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Movement Competency's Relationship to Health Related Quality of Life in Older Adults

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ABSTRACT

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The purpose of this study was to investigate the relationship between movement competency and health related quality of life (HRQOL) in adults aged 55 to 75 years. Seventy-eight, male (40) and female (38), subjects completed the study. Their mean (SD) age, height, and mass were 64.9 (5.8) years and 63.6 (4.9) years, 1.8 (.08) m and 1.7 (.07) m, 82.6 (11.8) kg and 70.3 (17.9) kg, for male and female, respectively. Subjects completed several tests in 3 categories: movement competency (Functional Movement Screen™ [FMS] [all 7 tests], sitting-rising test [SRT]); physical activity level (Physical Activity Scale for the Elderly [PASE]); and health related quality of life [HRQOL] (SF-36v2). A linear regression model was then developed to examine the relationship of a number of variables to quality of life. The strongest relationship to HRQOL was the FMS, with a positive correlation of 0.474 which is highly significant ($p < 0.0001$). Once the FMS score was accounted for, no other terms in the regression model were significant. The correlation between our two assessments of movement competency, the FMS and SRT was 0.644 which is highly significant ($p < 0.0001$). Our primary hypothesis was supported that those with better movement competency have a better health related quality of life. Our results suggest further research should be undertaken to see if properly administered individualized corrective therapeutic exercise programs could improve older adults' movement competency and thereby improve their quality of life.

Keywords: Functional Movement Screen, SF-36, sitting-rising test

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Introduction

America's older population is increasing at a disproportionate rate compared to the rest of the country's demographics (24, 30). This phenomenon is known as the "graying of America" (24). In 2010 there were 40 million people in America over the age of 65, accounting for 13% of the total population (31). Some project that this group will double in the next 15 years reaching 72 million by 2030 (31) and account for roughly 20% of the total American population by 2050 (39). There has also been a drastic increase in the longevity of adults compared to generations past (39). This means that more Americans are living longer, but the question arises, are these lives filled with quality?

Health related quality of life has become a topic of interest for many researchers working with older adults. Health Related Quality of Life (HRQOL) is defined as the quality of one's life as related to the summation of physical, mental, and social health (23). Aging and chronic conditions are directly correlated with decreases in quality of life (24). This correlation and increase in total number of individuals categorized as older adults have led researchers to try to determine how to diminish the effects of aging and improve quality of life in seniors. Much has been studied on the effects of physical activity on older adults' health related quality of life in terms of prevention and management of chronic disease (1, 24, 25). Multiple studies have been conducted on the effects of exercise interventions as a means to augment HRQOL (24, 26). It has been shown that increases in physical activity result in increased HRQOL (24, 26). It has not been demonstrated, however, that those who have greater movement competency are the same individuals that have higher HRQOL.

We define movement competency as the coordinated relationship of sufficient mobility and motor control to demonstrate proficiency in fundamental movement tasks/patterns. It has been demonstrated that poor competency in fundamental movement skills are correlated with having low cardiorespiratory fitness, decreased physical activity, and increases in obesity in children (14). We assessed movement competency using the Functional Movement Screen (FMS) and the sitting-rising test (SRT).

The FMS is a seven-movement screening system developed to assess basic movement patterns. It is scored by a four-point method: 3 = no compensations in pattern, 2 = some compensations in pattern, 1 = cannot complete the pattern, and 0 indicates pain in the pattern regardless of the score, with a total possible score of 21. Movement competency, as defined by the FMS, is a score of 2 or 3 on each of the tests with no asymmetries between right and left sides when applicable (6, 7, 18, 19). The SRT was developed by deBrito et al. This test is comprised of two parts: going from a standing position to a seated position and back again to standing. The scoring is based on a 5-point scale for both the descent and the ascent. For each limb used to aid either the ascent or the descent there is a deduction of 1 point, if a loss of balance is noted there is a deduction of .5 with a total possible score of 10 (5, 10).

