DISTINCT PHYSICAL FUNCTION PROFILES IN OLDER ADULTS RECEIVING CANCER CHEMOTHERAPY

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Abstract

Context—While physical function is an important patient outcome, little is known about changes in physical function in older adults receiving chemotherapy (CTX).

Objectives—Identify subgroups of older patients based on changes in their level of physical function; determine which demographic and clinical characteristics were associated with subgroup membership; and determine if these subgroups differed on quality of life (QOL) outcomes.

Methods—Latent profile analysis (LPA) was used to identify groups of older oncology patients (n=363) with distinct physical function profiles. Patients were assessed six times over two cycles of CTX using the Physical Component Summary (PCS) score from the SF12. Differences, among the groups, in demographic and clinical characteristics and quality of life (QOL) outcomes were evaluated using parametric and nonparametric tests.

Results—Three groups of older oncology patients with distinct functional profiles were identified: Well Below (20.4%), Below (43.8%), and Above (35.8%) normative PCS scores. Characteristics associated with membership in the Well Below class included: lower annual income, a higher level of comorbidity, being diagnosed with depression and back pain, and lack of regular exercise. Compared to the Above class, patients in the other two classes had significantly poorer QOL outcomes.

Conclusions—Almost 65% of older oncology patients reported significant decrements in physical function that persisted over two cycles of CTX. Clinicians can assess for those characteristics associated with poorer functional status to identify high risk patients and initiate appropriate interventions.

Keywords

physical function; older adults; chemotherapy; comorbidity; latent class analysis

INTRODUCTION

The number of older adults diagnosed with cancer is expected to increase by 67% between 2010 and 2030.[1] However, older adults are less likely to receive the most effective cancer treatments[2] and to complete a standard course of chemotherapy (CTX).[3] To optimize the receipt of cancer treatments in older adults, a significant amount of research has focused on predictors of mortality, dose reductions, and other traditional treatment outcomes (for reviews see 4–7). While prediction of these treatment outcomes is important,[8] virtually nothing is known about the impact of CTX on older oncology patients' functional status during the receipt of CTX.[9–12]

The assessment of physical function is an extremely important component of any evaluation of the overall health and physiologic reserves of oncology patients. While not assessed as consistently as comorbid conditions, functional status is as important as comorbidity in predicting mortality and health care utilization.[13,14] In addition, for many older adults, functional status is an extremely important health outcome that informs treatment decisions.[9]

After a diagnosis of cancer, regardless of age, patient-reported physical function deteriorates at an accelerated rate compared to that of age-matched controls.[4,5,15] However, only two research groups have characterized changes in physical function in older adults receiving cancer treatment, as well as demographic and clinical characteristics associated with functional decline.[16–18] In one large prospective study that recruited a sample of newly diagnosed older adults,[16,17] changes in physical function were evaluated using the physical functioning subscale of the Medical Outcomes Study Short Form 36 (SF-36).[19] In the first report from this study,[16] changes in physical function were assessed from prior to the diagnosis of cancer to 6 to 8 weeks after initial treatment. In the second report,[17] changes in physical function were evaluated multiple times for up to one year after the cancer diagnosis. In the multivariable analysis, older age and higher number of comorbidities were the only characteristics associated with decreases in physical function in the immediate treatment period.[16] In the 12 month follow-up study,[17] being female, as well as older age and a higher number of comorbidities were associated with declines in physical function. In the most recent study,[18] older adults were evaluated prior to their first and second cycles of chemotherapy (CTX) using a different measure of function, namely the Activities of Daily Living (ADL) scale.[20] In the multivariable model, higher scores on the Geriatric Depression Scale[21,22] and lower scores on another measure of function (i.e., Instrumental ADL scale[23]) at enrollment, were associated with increased risk for functional decline. Across these three studies,[16–18] cancer diagnosis, stage of disease, or type of cancer treatment were not associated with either outcome measure. Differences in the functional outcome measures used and the heterogeneous nature of the samples in terms of demographic and clinical characteristics may account for the different predictors that were identified.

