DISTINCTIONS BETWEEN SELF-REPORT AND PERFORMANCE-BASED MEASURES OF PHYSICAL FUNCTION IN OLDER PATIENTS PRIOR TO CHEMOTHERAPY

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ABSTRACT

Background: The maintenance of physical function (PF) is an extremely important outcome for older adults.

Objective: The aims of this study were to identify differences in subjective and objective measures of PF between younger older adults (YOA, 60-69 years of age) and older adults (OA, ≥70 years of age); compare the PF scores with age-matched samples from the general population; and evaluate for associations between subjective and objective measures of PF.

Methods: Patients (n=139) were assessed using subjective (i.e., European Organization for Research and Treatment of Cancer Core Quality-of-Life Questionnaire (QLQ-C30)) and objective (i.e., Short Physical Performance Battery (SPPB)) measures prior to chemotherapy (CTX). Data were analyzed using parametric and nonparametric tests.

Results: No differences were found between the two age groups in any of the subjective or objective measures of PF. Compared to the age-matched general population; both YOA and OA had significantly lower scores in both measures of PF. Large effect sizes were found for differences in QLQ-C30 role function, SPPB balance, and SPPB total scores between the YOA group and the age-matched general population samples. Correlations between the subjective and objective measures were low.

Conclusions: Older patients with cancer have lower PF than their age matched general population prior to CTX. Longitudinal studies are warranted to evaluate for changes in PF during and following CTX.

Implications for Practice: Nurses need to perform routine assessments of PF in older oncology patients prior to CTX. Our findings suggest that SPPB gait speed may be a useful screening measure for PF in older patients.

KEY WORDS: chemotherapy; physical function; older adults; gait; postural balance

INTRODUCTION

The incidence of cancer is increasing worldwide, primarily due to the rapid growth of the older population.[1, 2] With the expected 67% increase in the incidence of cancer in older adults over the next 10 years,[3] detailed information is needed on how physiologic changes associated with aging influence older adults responses to cancer treatments. Of particular importance to older adults is how a cancer diagnosis and its treatments will influence their level of physical function (PF).[4, 5]

PF is an extremely important outcome for older adults, because functional impairments are associated with a higher symptom burden,[6] decrements in quality of life (QOL),[7] and increased mortality.[8] In addition, impairments in PF decrease older adults' ability to perform activities of daily life (ADL) and maintain their independence, as well as increase caregiver burden and health care utilization.[6, 9] Because of its clinical importance, an evaluation of PF is an integral component of any comprehensive geriatric assessment.[10, 11]

Two approaches are commonly used to evaluate PF, namely self-report and performance-based measures. In most of the studies that compared subjective versus objective measures of PF in older adults,[12-25] while correlations ranged from low to high, the majority of investigators suggested that both types of measures are needed to obtain a complete picture of older adults' functional status. However, as noted in a recent review,[26] in 67% of the cancer clinical trials that were evaluated, the European Organization for the Research and Treatment of Cancer Quality of Life Questionnaire (i.e., QLQ-C30) was used to evaluate PF. In addition, in most of the studies that evaluated the benefits of using a comprehensive geriatric assessment, subjective measures of ADL and instrumental ADL (IADL) were used to evaluate PF (for reviews see [27, 28]).

For example, in a cross sectional study that evaluated PF in older adults (≥65 years, n=240) at the time of their cancer diagnosis, using measures of ADL and IADL,[29] functional decline was associated with older age, more advanced disease, and higher levels of cognitive impairment. Furthermore, in a Norwegian study that recruited older oncology patients (≥60 years, n=198),[30] compared to the general population without comorbidity (n=1648), cancer patients had significantly lower scores on the PF and the role function scales of the QLQ-C30.

Two studies were identified that used both subjective and objective measures of PF to predict functional decline in older oncology patients.[31, 32] In the first study, that evaluated patients (≥70 years) from their first to their second cycle of chemotherapy (CTX),[31] functional decline was defined as a decrease of ≥0.5 points on the Katz ADL scale. While the Timed Get Up and Go Test, the objective measure of PF, was included in the multivariate analysis, the only characteristics associated with functional decline were higher levels of depression and lower IADL scores. In the second study of women with breast cancer (≥65 years),[32] a self-report measure (i.e., Vulnerable Elder Survey) and three performance-based measures (i.e., Short Physical Performance Battery (SPPB), gait speed, grip strength) were evaluated to determine their ability to predict functional decline (i.e., a one point decrease on Katz ADL scale) at 12 months after diagnosis. All four measures demonstrated excellent predictive abilities. While findings from these two studies are inconsistent in terms of the added value of using both types of PF measures, neither of these studies accounted for changes in these measures with increasing age.

As noted in studies of the general population,[33, 34] impairments in PF assessed using self-report measures increase with age. For example, in studies that used the QLQ-C30 to evaluate PF in the Norwegian general population (n=1,965), [33] as well as in six European countries (n=16,151),[34] participants' scores on the physical and role function scales decreased with age in a linear fashion until age 69 years. At 70 years of age, mean scores on both scales

decreased dramatically. Similar age-related findings were reported for performance-based measures of PF.[35-39]

Given the existing age bias in oncology clinical trials [40-42] and the paucity of research on self-report and performance-based measures of PF, the purposes of this study, in a sample of older gynecological and colorectal cancer patients (n=139) whose PF was assessed prior to the initiation of CTX, using both types of measures, were to: identify differences in subjective and objective measures of PF between the two age groups; compare the scores for both PF measures from our sample of YOA and OA with age-matched samples without cancer drawn from the general population;[30, 39] and evaluate for associations between the subjective and objective measures of PF.