With the rapid increase in the population of older adults, and its associated increases in health care costs and decreased health, it is important to develop and implement programs or guidelines to diminish the effects associated with aging (1, 24, 25, 39). The purpose of this study was to investigate the relationship between movement competency, as assessed by the FMS and SRT, and HRQOL in adults (as assessed by the SF-36v2) between the ages of 55 and 75 years. We hypothesized that there would be a positive correlation between FMS scores and HRQOL in older adults. We also hypothesized that those with greater movement competency would also be engaged in greater amounts of physical activity compared to those with a decreased movement competency. This relationship was examined by comparing movement competency (the FMS and SRT) with a physical activity (PASE) survey.

Methods

Experimental Approach to the Problem

As stated previously, the primary purpose of this study was to determine if older adults' movement competency is related to their health related quality of life. The FMS was the primary method used to assess movement competency, to ensure the FMS was appropriately used, it was administered by a level 2 FMS certified exercise specialist. The same test administrator evaluated participants using the SRT as outlined by deBrito et al. (5, 10). A video outlining the criteria can be found at: http://www.youtube.com/watch?v= MCQ2WA2T2oA. The SF-36v2 was administered as instructed by QualityMetric Health Outcomes (29). We also examined the correlation between the FMS and the SRT. A secondary purpose of our study was to determine if physical activity levels, as assessed by the PASE questionnaire, were related to movement competency (FMS and SRT).

Subjects

A total of 80 subjects aged 55-75 years volunteered to participate in the study (41 males and 39 females). Two subjects (1 male and 1 female) had incomplete data and were excluded from the statistical analysis. The subject population had a mean (SD) age, height, and mass of 64.9 (5.8) years and 63.6 (4.9) years, 1.8 (.08) m and 1.7 (.07) m, 82.6 (11.8) kg and 70.3 (17.9) kg, male and female, respectively. Each subject read and signed an approved university IRB informed consent prior to participation in the study. Subjects were recruited through posted and distributed flyers and posters, word of mouth, and by third party means around the university's campus as well as at the Huntsman Senior Games in St George, Utah.

Functional Movement Screen

The FMS was designed by Cook and Burton to "assess the fundamental movement patterns of an individual" and "to provide observable performance of basic locomotor, manipulative, and stabilizing movements" (8). It provides a standardized approach to assess, define, and document fundamental movement patterns of individuals for clinicians and practitioners, particularly as part of a preparticipation screening tool (8). When used as part of a comprehensive assessment, the FMS can be utilized to assess one's risk for injury and in some cases performance predictability (7-9, 19, 27). The information on one's risk for injury comes through demonstration of sufficient movement competency or lack thereof. Analysis of this information can provide an acceptable cutoff score for increased risk of injury. The FMS is a reliable measurement of movement competency (13, 16, 22, 30).

The FMS tests fundamental movement patterns by assessing seven movements that follow the neurodevelopmental sequence. The tests are: shoulder mobility, active straight leg raise, trunk stability push-up, rotary stability, in-line lunge, hurdle step, and deep squat (2, 8, 9). The seven fundamental movements of the screen direct the person being observed through locomotor, manipulative, and stabilizing movements that require a balance of mobility and stability: "The tests place the individual in extreme positions where weaknesses and imbalances become noticeable if appropriate stability and mobility is not utilized" (8).

Administration and Scoring of the FMS

The order of the movements in the FMS are as follows: deep squat, hurdle step, in-line lunge, shoulder mobility, active straight leg raise, trunk stability push-up, and rotatory stability. In addition to the 7 screens there are 3 clearance tests for pain, these are associated with shoulder mobility, trunk stability, and rotary stability. Each screen in the FMS is rated using a 3 to 0 scoring system. A score of 3 indicates that the participant is able to perform the pattern as outlined by the administrator. A 2 indicates that the participant was able to perform the desired pattern with required compensation or imperfection. A 1 indicates that the participant is unable to perform the described pattern. The clearance tests are scored on a painful or pain-free reaction to the test. A positive score for the clearance test negates the score for the movement pattern resulting in a score of 0 for that pattern (7-9). A score of 0 is given if pain is present during the performance of any test, regardless of movement competency.