While physical function is an extremely important patient outcome,[24,25] research on changes in function older oncology patients is extremely scarce. To begin to address this gap, the purposes of this study, in a sample of older oncology outpatients (n=363; 65 years of age) whose physical function was assessed using Physical Component Summary (PCS) score from the SF12, six times over two cycles of CTX, were to: identify subgroups of older patients (i.e., latent growth classes) based on changes in their level of self-reported physical function; determine which demographic and clinical characteristics were associated with subgroup membership; and determine if these subgroups differed on quality of life (QOL) outcomes.

METHODS

Patients and Settings

Details regarding the methods for the larger, longitudinal study from which this sample was drawn are published elsewhere.[26,27] In brief, for the larger study, eligible patients were 18 years of age; had a diagnosis of breast, gastrointestinal (GI), gynecological (GYN), or lung cancer; had received CTX within the preceding four weeks; were scheduled to receive at least two additional cycles of CTX; were able to read, write, and understand English; and gave written informed consent. Patients were recruited from two Comprehensive Cancer Centers, one Veteran's Affairs hospital, and four community-based oncology programs. A total of 2234 patients were approached and 1343 consented to participate (60.1% response rate). The major reason for refusal was being overwhelmed with their cancer treatment. For this study, data from patients who were 65 years of age (n=363) were used in the analysis of changes in physical function.

Instruments

At enrollment, a demographic questionnaire obtained information on age, gender, ethnicity, marital status, living arrangements, education, employment status, and income. The Karnofsky Performance Status (KPS) scale was used to assess patients' overall performance status.[28] Patients rated their functional status using the KPS scale that ranged from 30 (I feel severely disabled and need to be hospitalized) to 100 (I feel normal; I have no complaints or symptoms).[29,30]

Self-Administered Comorbidity Questionnaire (SCQ) consists of thirteen common medical conditions simplified into language that can be understood without prior medical knowledge.[31] Patients indicated if they had the condition; if they received treatment for it (proxy for disease severity); and if it limited their activities (indication of functional limitations). Across the thirteen conditions, the total SCQ score can range from 0 to 39 with higher scores indicating a worse comorbidity profile. The SCQ has well established validity and reliability.[32,33]

Physical function over the two cycles of CTX was assessed using the PCS score from the SF-12.[34] The SF-12 consists of 12 questions about physical and mental health as well as overall health status. The SF-12 was scored into two components that measure physical (i.e., PCS) and psychological (mental component summary (MCS)) function. These scores can

range from 0 to 100. Higher PCS and MCS scores indicate better physical and psychological functioning, respectively. The PCS score includes the dimensions of physical functioning, role-physical, bodily pain, and general health perceptions. The individual items on the SF-12 were used to evaluate generic aspects of QOL. The SF-12 has well established validity and reliability.[34]

Disease-specific QOL was evaluated using the Quality of Life Scale-Patient Version (QOL-PV)).[35,36] This 41-item instrument measures four domains of QOL (i.e., physical, psychological, social, and spiritual well-being) in oncology patients, as well as a total QOL score. Each item is rated on a 0 to 10 numeric rating scale (NRS) with higher scores indicating a better QOL. The QOL-PV has well established validity and reliability.[35–38] In the current study, the Cronbach's alpha for the QOL-PV total score was 0.92.

Study Procedures

The study was approved by the Committee on Human Research at the University of California, San Francisco and by the Institutional Review Board at each of the study sites. Eligible patients were approached by a research staff member in the infusion unit to discuss participation in the study. Written informed consent was obtained from all patients. Depending on the length of their CTX cycles, patients completed questionnaires in their homes, a total of six times over two cycles of CTX (i.e., prior to CTX administration (i.e., recovery from previous CTX cycle, Assessments 1 and 4), approximately 1 week after CTX administration (i.e., acute symptoms, Assessments 2 and 5), approximately 2 weeks after CTX administration (i.e., potential nadir, Assessments 3 and 6)). Research nurses reviewed patients' medical records for disease and treatment information.

Data Analysis

Descriptive statistics—Data were analyzed using SPSS version 23.[39] Descriptive statistics and frequency distributions were calculated for demographic and clinical characteristics.

