	.50	0.03	0.03	.57
2	(Constant)	38.0	16.6		2.29	.03			
	Age	0.38	0.17	0.29	2.21	.03			
	Sex	2.16	2.0	0.13	1.09	.28			
	BMI	0.004	0.18	0.003	0.02	.98			
	FGS	−3.66	0.88	−0.49	−4.16	<.001	0.23	0.20	.001

Abbreviations: BMI, body mass index; FGS, fast gait speed; PASE, Physical Activity Scale for the Elderly.

Table 5. Results of Multiple Regression Analysis of Mental Component Summary, PASE Excluded (N = 70)

Step	Variable	Unstandardized Coefficients B	Unstandardized Coefficients SE	Standardized Coefficients β	*t*	*p*	R^2	Step R^2 Change	Step *p*
1	(Constant)	35.2	19.1		1.84	.07			
	Age	0.01	0.19	0.01	0.08	.94			
	Sex	1.37	2.14	0.08	0.64	.53			
	BMI	0.47	0.21	0.29	2.26	.03	0.08	0.08	.12
2	(Constant)	24.9	19.3		1.29	.200			
	Age	0.06	0.18	0.04	0.30	.764			
	Sex	1.72	2.10	0.10	0.82	.416			
	BMI	0.49	0.20	0.30	2.40	.019			
	30-s CS	0.52	0.25	0.24	2.07	.042	0.14	0.06	.04
3	(Constant)	33.7	18.9		1.78	.08			
	Age	0.03	0.18	0.02	0.17	.87			
	Sex	0.36	2.10	0.02	0.17	.86			
	BMI	0.56	0.20	0.34	2.83	.006			
	30-s CS	0.89	0.29	0.40	3.10	.003			
	Arm curl	−0.78	0.32	−0.33	−2.45	.02	0.21	0.07	.008

Abbreviations: BMI, body mass index; PASE, Physical Activity Scale for the Elderly; 30-s CS, 30-second chair stand.

Analysis of Factors Associated with the MCS

Correlation analysis revealed that BMI ($p < .01$) was the only variable significantly correlated with the MCS of the SF-36.

For the MCS, stepwise regression analysis with the PASE included was conducted entering age, sex, and BMI, resulting in a multiple $R^2 = 0.16$, $p = .02$. Entering the remaining variables resulted in the 8-ft up-and-go being retained in the analysis and a multiple $R^2 = 0.22$ ($F = 3.71$; $p = .01$). Body mass index and the 8-ft up-and-go significantly contributed to the MCS (β = 0.39 and β = 0.27 respectively). Repeating the analysis without the PASE (N = 70) resulted in a model retaining the variables of 30-second chair stand and arm curl, multiple $R^2 = 0.21$ ($F = 3.47$; $p < .01$) (Table 5). In this model, chair stands, arm curl, and BMI contributed significantly to the MCS of the SF-36 (β = 0.40, β = 0.33, and β = 0.34, respectively).

DISCUSSION

This study sought to determine which of the variables of physical activity, gait speed, balance, strength, endurance, or flexibility was associated with HRQL in healthy, community-dwelling older adults. We found that FGS, balance (FAB and 8-ft up-and-go), and lower body strength were significantly associated with the PCS of the SF-36, the HRQL measure used in this study. Fast gait speed, however, was the only variable that uniquely contributed to the variance in the PCS. When eliminating the FGS variable in this study, regression analysis revealed that balance (FAB), upper body strength, and upper body flexibility were associated with the PCS. These 3 combined variables explained 34% of the variance in the PCS, whereas FGS alone explained 26% of the variance. Although balance, upper body strength, and upper body flexibility were associated with the PCS, therapists may choose to measure FGS initially to be more efficient and gain insight into the person's physical health status.

An association between gait speed and the PCS of the SF-36 has been reported in 85-year-old adults[14] and in frail older adults.[42] Although this study found that FGS had the strongest relationship to the PCS, many studies recommending measurement of gait speed in older adults have measured usual[35,43,44] or self-selected gait speed,[32] CGS,[45] or did not specifically state the instructions given to the participants.[14,42] Guralnik et al[43] reported that gait speed alone was nearly as good as performing a full battery of tests for predicting risk of disability in activities of daily living in nondisabled, community-dwelling older adults. In another study, walking velocity was reported to be better for detecting a decline in function than self-report of function in community-dwelling older women.[44] Montero-Odasso et al[45] have reported that slow gait velocity in well-functioning older adults is enough to predict future adverse events (total adverse events, hospitalizations, new falls, and need for caregiver) despite normal performance in more complex mobility tests. Studenski et al[46] reported that predicted years of remaining life increased as usual gait speed increased and the authors suggested that gait speed may be especially informative for older adults who report no functional limitation or only difficulty with instrumental activities of daily living. This study provides evidence of the value of measuring FGS as it was strongly associated with the PCS of the SF-36.