Sitting-Rising Test (SRT)

The SRT assesses one's ability to go from a standing position to a sitting position and back to a standing position. The SRT can be applied to populations across the full spectrum of life from pediatrics to geriatrics (10). It has a 10-point scale.

It has been found that individuals with scores < 8 have a 2-5 fold increase in mortality rates in both men and women ages 51-80 years (10). The most interesting result from de Brito et al. was that a 1-point increase in the SRT results in a 21% reduction in mortality rates (10). It was found that a low score, when compared to the control group, which scored between 8-10, resulted in a greater than 6 fold increase in all-cause mortality (10). It has also been found that there is a correlation between flexibility and the SRT (5). Flexibility is an intricate relationship between sufficient mobility and motor control, therefore we can define flexibility as a component of movement competency.

Administration and Scoring of the SRT

The SRT instructs the subject: "Without worrying about the speed of movement, try to sit and then to rise from the floor, using the minimum support that you believe is needed" (10). The scoring for the SRT is comprised of a 10-point scale, the test is broken into two halves of the movement: getting down and getting up. Each half is assessed on a 5-point scale, with a score of 5 being a perfect score. Scoring for the SRT is assessed during the movement by two classifications: 1) whether the participant loses balance, minus ½ for each loss of balance, and 2) how many appendages or bases of support are used to aide them in their descent or arising from the ground, 1 point is subtracted for each point of contact that touches the ground (10).

SF-36v2

The SF-36v2 is a 36-question survey resulting in an 8-scale profile and a summary of physical and mental measures: physical functioning, role-physical, bodily pain, general health, vitality, social functioning, role-emotional, and mental health (34, 35). These 8 components can further be classified into one of two grouping systems: physical component (PCS) and mental component (MCS). The PCS comprises: physical health, role-physical, bodily pain, and general health with the first three components being the most valid physical health measures. The PCS has also been demonstrated to be a valid physical health measure (35). The mental component is comprised of: vitality, social functioning, role-emotional, and mental health. The MCS has been shown to be useful in screening for psychiatric disorders (35). The MCS has been shown to improve with the treatment of depression (35). The goal of the authors of the SF-36 was to create a short survey to study general health concepts that are not age, illness, sex, or class specific (36); as well as being able to compare across specific and general populations, diseases, and treatment outcomes (35). The SF-36 has been utilized across the globe as a valid and reliable measure and has been translated into over 45 languages (17, 21, 34). The SF-36 has also been shown to have high internal consistency, test-retest reliability, and construct, content, concurrent, criterion, and predictive evidence validity (4, 34). The SF-36v2 is a valid and reliable measurement of health-related quality of life across population samples, within homogenous samples, and across those individuals with healthy and compromised immune systems (17, 21, 34). It is important to note that there is a specific method of delivery with respect to the forms and instructions for each of the three administration methods (36). The complete SF-36v2 was administered by paper, but our correlation comparisons were done with the SF-36v2 PCS. The time required to complete the survey was approximately 15 minutes.

PASE

The Physical Activity Scale for the Elderly (PASE) is one physical activity questionnaire that has been found to be valid and reliable in the aging population (11, 37, 38). The research is mixed on the reliability and validity of all self-reported physical activity questionnaires (11, 15, 33). The PASE is a paper-based, self-reporting survey that assesses the typical week of activity for an individual. Administration of the paper survey took approximately 5-15 minutes to complete.

Procedures

Each subject read and completed an institutionally approved IRB informed consent form and a PARQ+ questionnaire. They then had their waist measurements taken at the umbilicus, and height and mass recorded. Subjects then filled out the SF-36v2 and the PASE questionnaires. Once this was completed, each subject changed into exercise attire that was loose enough not to restrict movement. Each subject was administered the FMS as outlined by Cook et al. by a FMS certified practitioner (7). Following each movement performed by the subject, the movement was evaluated and recorded and the cumulative score out of 21 was recorded. The FMS was videotaped from both an anterior and lateral view using an Apple iPad camera for research records. The FMS test kit and SRT were administered on a flat nonslip surface. Subjects were administered the SRT as outlined by de Brito et al. (10). The SRT also was videotaped for further analysis using the same cameras as the FMS.