METHODS

Sample and settings

The procedures for the parent study are described in detail elsewhere.[43] In brief, this study is part of a larger longitudinal study that evaluated for changes in PF in older adults undergoing CTX. Patients were recruited from one community and two university hospitals in Norway. The inclusion criteria were: aged ≥60 years with gynecological or colorectal cancer; scheduled to receive primary or adjuvant CTX; had a Montreal Cognitive Assessment (MoCA) score of ≥23;[44] and a Karnofsky Performance Status (KPS) score of ≥60.[45] Patients were excluded if they had received CTX or radiation therapy within the six months prior to enrollment. A total of 208 patients were approached and 149 consented to participate (71.6% response rate). Of these 149 patients, one withdrew and nine were excluded because their MoCA score was <23.

Instruments

Demographic and clinical characteristics - At enrollment, patients completed a demographic questionnaire that obtained information on gender, living arrangements, marital

status, education, height and weight, and employment status. In addition, they completed the KPS scale which was used to assess the patients' overall function. The KPS scores ranged from 40 (disabled; requires special care and assistance) to 100 (normal no complaints; no evidence of disease),[46, 47] and the Self-Administered Comorbidity Questionnaire (SCQ-16).[48] The SCQ-16 evaluates the occurrence, treatment, and functional impact of 16 common medical conditions. Total SCQ scores range from 0 to 48. The SCQ-16 has well established validity and reliability.[48]

Patients reported visual and hearing impairments and the occurrence of tinnitus. The occurrence and severity of visual and hearing impairments were assessed by two questions adapted from the 15D questionnaire:[49, 50] 1) Do you have problems with vision/hearing? and 2) Do you use any aids to read/hear? To assess the occurrence of tinnitus, patients were asked if they were bothered by tinnitus (yes/no).[51]

Subjective measure of PF – Patients completed the European Organization for the Research and Treatment of Cancer Quality of Life Questionnaire (i.e., QLQ-C30) that is one of the most commonly used QOL questionnaires in oncology patients.[7, 34, 52] This questionnaire consists of five function scales (i.e., physical, role, cognitive, emotional, social), seven symptom scales (i.e., fatigue, pain, nausea and vomiting, dyspnea, insomnia, appetite loss, constipation), a financial difficulties scale, and a global QOL scale.[52] The questionnaire has a 1-week time frame and uses a four-point response format (i.e., "not at all,'' "a little,'' "quite a bit,'' "very much''), with the exception of the global QOL scale, that is scored on a 1 (very poor) to 7 (excellent) scale. The raw scores were linearly transformed on a 0 to 100 scale, using the algorithm in the QLQ-C30 scoring manual.[53] Higher scores indicate a better level of function and QOL. For the symptom scales, higher scores indicate more severe symptoms. For this analysis, self-reported PF was assessed using the following scales: PF,

role function, and global QOL. In the current study, Cronbach's α was 0.78 for the PF scale that consists of five items.

Objective measure of PF - The Short Physical Performance Battery (i.e., SPPB) is a performance-based measure that is widely used to evaluate physical performance in older persons.[25, 54-57] It consists of three timed tasks: hierarchical standing balance, 3- or 4-meter gait speed, and repeated chair stand. For the balance test, patients were required to maintain three stances for 10 seconds (i.e., standing with feet side-by-side, semi-tandem, and tandem). The balance score can range from 0 (i.e., duration of the side-by-side and semi-tandem tests is <10 seconds and the duration of the tandem test is <3 seconds) to 4 (no balance impairment).

Depending on the available space to perform the test, gait speed was scored based on the time taken to walk 3 or 4 meters at usual speed. The test was performed twice and the shortest time was used in the analysis. Tape was used to mark out the distance on a flat unobstructed course. Patients began in a standing position, with their toes just touching the start line. The timer was started when the patient began moving and was stopped when the patients` foot completely crossed the 3 or 4 meter line. Completion times of <3.62 or <4.82 seconds (i.e., <1.2 meter/second (m/sec)), respectively are considered to be normal.[56]

The repeated chair stand task was scored as the time taken to complete 5 repetitions of the sit to stand maneuver. All sit-to-stand maneuvers were performed using a dining chair. Patients were instructed to fold their arms across their chest during the task. The timer was started when the patient`s back left the backrest and was stopped when s/he straightened out completely for the fifth time. Completion times of ≤11.19 seconds are considered normal.[56]

The timed results for each task were rescaled into a predefined 4-point scale, with scores ranging from 0 (being unable to complete the task) to 4 (best performance). The total SPPB summary score is the sum of the three rescaled task scores and can range from 0 to 12 with higher scores indicating better PF.[25, 55, 56] A SPPB summary score of ≤9 was associated

with disability, nursing home placement, and increased mortality.[25] In addition to the rescaled SPPB scores, the unscaled scores for gait speed (m/sec) and the chair stand test (sec) are reported.[57] The SPPB has high retest reliability in older people.[58]

Ethical considerations

Regional Committee for Medical and Research Ethics, Norway and the institutional review board at each of the study sites approved the study (reference No. 2015/1277/REK southeast). All patients provided written informed consent.