Walking speed is an essential vital sign that should be measured routinely to gain information on health status,[32] and categorizing healthy adults according to gait velocity may allow implementation of preventative strategies for delaying first fall and further disability in those at risk.[45] Gait speed can be used to identify older adults with longer or shorter life expectancies so that appropriate interventions can be implemented.[46] In nondisabled persons, measures of walking speed can be used to target those who demonstrate reduced performance to improve their functional ability and QOL with a focused intervention.[43] Following an investigation of factors associated with HRQL in 80- and 85-year-old community-dwelling older adults, Takata et al[14] have concluded that a 1-second decrease in walking time over 10 m may contribute to improvement in some aspects of HRQL. Future research using a larger and more diverse sample of participants may reveal a more specific relationship between optimum gait speed and optimum HRQL in community-dwelling older adults.

In this study, BMI had the strongest association with the MCS of the SF-36. Regression analysis found that balance (with the PASE included), lower body strength, and upper body strength (when excluding the PASE) contributed to the variance in the MCS, but BMI was significantly associated with all analyses. The mean BMI of the participants in this study was 26.8 (range = 13.7–45.2), which positions our sample at the low end of overweight for BMI (25.0–29.9).[47] Adverse HRQL is associated with being underweight in community-dwelling older adults.[12] Unintentional weight loss of more than 10 lb per year is one marker of frailty,[35] and frailty is associated with lower QOL.[48] In general, obese older adults who are active do not have increased odds of fair/poor subjective health.[12]

In this study, physical activity was not correlated with the PCS or the MCS. This finding was unexpected because previous studies have demonstrated a relationship between physical activity and HRQL in older adults.[5,10-12] One explanation for our finding is that recent work investigating the relationship between physical activity and HRQL has shown that possible intermediate factors affect the 2 rather than a direct relationship. In a review of the literature on physical activity and QOL (focusing on QOL outcomes of HRQL and satisfaction with various aspects of the physical self) in older adults, Rejeski and Mihalko[5] discussed several potential mediators for physical activity on QOL, such as the effect of physical activity on self-efficacy and the enjoyment of an activity. The authors have also discussed moderators and stated that the importance or value of a domain of function moderates the effect of interventions on satisfaction with that domain of one's life. For instance, the value older adults place on physical activity moderates the effect that a physical activity intervention has on satisfaction with physical function. In a longitudinal study investigating the impact of an exercise trial, Elavsky et al[49] found that at a 1-year follow-up physical activity had direct effects on self-efficacy, self-esteem, and affect and that self-efficacy and affect had direct effects on QOL. At a 5-year follow-up, physical activity had direct effects on self-esteem and affect and affect had a direct effect on QOL. In a systematic review of the literature on the relationship between physical activity and HRQL in adults aged 15 to 65 years, Bize et al[50] raised concerns about the limited evidence of the causal relationship between physical activity and HRQL, noting that cognitive constructs such as self-efficacy could confound the association.

Some authors suggest that other factors may affect HRQL more than physical factors.[5,9,51,52] Although Rejeski and Mihalko[5] have concluded that physical activity positively influences HRQL regardless of age, activity status, and health of participants, they have also noted that the effect of physical activity on HRQL is probably less dramatic in areas where the older adult is functioning at or above the norm. Alexandre et al[9] investigated factors associated with HRQL in healthy, older adults and reported that there was not a significant association between measures of HRQL and physical activity. Instead, depression, marital status, leisure activities, and income were associated with various domains of HRQL. In a longitudinal survey study of older adults, QOL was associated with biomedical, social, psychological, and successful aging variables at baseline and at an 8-year follow-up, but regression analysis found that only baseline psychological variables, including self-efficacy and optimism, retained statistical significance and that self-rated health, social support, participation, and self-rated active aging were significant at follow-up.[51] Results of a cohort study revealed that personality traits and minor depressive symptoms had a greater influence on HRQL than more objective measures (eg, grip strength) in community-dwelling older adults.[52]