Statistical Analysis

All data were analyzed using the R statistical software package (32). To examine our primary hypothesis of the relationship between movement competency and health related quality of life, correlations were determined for the main variables of interest: FMS and SF-36v2 (PCS), as well as FMS and SRT. A linear regression model was then developed to examine the relationship of a number of variables to quality of life. These variables included: FMS, SRT, PASE, SF-36v2 (MCS), asymmetry in the FMS, pain in the FMS, and gender. To examine our secondary hypothesis of the relationship between movement competency and physical activity, correlations between FMS and PASE and SRT and PASE were determined.

Results

Means and standard deviations for FMS, SF-36v2 (PCS), SRT and PASE, stratified according to age and gender, can be found in Table 1.

The linear regression model developed to examine the relationship of movement competency as determined by the FMS and SRT as well as PASE, SF-36v2 (MCS), asymmetry in the FMS, pain in the FMS, and gender determined the variable with the strongest relationship to the SF-36v2 (PCS) was the FMS. The correlation between these two variables was 0.474 which is highly significant ($p < 0.0001$). Once the FMS score was accounted for, no other terms in the regression equation were significant. We plotted a line of best fit in Figure 1 between movement competency (FMS) and health-related quality of life (SF-36v2 (PCS)). The equation for the line of best fit is SF-36v2 (PCS) = 38.11 + 1.28 * FMS. We also showed 95% confidence intervals and 95% prediction intervals around the best fit line on the plot. The correlation between our two assessments of movement competency, the FMS and SRT, was 0.644 which was highly significant ($p < 0.0001$).

The correlations dealing with our secondary hypotheses, concerning the relationship between functional movement and physical activity, proved to be nonsignificant ($p > 0.05$). The correlation between FMS and PASE was 0.192 and between SRT and PASE was 0.157.

Discussion

This is the first study to examine the relationship between movement competency and health related quality of life in older adults. While previous studies have shown the positive effects of physical activity on increased health related quality of life, our linear regression indicated that movement competency was a more robust indicator of health related quality of life (1, 46, 48). When the functional movement screen was added to our equation, physical activity no longer was significant nor were SRT, SF-36v2 (MCS), asymmetry in the FMS, pain in the FMS, and gender. This supported our primary hypothesis that those with better movement competency have a better health related quality of life.

Our highly significant correlation of 0.644 ($p < 0.0001$) between the functional movement screen and the sitting-rising test indicated that they were both valid assessments of movement competency.

Our secondary hypothesis that those with greater movement competency would also engage in greater amounts of physical activity proved not to be borne out with our results. Both of our assessments of competency, the FMS and SRT, had poor correlations with the PASE, our physical activity questionnaire. The correlations were 0.192 and 0.157 respectively, both ($p > 0.05$). We are unsure of the reason for this rather poor correlation between competency and overall physical activity, but perhaps the concern expressed by previous authors regarding the reliability and validity of self-reported physical activity questionnaires was evident in our study as well (22, 31, 59).

The results of the overall FMS scores of our study of older adults are very similar to those reported by Perry and Koehle (28). We both observed decreases in FMS scores over the two decades from 55 to 75 years of age in both genders. They reported the total FMS scores of women from 55-64 years to be approximately 13.27 ± 3.43 while we had scores of 12.38 ± 2.18 over the same decade; for 65+ years Perry and Koehle reported scores declining to 13.17 ± 3.01 while they fell to 11.43 ± 2.31 in our sample. The men from 55-64 years were 13.31 ± 2.68 and the 65+ years were 12.56 ± 3.27 in Perry and Koehle's study; and for the 55-64 years 12.87 ± 1.89 and for the 65-75 years groups 11.06 ± 2.22 in our study.

The same trend of declining scores in the SRT, PASE and SF-36v2 PCS were observed in our study the first decade (55-64 years) to the second decade (65-75 years) (Table 1). This denotes a decrease in movement quality and quantity and HRQOL when comparing the two decades present in this study.