Study procedures

Oncologists or nurses approached patients prior to the initiation of CTX to assess their interest in study participation. Then, patients were introduced to the research staff who explained the study and scheduled an appointment to perform the measures. The questionnaires and SPPB were administered in the clinic or in the patient's home before, the same day, or immediately after the first infusion of CTX. Reliability testing for all of the study measures was done on an annual basis with all of the research staff. An inter-rater reliability of >90 was achieved for all of the study measures. Research staff reviewed patients' medical records for disease and treatment information

Statistical analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS, Version 26, IBM Corporation, Armonk, NY). Descriptive statistics were used to evaluate demographic and clinical characteristics. While no clear age cut-off or definition of an older cancer patient exists, consistent with the guidelines from the International Society of Geriatric Oncology,[59] in this study, older was defined as a person $\geq$70 years of age. Differences between the two older age groups in various characteristics were evaluated using Independent sample t-tests. For each of the older age groups, one-sample t-tests were used to compare the oncology patients` scores on the PF measures with age-matched scores for women from the

general Norwegian population.[30, 39] The female scores were used as the reference values because the majority of the older adults in our sample was female.

To evaluate for clinically meaningful differences in the PF measures between the patients and individuals drawn from the general population, effect size calculations were done (i.e. Cohen`s *d*) [60] and evaluated using the following cut-offs for small (from 0.2 to 0.5), medium (from 0.5 to 0.8), and large (>0.8) effects.[39, 60-62] Associations between the subjective and objective measures of PF for the total sample were done using Pearson Product Moment Correlation Coefficients. A p-value of <0.05 was considered statistically significant.

RESULTS

Differences in demographic and clinical characteristics

Details on differences in demographic and clinical characteristics are described in our previous publication.[43] In brief, of the 139 patients, 49.6% were YOA with a mean age of 65.6 (standard deviation (SD) =3.0) years and 50.4% were OA with a mean age 75.3 (SD=4.9) years. Overall, the sample was predominately female (93.5%), married or partnered (62.9%), and 37% had a college degree. Except for age, employment status, and the occurrence of high blood pressure, no differences were found in any of the demographic and clinical characteristics between the two age groups. Compared to the YOA, OA were less likely to be employed (i.e. 32.8% vs 1.5%, p<.001) (Supplemental Table 1).

In terms of clinical characteristics, the total sample had a body mass index (BMI) of 25.8 (SD=6.0), had a KPS score of 86.7 (SD=10.9), and were 1.3 (SD=3.6) years from their cancer diagnosis. Of the total sample, 87.1% had a diagnosis of gynecological cancer, 54.0% had undergone surgery prior to CTX, and 33.1% received treatment for recurrent disease. In addition, these patients had 1.9 (SD=1.8) comorbidities and had an SCQ score of 3.7 (SD=4.0). In terms of high blood pressure, compared to the YOA group (24.1%), patients in the OA group (45.5%, p=.015) had a higher occurrence rate.[43]

Differences in subjective and objective measures of PF

As shown in Figures 1A to 1C, no differences were found between the two age groups in any of the subjective measures of PF. However, when each of the age group`s scores on the three QOL-C30 scales (i.e., PF, role function, global QOL) were compared to normative data from the Norwegian general population, for both of the YOA and OA groups, all of their scores were significantly lower than those of the general population.

In terms of the objective measures of PF, no differences were found between the two age groups on any of the SPPB rescaled scores (i.e. standing balance, gait speed, chair stand, Figures 2A to 2C respectively), as well as on the SPPB total score (Figure 2D) and on the unscaled scores for the chair stand test (Figure 3A) and gait speed (Figure 3B). However, compared to the general population, except for the SPPB rescaled score for standing balance (Figure 2A), all of the other SPPB rescaled scores (Figures 2B and 2C), as well as the total SPPB score (Figure 2D), were significantly worse in both older age groups. In addition, compared to the general population, the unscaled scores for the chair stand test (Figure 3A) and gait speed (Figure 3B) were significantly worse in both older age groups.

Clinically meaningful differences in subjective and objective measures of PF

As shown in Table 1, when effect size calculations were done to evaluate for clinically meaningful differences in all of the subjective and objective measures of PF, between the YOA group and the general population, effect sizes ranged from -0.15 for the rescaled SPPB balance score to -0.82 for the QLQ-C30 role function score. When similar calculations were done between the OA group and the general population, effect sizes ranged from 0.09 for the rescaled SPPB balance to -0.50 for the unscaled gait speed test.

Associations between subjective and objective measures of PF

As shown in Table 2, except for the rescaled SPPB balance score (where no significant correlations were found), the majority of the correlations between the subjective and objective

measures of PF were significant. Significant correlations ranged from 0.18 for the rescaled SPPB chair stand score versus KPS score (p=.046) to 0.37 for the SPPB total score versus QLQ-C30 PF score (p<.001).

DISCUSSION

To our knowledge, this study is the first to evaluate for differences in both self-report and performance-based measures of PF in two groups of older oncology patients prior to the initiation of CTX. While previous studies of the general population found age-associated declines in subjective and objective measures of PF,[33, 34] no differences were found in any of the subjective and objective measures of PF between our YOA and OA groups. This lack of age-related decline in our sample of older oncology patients may be partially explained by the lack of differences between our two age groups in a number of characteristics (e.g., BMI,[63] comorbidity burden,[64] presence of metastatic disease[65]) that have been associated with poorer PF in oncology patients.