Latent profile analysis (LPA) of physical function scores—As was done for different outcomes,[40] unconditional LPA was used to identify the profiles of physical function scores (i.e., PCS scores) that characterized unobserved subgroups of patients (i.e., latent classes) over the six assessments. Typically, growth mixture modeling or latent class growth modeling would be used to identify latent classes of individuals who change differently over time. However, the data in this study demonstrated a complex pattern of change because a pre-treatment assessment, an immediate post-treatment assessment, and a second post-treatment assessment were done over two cycles of CTX. Therefore, LPA is more appropriate for this type of change trajectory. In order to incorporate expected correlations among the repeated measures, we included covariance parameters among measures that were one or two occasions apart (i.e., a covariance structure with a lag of two). In this way, we retained the within person correlation among the measures, at the same time that we focused on the patterns of means that distinguished among the latent classes. We limited the covariance structure to a lag of two to accommodate the expected reduction

in correlation that would be introduced by two treatments within each set of three measurement occasions, and to reduce model complexity.

Estimation was carried out with full information maximum likelihood with standard errors and a Chi-square test that are robust to non-normality and non-independence of observations ("estimator=MLR"). Model fit was evaluated to identify the solution that best characterized the observed latent class structure with the Bayesian Information Criterion (BIC), Vuong-Lo-Mendell-Rubin likelihood ratio test (VLRM), entropy, and latent class percentages that were large enough to be reliable (i.e., likely to replicate in new samples).[41,42] Missing data were accommodated with the use of the Expectation-Maximization (EM) algorithm.[43]

Mixture models, like LPA, are known to produce solutions at local maxima. Therefore, our models were fit with from 1,000 to 2,400 random starts. This approach ensured that the estimated model was replicated many times and was not due to a local maximum. Estimation was done with Mplus Version 7.4.[44]

Evaluation of differences among the latent classes—Differences among the latent classes in demographic and clinical characteristics and QOL outcomes were evaluated using analysis of variance and Kruskal-Wallis or Chi Square tests with Bonferroni corrected post hoc contrasts. All calculations used actual values. A corrected p-value of <.0167 (i.e., .05/3) was considered statistically significant.

RESULTS

LCA of Physical Function

As shown in Table 1, a three class solution was selected because the VLMR was significant, indicating that three classes fit the data better than two classes and the VLMR was not significant for the 4-class solution, indicating that too many classes had been extracted. The classes were named based on a mean reference PCS score of 44.9 identified in the 2001 Utah Health Status Survey as the age based normative score for individuals between 65 to 74 years of age.[45] As shown in Figure 1, 35.8% of the sample had PCS scores that were above the normative score at enrollment (i.e., 50.6, "above"). The largest class (43.8%) had PCS scores at enrollment that were slightly below the normative score (i.e., 39.8, "slightly below"). The third class (20.4%) had PCS scores at enrollment that were well below the normative score (i.e., 26.2, "well below"). Across all three classes, the PCS scores remained relatively stable over the two cycles of CTX.

Differences in Demographic and Clinical Characteristics

As shown in Table 2, across the three latent classes, KPS scores (i.e., well below < slightly below < above), as well as number of comorbidities and SCQ scores (i.e., well below > slightly below > above) were in the expected directions. In addition, compared to the above class, patients in the slightly below and well below classes were more likely to be unemployed, to report a lower income, and to have heart disease. Compared to the slightly below and above classes, patients in the well below class were less likely to exercise on a regular basis and more likely to report back pain. Finally, compared to the above class,

patients in the well below class had lower hemoglobin and hematocrit levels and were more likely to report depression.

No age or gender differences were found among the latent classes. In addition, none of the disease (i.e., cancer diagnosis, time since cancer diagnosis, number of metastic sites) or treatment (i.e., number of prior cancer treatments, types of prior cancer treatments, CTX cycle length) characteristics were associated with latent class membership.

Differences in Generic QOL Outcomes

As shown in Table 3, for the SF-12 physical function, role physical, bodily pain, general health, vitality, and social functioning scores, the differences among the latent classes followed the same pattern (i.e., well below < slightly below < above). For the role emotional score, compared to patients in the slightly below and above classes, patients in the well below class reported lower scores. In terms of the PCS and MCS scores, the PCS scores followed the expected direction (i.e., well below < slightly below < above). No differences were found among the latent classes in MCS scores.