Practical Applications

The phenomenon of the "graying of America" necessitates, from both a financial and humanitarian perspective, that society must address the quality of life of this increasing demographic of the nation. Our preliminary investigation indicates a significant positive relationship between one's movement competency and the quality of life in older adults. Previous research has indicated that movement competency can be improved if proper therapeutic exercise is undertaken (3, 12, 18, 20).

The long-term hope of this study was that an improved understanding of the relationship between movement competency and quality of life of older adults could influence the development and implementation of corrective exercise procedures to possibly enhance the quality of life among older adults. Our results suggest further research should be undertaken to see if properly administered individualized corrective therapeutic exercise programs could improve older adults' movement competency and thereby improve their quality of life.

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Table 1. FMS, SF-36v2 PCS, SRT and PASE scores stratified by age and gender (Means and SD)

Age	Gender	N	FMS	SF-36v2 PCS	SRT	PASE
55 < 65 yrs	Female	24	12.38 ± 2.18	53.51 ± 5.76	8.23 ± 1.98	229.5 ± 99.5
65 ≥ 75 yrs	Female	14	11.43 ± 2.31	52.46 ± 6.14	7.78 ± 1.36	194.4 ± 66.8
55 < 65 yrs	Male	23	12.87 ± 1.89	54.40 ± 6.24	8.24 ± 1.21	247.7 ± 77.6
65 ≥ 75 yrs	Male	17	11.06 ± 2.22	53.74 ± 5.99	8.06 ± 0.86	208.6 ± 80.8

Table 2. Age, Height, Mass, Height to Waist, BMI

	N	Age	Height (cm)	Mass (kg)	BMI	H-W
Female	38	63.6 ± 4.89	167 ± 7.23	70.3 ± 17.87	25.2 ± 5.76	.5 ± .09
Male	40	64.9 ± 5.81	179.7 ± 8.84	82.6 ± 11.81	25.6 ± 3.54	.5 ± .046

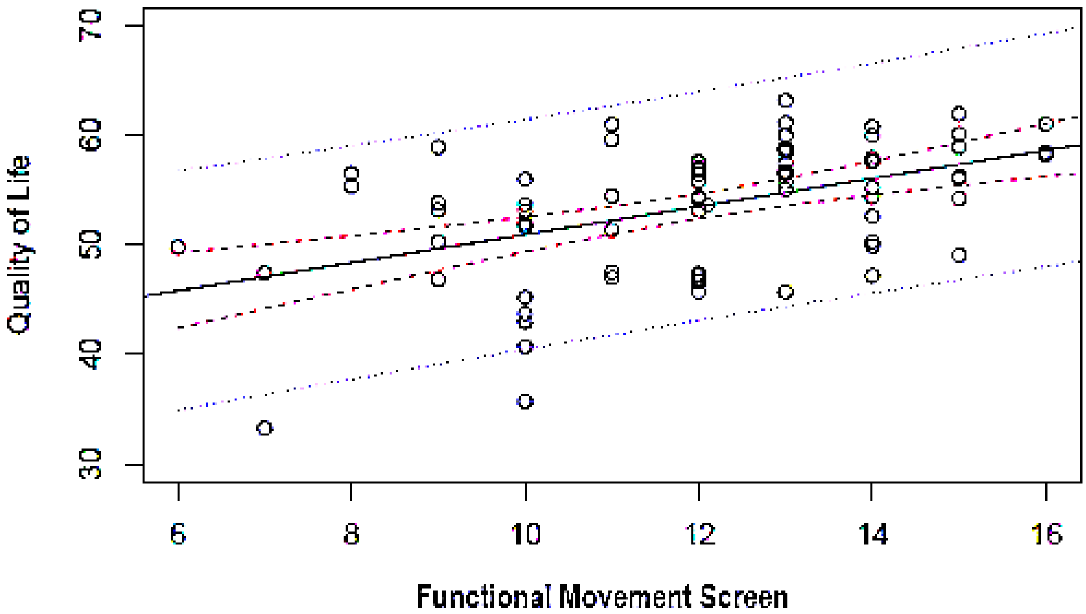

Figure 1. Plot of the relationship between Quality of Life and Movement Competency with the line of best and 95% confidence intervals (red lines) and 95% prediction intervals (blue lines).