While not unexpected, for both the physical and role function scales of the QLQ-C30, compared to the general population, scores for both groups of older patients were not only statistically significantly lower, but represented clinically meaningful decrements in PF. Of note, the effect sizes for the YOA (d=0.53 for physical and d=0.82 for role) were larger than those for the OA (d=0.20 and 0.34, respectively). In addition, when our patients' scores are compared to age-based scores of oncology patients,[66] interesting findings emerged. For the YOA, compared to oncology patients between the ages of 50-70 (n=3476) who reported mean physical and role function scores of 78.7 and 69.7, respectively, our patient`s scores were significantly lower (both p<.01). In contrast, for the OA group, compared to oncology patients between the ages of 71-80 (n=547) who reported physical and role function scores of 68.5 and 65.4, respectively, no differences in these scores were found. Potential explanations for the lower scores in our YOA compared to the large representative sample of oncology patients [66]

are that our YOA were more likely to be female, had a lower mean KPS score, and were more likely to have metastatic disease. These characteristics are known to be associated with poorer functional status in oncology patients.[65, 67, 68]

Similar to the subjective measures, except for the standing balance test, while no differences in SPPB scores were found between our two age groups, both groups had significantly worse scores on all of the other timed tasks compared to the general population. In terms of the SPPB total score which is a composite measure of an older adult`s physical performance,[25, 54-57] while our mean scores were comparable to a similar sample of oncology patients (i.e., 9.8),[69] the mean scores for both the YOA (9.5) and OA (9.4) groups were close to the clinically meaningful cut-off score of $\leq$9.0. In fact, 39.7% of our YOA and 46.3% of our OA patients were below this threshold. These relatively low SPPB total scores may be partially explained by the fact that across the total sample, 54.0% of the patients were recovering from surgery and 77.6% had metastatic disease. These patients warrant additional monitoring because in older oncology patients this cut-off score was associated with a higher symptom burden[6], higher rates of functional decline,[70] and decreased survival.[70]

In both the gerontology [57] and oncology [32] literature, studies have evaluated the ability of the entire SPPB versus gait speed alone to predict functional decline and disability. In both of these studies, the entire SPPB performed slightly better than gait speed alone. This consideration is an important one, particularly in clinical practice given that the entire SPPB takes approximately 10-15 minutes to complete, while gait speed takes only one to two minutes.[25] In the current study, the correlations between the SPPB total score and the gait speed ($r=.75$) and chair stand ($r=.67$, both $p<.001$) scores were relatively high which suggests that the shorter test could be used as a screening tool. However, as noted by Guralnik and colleagues,[57] each test may provide unique information on how various diseases may effect different aspects of lower extremity function. This type of specific functional information may

be particularly important in oncology patients. For example, no differences were found between the general population and our older oncology patients on the balance test prior to the initiation of CTX. However, an evaluation of changes over time in balance will be particularly important in older adults who will receive neurotoxic CTX.[71]

Consistent with previous reports,[12-25] the correlations between the subjective and objective measures of PF were very low. When completing the PF scale of the QLQ-C30, patients are asked to rate their level of difficulty with doing strenuous activities, going for a short walk, or going for a long walk. While one would hypothesize that their ratings of difficulty with these activities would strongly correlate with the SPPB performance measures like the gait speed test, our findings suggest that both types of measures are needed to obtain a complete picture of older oncology patients' level of PF. Because the QLQ C-30 takes approximately ten minutes to complete and requires specialized scoring algorithms, it may be more suitable for clinical research. However, the use of the single item patient-rated KPS scale may be a useful screen in clinical practice. In terms of performance-based measures, clinicians may want to screen oncology patients prior to the initiation of CTX using either the chair stand test or gait speed.

Several limitations warrant consideration. Because the sample was primarily women with gynecological cancer, our findings may not generalize to men and to older adults with other types of cancer. In addition, while the total sample was relatively large, the two age groups were relatively small. Another limitation is that no information was obtained on our older adults' exercise routines and on their use of physical therapy. This information may have provided insights on our sample`s relatively low PF scores. It should be noted that while the proportion of patients in both groups had similar types of cancer treatments, future studies need to evaluate for age differences in PF in older adults prior to the initiation of any cancer treatment. Given that functional decline can progress in older oncology patients, [9, 72]

longitudinal studies are needed that evaluate for changes in PF during and following CTX and specific demographic and clinical characteristics associated with functional decline.

Despite these limitations, to our knowledge, this study is the first to evaluate age-related differences in both self-report and performance-based measures of PF in a sample of older oncology patients. Our findings suggest that compared to the general population, both groups of older oncology patients experience decrements in PF prior to the administration of CTX. Given that functional deficits are associated with higher rates of functional decline [7] and decreased survival time,[8] oncology nurses need to perform routine assessments of PF prior to and on a regular basis during treatment. To obtain a more complete picture of PF in older cancer patients, clinicians need to use both subjective and objective measures of PF because they evaluate different aspects of PF. The SPPB gait speed may be a useful screening measure for older cancer patients. In addition, clinicians can use this information to identify older patients at risk, suggest evidence-based interventions to improve patients' PF, and make appropriate referrals (e.g., physical therapy) to improve patients' PF. Oncology nurses can provide older patients with education about the benefits of routine exercise and physical activity.[73] To preserve older adults' independence and assist them at maintain a good QOL, oncology nurses need to encourage patients to wear accelerometers to track their level of physical activity on a daily basis.[74, 75]

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Figure Legends

Figure 1. Scores for the total sample and differences in scores for the European Organization for the Research and Treatment of Cancer Quality of Life Questionnaire (QLQ-C30), A) PF, B) role function and C) global quality of life, between the younger older adults (YOA) and older adults (OA)), as well between each of the older adult groups and the general population. All values are plotted as means ± standard deviation.