A final explanation for our finding is that the PASE may not be the best measure of physical activity in healthy, older adults, particularly adults who live in communities where they do not carry out usual household activities. Reliability and validity studies of the PASE were first conducted on a sample of community-dwelling older adults, and findings indicated that the activities making the largest individual contributions to the total PASE score were housework, yard care, walking, heavy housework, and jobs in standing or walking.[29] Although selecting the PASE for this study captured the participants' activity in fitness training and leisure activities, our sample lived in a community in which they spent little time on home maintenance and very few reported volunteer or paid work. In another study, Washburn et al[22] added evidence for the validity of the PASE, but that study was conducted in sedentary older adults. Harada et al[53] investigated the validity of 3 physical activity measures, one of which was the PASE, in individuals recruited from community centers versus retirement homes. Scores on the PASE were correlated with several aspects of the PCS in all subjects; however, the PASE was not correlated to the PCS in subgroup analysis in those older than 75 years or in women. In addition, higher correlations were seen in those living in a retirement home.[53] Elavsky et al[49] found no direct relationship between scores on the PASE and QOL, and the authors recommended that the PASE be corroborated with other measures of physical activity, such as accelerometers. Similarly, the PASE was used in a study by White et al,[54] looking at particular factors modifying the relationship between physical activity and satisfaction with life in community-dwelling older adults; results showed no direct significant relationship between measures of HRQL and the PASE.

In this study, an alternative measure of physical activity may have demonstrated a relationship between physical activity and HRQL. Bize et al[50] discussed the validity of self-report measures of physical activity including how validity can be increased by using concurrent measures, such as activity monitors. An alternative for future research may be to use the American College of Sports Medicine's guidelines for exercise[55] as a means of obtaining self-report of physical activity along with an activity log.[56]

Study Limitations

Our selected group of community-dwelling older adults is not representative of the general older adult population. Convenience sampling was used, the majority of participants in this study were white, all were residents of one independent living community, and most were of higher socioeconomic status: each of these factors limits the generalizability of the study's findings. Furthermore, this study was a cross-sectional research design, which limits the ability to establish causality.[57,58] Our intent was to investigate healthy, older adults, but we did not screen the participants for specific comorbidities or do a specific test of mental status. A comparison of the percentile ranking of the participants 75 to 84 years (66.7% of our sample) on the 8-ft up-and-go test to the age group percentile norms reported by Rikli and Jones[19] revealed that men aged 75 to 79 years and 80 to 84 years were in the 40th and 35th percentile ranks, respectively; and women aged 75 to 79 years and 80 to 84 years were in the 35th and 25th percentile ranks, respectively. This example illustrates that our sample, although living in private residence without caregivers, was possibly not as healthy as expected. Related to this is the author's choice of using the Modified Functional Walking Categories and the choice of unlimited household walker to define and limit the sample studied. Although the tool has been validated in individuals with stroke,[15] it has not been validated in healthy, older adults. Selecting one of the higher categories on the scale for the inclusion criteria may have helped to verify that the sample tested was healthy. Seventeen participants did not fully complete the PASE, which limited the number of full data sets available for analysis. However, inclusion or exclusion of the PASE in analysis of the relationship between the study variables and the PCS of the SF-36 did not alter the results. Excluding the PASE did alter the results of the regression analysis for the MCS of the SF-36; however, including or excluding the PASE retained a significant contribution of BMI to the MCS. Our sample size was 84 participants (short of the desired 102 participants), which limits the power of our findings.

CONCLUSIONS

Fast gait speed, balance (FAB and 8-ft up-and-go), and lower body strength were associated with the PCS of the SF-36; however, FGS uniquely explained the greatest variance in the PCS. Balance (8-ft up-and-go) and, particularly, BMI contributed significantly to the MCS of the SF-36. Physical activity, as measured by the PASE, was not correlated with the PCS or MCS. The findings of this study support routine testing of FGS in community-dwelling older adults as an indicator of physical health status. To optimize HRQL in community-dwelling older adults, FGS, balance, and BMI may be key variables for physical therapists to measure and monitor for guidance in the development of effective intervention programs.

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