Differences in Disease-specific QOL Outcomes

As shown in Table 3, for the QOL-PV at enrollment, the physical well-being, psychological well-being, social well-being, and total QOL scores, the differences among the latent classes followed the same pattern (i.e., well below < slightly below < above). No differences were found among the latent classes in the spiritual well-being scores.

DISCUSSION

This study is the first to use LPA to identify groups of older oncology patients with distinct physical function profiles over two cycles of CTX. In this relatively large sample of 363 patients, with a mean age of 71.4 (±5.5) years, three groups of older adults with distinct physical function profiles were identified. When the mean PCS scores at enrollment for these three groups were compared to age-based normative data for individuals between 65 to 74 years from the 2001 Utah Health Status Survey (i.e., a mean PCS score of 44.9),[45] 64.2% of our sample was slightly or well below this normative score. As a validity check, compared to the "above normative score" class, the differences in PCS scores at enrollment for the slightly below (i.e., Cohen's d = 1.0) and well below (i.e., Cohen's d = 2.3) classes represent not only statistically significant, but clinically meaningful differences in physical function.[46,47] In addition, the PCS scores for the two lower classes were below those reported in studies of older cancer survivors.[48,49]

It is interesting to note that while previous studies reported a decline in self-reported physical function in the immediate treatment period,[16,18] the PCS scores within each of our latent classes remained relatively stable over the two cycles of CTX. One potential explanation for these differences is that mean scores were used in the previous studies to evaluate changes over time. This approach does not allow for the identification of subgroups with distinct physical function profiles. Similar to our findings, Given and colleagues reported that when assessments of average change in physical functioning scores for patients who remained within the same quartile over two assessment were made, these patients

scores did not deteriorate over time.[17] Additional research is warranted to confirm the latent classes identified in our study.

While consistent with previous reports,[16–18] an interesting finding from this study is that none of the cancer or treatment characteristics were associated with latent class membership. Given that metastic disease is associated with decrements in physical function, a reasonable hypothesis would be that older adults in the slightly below and well below classes would have a higher number of metastatic sites and/or would have received a higher number of cancer treatments. Perhaps these patients did not report their functional decline to their oncologists or they were receiving lower doses of CTX compared to those in the above class. Our finding of a lack of an association between cancer burden and functional status warrants confirmation in future studies.

Of note, and consistent with two reports from the same cohort,[16,17] both a higher number of comorbid conditions and a more severe comorbidity profile were associated with membership in the two lower physical function classes. In addition, similar to findings from a large epidemiologic study,[50] the most common comorbid conditions in this sample were high blood pressure, back pain, osteoarthritis, lung disease, depression, and diabetes. In the current study, the four comorbid conditions that differentiated between the well below and the above normative score classes were: heart disease, lung disease, depression, and back pain. These findings support the need to evaluate not only the number but the impact of specific comorbid conditions on older oncology patients' functional status as part of a comprehensive geriatric assessment.[51–53]

Anemia is a common problem in older adults.[54,55] Recently, anemia was defined as a hemoglobin level of <12 g/dL in both older men and women.[56] Using this definition, not unexpectedly in patients undergoing CTX, all three classes of older patients were anemic. This problem is important to evaluate in older adults because anemia is associated with decreased physical performance,[57] an increase in the number of falls,[58] frailty,[57,59,60] increase in depressive symptoms,[61,62] increase in the number of hospitalizations,[63] and increased mortality.[64,65] While the level of anemia observed in this study may not warrant routine treatment in oncology patients, clinicians need to monitor older adults receiving CTX more carefully to evaluate the impact of anemia on their ability to function.

In terms of demographic characteristics, a higher percentage of older adults in the two lower physical function classes were not employed and reported a lower annual household income. This finding is consistent with work by Owusu and colleagues who found that older women newly diagnosed with nonmetastatic breast cancer, who had a median household income of < $35,000 were 2.5 times more likely to have functional disability at the time of their initial diagnosis.[66] These findings suggest that financial and social factors warrant evaluation and interventions to mitigate their negative impact on physical function.