Figure 2. Scores for the total sample and differences in scores for the Short Physical Performance Battery (SPPB), A) standing balance, B) gait speed, C) chair stand and D) total

score between the younger older adults (YOA) and older adults (OA), as well between each of the older adult groups and the general population. All values are plotted as means ± standard deviations.

Figure 3. Unscaled scores for the total sample and differences in scores for the Short Physical Performance Battery (SPPB), A) chair stand and B) gait speed between younger older adults (YOA) and older adults (OA), as well between each of the older adult groups and the general population. All values are plotted as means ± standard deviations.

Table Legends

Table 1. Evaluation of Clinically Meaningful Differences in Subjective and Objective Measures of Physical Function Between the General Population and Each of the Two Age Groups.

Table 2. Correlations between Subjective and Objective Measures of Physical Function.

Supplementary Table 1. Differences in Demographic and Clinical Characteristics Between Younger Older Adults (YOA) and Older Adults (OA).

Table 1. Evaluation of Clinically Meaningful Differences in Subjective and Objective Measures of Physical Function Between the General Population and Each of the Two Age Groups[1]

Measure	Comparison between YOA and GP	Comparison between OA and GP
Subjective Measures of Physical Function		
EORTC Physical Function	-0.53	-0.29
EORTC Role Function	-0.82	-0.34
EORTC Global QOL	-0.68	-0.29
Objective Measures of Physical Function		
Chair stand (sec)	0.39	0.28
Gait speed (m/sec)	-0.61	-0.50
SPPB Balance	-0.15	0.09
SPPB Chair stand	-0.67	-0.40
SPPB Gait speed	-0.52	-0.45
SPPB Total score	-0.80	-0.47

[1] Evaluation done using Cohen`s *d* (see reference # 60)

Abbreviations: EORTC, European Organization for the Research and Treatment of Cancer Quality of Life Questionnaire; GP, general population; m/sec, meters per seconds; OA, older adults (≥70 years); sec, seconds; SPPB, Short Physical Performance Battery; YOA, younger older adults (60-69 years)

Table 2. Correlation between Subjective and Objective Measures of Physical Function

Measures	Statistics	KPS score	EORTC QLQ-C30 Physical Function	EORTC QLQ-C30 Role Function	EORTC QLQ-C30 Global Health	SPPB Balance	SPPB Gait Speed	SPPB Chair Stand
EORTC QLQ-C30 Physical Function[a]	r *p*	.64 <.001						
EORTC QLQ-C30 Role Function[a]	r *p*	.59 <.001	.69 <.001					
EORTC QLQ-C30 Global Health[a]	r *p*	.50 <.001	.62 <.001	.69 <.001				
SPPB Balance[b]	r *p*	.10 .290	.12 .189	-.03 .712	-.03 .757			
SPPB Gait speed[b]	r *p*	.19 .037	.17 .067	.09 .357	.19 .040	.36 <.001		
SPPB Chair stand[b]	r *p*	.18 .046	.34 <.001	.21 .019	.24 .007	.10 .275	.23 .009	
SPPB Total[b]	r *p*	.28 .002	.37 <.001	.22 .014	.26 .004	.60 <.001	.75 <.001	.67 <.001

[a]Subjective measures of physical function, [b]Objective measures of physical function

Abbreviations: EORTC QLQ-C30, European Organization for the Research and Treatment of Cancer Quality of Life Questionnaire; KPS, Karnofsky Performance Status; SPPB, Short Physical Performance Battery

Supplementary Table 1. Differences in Demographic and Clinical Characteristics Between Younger Older Adults (YOA) and Older Adults (OA)

Characteristics	Total (n=139)	YOA (<70) 49.6% (n=69)	OA (≥70) 50.4% (n=70)	Statistics
	Mean (SD)	Mean (SD)	Mean (SD)	
Age (years)	70.5 (6.4)	65.6 (3.0)	75.3 (4.9)	t=-14.13; p<.001
Karnofsky Performance Status score	86.7 (10.9)	86.0 (10.4)	87.2 (11.4)	t=-0.61; p=.546
Body mass index (kg/m^2)	25.8 (6.0)	25.1 (4.9)	26.6 (6.8)	t=-1.53; p=.129
Number of comorbidities	1.9 (1.8)	1.7 (1.6)	2.1 (1.9)	t=-1.30; p=.195
Self-administered Comorbidity Questionniare score	3.7 (4.0)	3.2 (3.4)	4.1 (4.4)	t=-1.27; p=.208
Time since cancer diagnosis (years)	1.3 (3.6)	1.7 (4.3)	1.0 (2.7)	t=1.22; p=.225
Hemoglobin (g/dl)	12.6 (1.7)	12.4 (1.7)	12.7 (1.6)	t=-1.15; p=.253
	% (n)	% (n)	% (n)	
Gender				
Females	93.5 (130)	91.3 (63)	95.7 (67)	FE; p=.326
Males	6.5 (9)	8.7 (6)	4.3 (3)	
Married or partnered (% yes)	62.9 (83)	59.4 (38)	66.2 (45)	FE; p=.473
Lives alone (% yes)	34.4 (45)	35.9 (23)	32.8 (22)	x^2=1.25; p=.536
Currently employed (% yes)	16.5 (21)	32.8 (20)	1.5 (1)	FE; p<.001
Education				
Primary school	16.0 (19)	12.5 (7)	19.0 (12)	x^2=.09; p=.607
High school	47.1 (56)	50.0 (28)	44.4 (28)	
College	37.0 (44)	37.5 (21)	36.5 (23)	
Vision deficit (% yes)	10.4 (12)	9.8 (5)	10.9 (7)	FE; p=1.000
Aids for reading (% yes) (n = 85)	76.5 (65)	82.1 (32)	71.7 (33)	FE; p=.312
Hearing deficit (% yes)	14.8 (18)	10.7 (6)	18.2 (12)	FE; p=.310
Aids for hearing (% yes) (n = 75)	12.0 (9)	5.9 (2)	17.1(7)	FE; p=.171
Tinnitus (% yes)	18.4 (23)	19.0 (11)	17.9 (12)	FE; p=1.000
Specific comorbidities (% yes)				
Heart disease	13.2 (16)	10.3 (6)	15.9 (10)	FE; p=.429
High blood pressure	35.5 (44)	24.1 (14)	45.5 (30)	FE; p=.015
Lung disease	10.7 (13)	6.9 (4)	14.3 (9)	FE; p=.245
Diabetes	7.4 (9)	5.2 (3)	9.4 (6)	FE; p=.496
Ulcer or stomach disease	7.4 (9)	3.4 (2)	10.9 (7)	FE; p=.168
Bowel disease	9.9 (12)	10.5 (6)	9.4 (6)	FE; p=1.000
Kidney disease	1.7 (2)	1.8 (1)	1.6 (1)	FE; p=1.000

Liver disease	1.7 (2)	0.0 (0)	3.1 (2)	FE; p=.498
Anemia/blood disease	3.4 (4)	0.0 (0)	6.6 (4)	FE; p=.120
Headache	8.5 (10)	3.6 (2)	12.9 (8)	FE; p=.099
Depression	10.1 (12)	12.3 (7)	8.1 (5)	FE; p=.548
Osteoarthritis	41.0 (50)	38.6 (22)	43.1 (28)	FE; p=.713
Back pain	32.5 (38)	35.7 (20)	29.5 (18)	FE; p=.555
Rheumatoid arthritis	3.4 (4)	1.8 (1)	4.8 (3)	FE; p=.621
Disease in connective tissue	6.8 (8)	10.7 (6)	3.3 (2)	FE; p=.150
Skin disease	6.7 (8)	9.1 (5)	4.7 (3)	FE; p=.469
Cancer diagnosis				
Gynecological	87.8 (122)	84.1 (58)	91.4 (64)	FE; p=.206
Colorectal	12.2 (17)	15.9 (11)	8.6 (6)	
Surgery prior to chemotherapy (% yes)	54.0 (75)	53.6 (37)	54.3 (38)	FE; p=1.000
Metastasis (% yes)	77.6 (104)	74.6 (50)	80.6 (54)	FE; p=.535
Treated for recurrent disease (% yes)	33.1 (46)	39.1 (27)	27.1 (19)	FE; p=.152
Type of prior cancer treatment (out of 46 patients)				
Surgery (% yes)	90.4 (40)	92.0 (23)	89.5 (17)	FE; p=1.000
Radiation therapy (% yes)	15.9 (7)	7.7 (2)	27.8 (5)	FE; p=.103
Chemotherapy (% yes)	90.9 (40)	96.2 (25)	83.3 (15)	FE; p=.289
Other cancer treatment (% yes)	31.6 (12)	37.5 (9)	21.4 (3)	FE; p=.472

Abbreviations: dl, deciliters; FE, Fisher's Exact; g, grams; kg, kilograms; m^2, meters squared; SD, standard deviation