Of note, while in the other two classes approximately 70% of the patients reported that they exercised on a regular basis, only 37% of the patients in the well below class indicated this level of exercise. Given that older adults who engage in 150 minutes of moderate intensity aerobic exercise per week can reduce the risk of functional impairments by 50%,[67]

clinicians need to assess patients' level of exercise prior to and during CTX and prescribe exercise interventions.

In terms of generic and disease specific domains of QOL, as shown in Table 3, significant differences were found among the three physical function classes for almost all of the subscales on the SF-12 and the QOL-PV. With the exception of the mental health, MCS, and spiritual well-being subscales, decrements in physical function were associated with lower scores on all domains of QOL. All of the differences in the various QOL subscales represent not only statistically significant but clinically meaningful decrements in the various QOL domains (i.e., Cohen's d's that ranged beween 0.3 and 2.0).[46,47] Given the findings from recent interventions studies in older adults and cancer survivors that suggest that physical activity interventions improve patients' functional status and QOL,[68–72] additional research is warranted to evaluate the use of these types of interventions in older adults during CTX. The lack of significant differences among the classes on the mental health and MCS scores may indicate that these items on the SF-12 are not specific enough to capture depressive symptoms.

Several study limitations warrant consideration. Objective measures of physical function were not assessed in this study. However, the PCS score of the SF-12 is a valid and reliable measure of physical function and normative scores are available for comparative purposes. In addition, it is important to note that patients' self-reported KPS scores, a commonly used measure of functional status in oncology patients, differentiated among the latent classes. Sampling bias may result in an underestimation of the physical function of older adults receiving CTX because patients with lower levels of function may have declined participation. Other measures included in a comprehensive geriatric assessment (e.g., nutritional status, frailty) were not evaluated in this study. Future studies need to compare the latent classes identified in this study to other subgroups identified using other measures of function (e.g., frail versus vulnerable versus fit[73]) While patients were assessed over two cycles of CTX, an assessment prior to the initiation of the current CTX regimen was not performed. In addition, future studies should determine which components of physical function (i.e., individual items on the SF12) have the most impact on latent class membership.

Despite these limitations, the findings from this study provide new insights into the percentage of older adults receiving CTX who reported decrements in physical function that are below normative values for older adults in the general population. Given the negative impact of comorbidity on physical function observed in our study and other studies,[16,17] additional research is warranted on the impact of specific comorbidities and whether optimal management of these comorbidities affects physical function. Future intervention studies to improve physical function in older adults undergoing CTX need to account for demographic, clinical, behavioral, and social characteristics that influence physical function.

Acknowledgments

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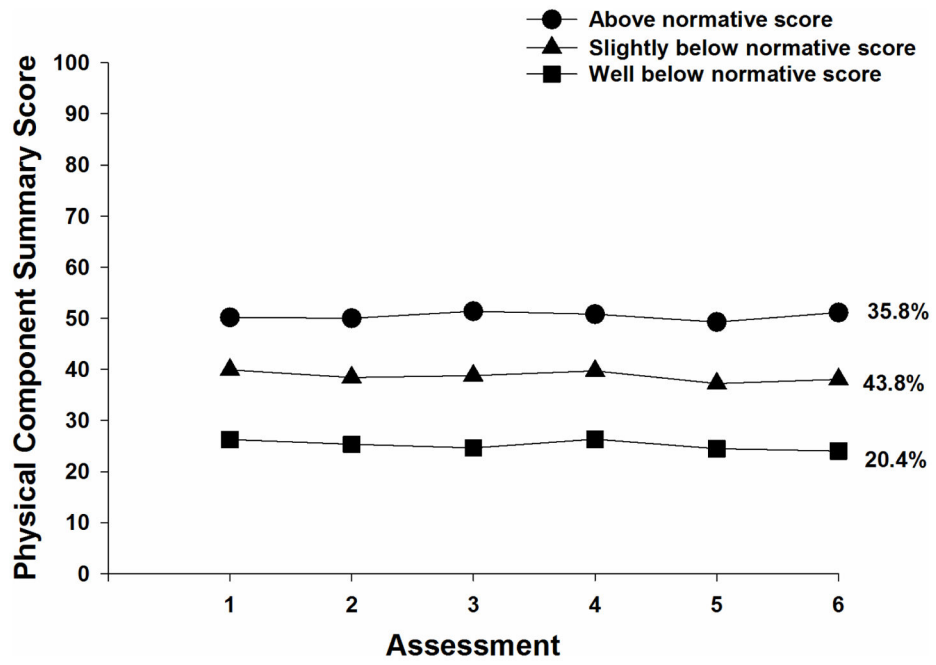
Figure 1.