Figure 1

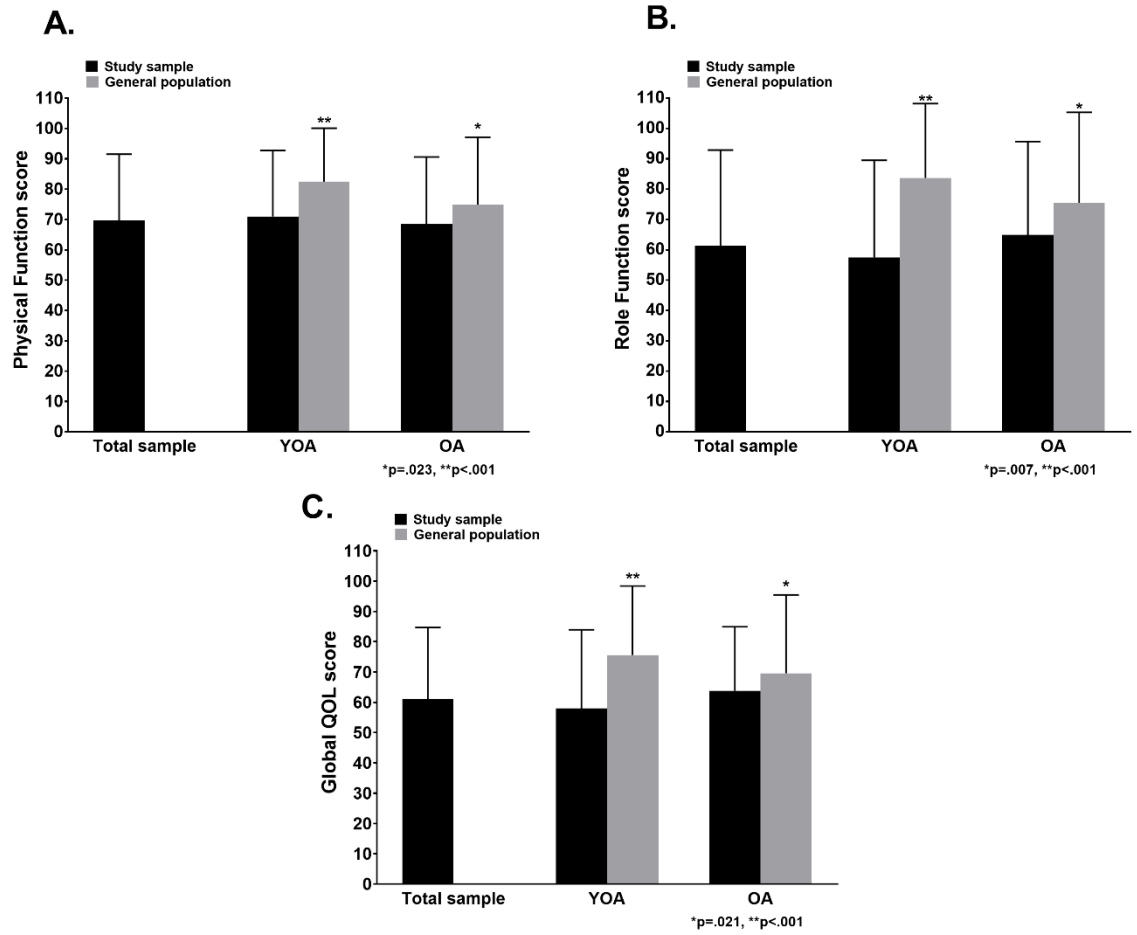

A.
Study sample
General population
Physical Function score
110
100
90
80
70
60
50
40
30
20
10
0
**
*
Total sample
YOA
OA
*p=.023, **p<.001
B.
Study sample
General population
Role Function score
110
100
90
80
70
60
50
40
30
20
10
0
**
*
Total sample
YOA
OA
*p=.007, **p<.001
C.
Study sample
General population
Global QOL score
110
100
90
80
70
60
50
40
30
20
10
0
**
*
Total sample
YOA
OA
*p=.021, **p<.001

Figure 2

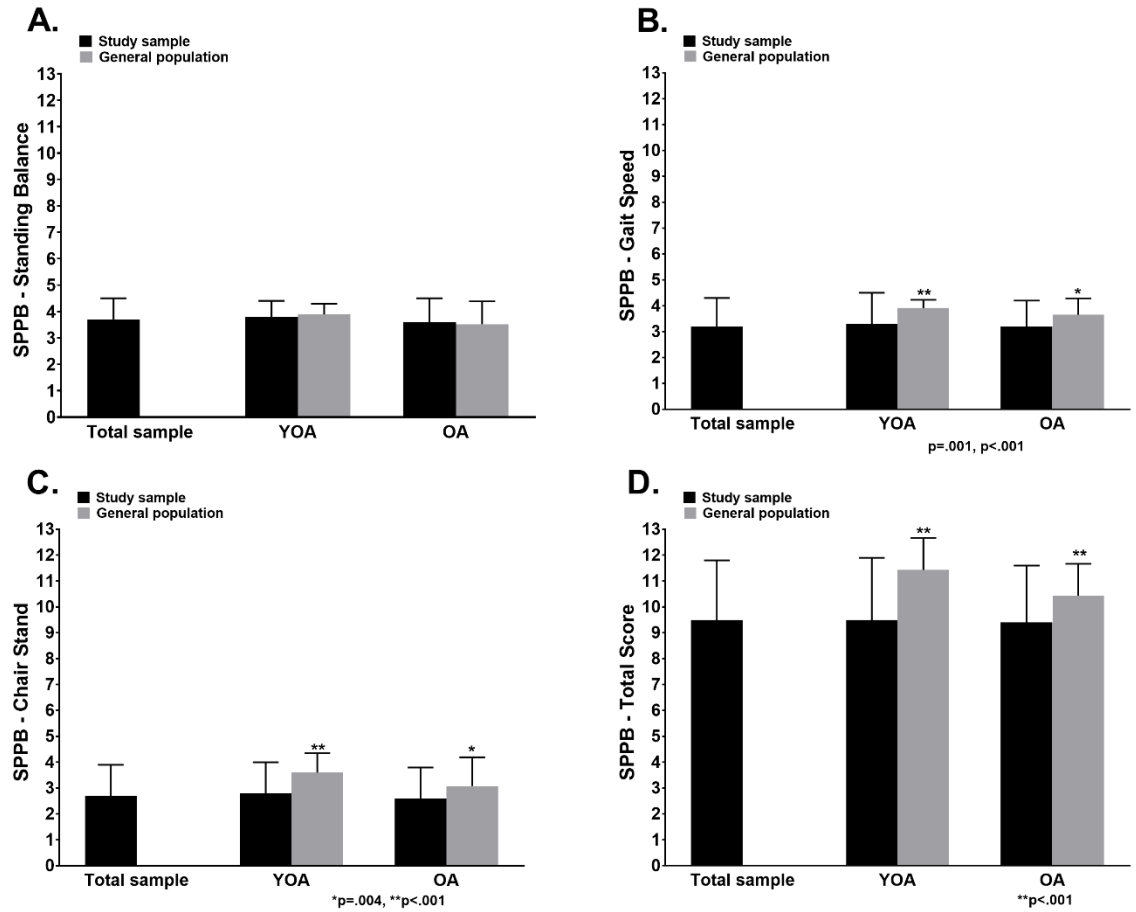
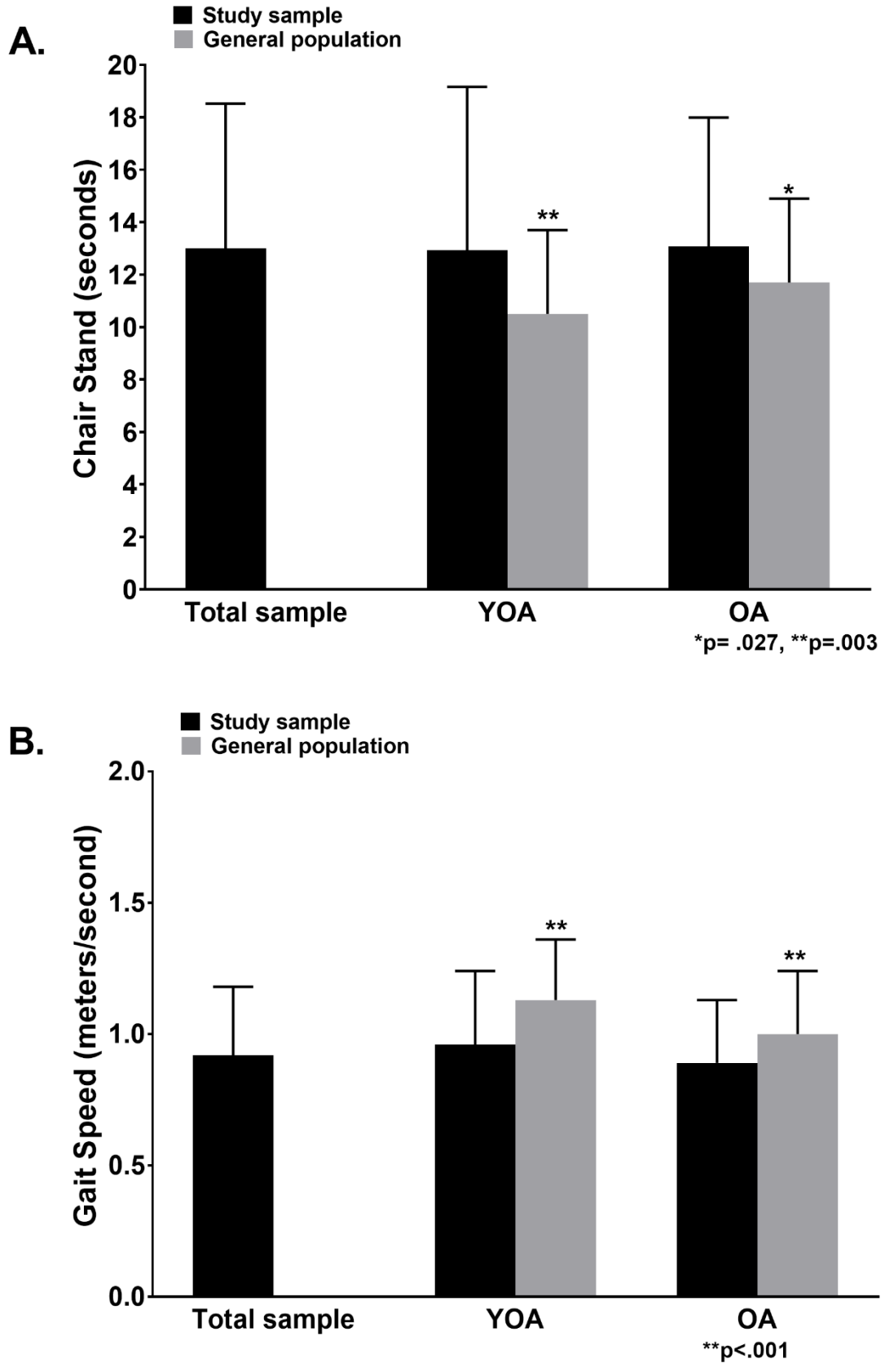

A.
Study sample
General population
SPPB - Standing Balance
Total sample
YOA
OA
B.
Study sample
General population
SPPB - Gait Speed
**
*
Total sample
YOA
OA
p=.001, p<.001
C.
Study sample
General population
SPPB - Chair Stand
**
*
Total sample
YOA
OA
*p=.004, **p<.001
D.
Study sample
General population
SPPB - Total Score
**
**
Total sample
YOA
OA
**p<.001

Figure 3


A.
Study sample
General population
Chair Stand (seconds)
20
18
16
14
12
10
8
6
4
2
0
**
*
Total sample
YOA
OA
*p= .027, **p=.003
B.
Study sample
General population
Gait Speed (meters/second)
2.0
1.5
1.0
0.5
0.0
**
**
Total sample
YOA
OA
**p<.001