Trajectores of physical component summary function scores for the three physical function latent classes

Table 1

Latent Profile Analysis Solutions and Fit Indices for One- Through Four-Classes for SF-12 Physical Component Scores

Model	LL	AIC	BIC	VLMR	Entropy
1 Class	−1927.82	3897.64	3979.42	n/a	n/a
2 Class	−1800.19	3656.37	3765.41	255.27**	.79
3 Class[a]	−1725.57	3521.14	3657.44	149.23*	.82
4 Class	−1684.82	3453.64	3617.20	81.50ns	.81

ns Not significant;

*
p < .05;

**
p < .001

[a] The 3-class solution was selected because the VLMR was significant, indicating that three classes fit the data better than two classes, and the VLMR was not significant for the 4-class solution, indicating that too many classes had been extracted.

Note. AIC = Akaike Information Criterion, BIC = Bayesian Information Criterion, LL = log-likelihood, VLMR = Vuong-Lo-Mendell-Rubin likelihood ratio test for the K vs. K-1 model

Table 2

Differences in Demographic and Clinical Characteristics Among the Physical Function Latent Classes

Characteristic	Well Below Normative Score (0) 20.4% (n=74)	Below Normative Score (1) 43.8% (n=159)	Above Normative Score (2) 35.8% (n=130)	Statistics
	Mean (SD)	Mean (SD)	Mean (SD)	
Age (years)	72.7 (6.0)	71.2 (5.4)	70.7 (5.4)	F=2.96, p=.053
Education (years)	16.6 (3.6)	16.0 (2.9)	17.0 (3.1)	F=3.43, p=.034 1 < 2
Body mass index (kg/m²)	27.1 (5.9)	26.2 (5.1)	25.5 (5.3)	F=2.09, p=.125
Karnofsky Performance Status score	68.7 (12.1)	83.3 (10.6)	89.6 (8.0)	F=97.22, p<.001 0 < 1 < 2
Number of comorbidities	3.6 (1.6)	2.9 (1.5)	2.3 (1.2)	F=17.01, p<.001 0 > 1 > 2
SCQ score	8.2 (3.9)	6.4 (3.4)	4.7 (2.4)	F=30.09, p<.001 0 > 1 > 2
Hemoglobin (gm/dl)	11.1 (1.6)	11.4 (1.4)	11.8 (1.3)	F=6.15, p=.002 0 < 2
Hematocrit (%)	33.5 (4.7)	34.2 (4.1)	35.3 (4.0)	F=4.96, p=.008 0 < 2
Time since cancer diagnosis (years)	4.4 (7.9)	2.4 (4.3)	2.6 (4.2)	KW, p=.212
Time since cancer diagnosis (median)	1.05	0.5	0.5	
Number of prior cancer treatments	2.0 (1.6)	1.7 (1.5)	1.7 (1.6)	F=1.11, p=.329
Number of metastatic sites including lymph node involvement	1.4 (1.3)	1.4 (1.2)	1.3 (1.1)	F=0.76, p=.471
Number of metastatic sites excluding lymph node involvement	1.1 (1.1)	0.9 (1.1)	0.8 (0.9)	F=1.71, p=.183
	% (n)	% (n)	% (n)	
Gender Female	78.4 (58)	67.3 (107)	63.8 (83)	χ^2=6.00, p=.199

Characteristic	Well Below Normative Score (0) 20.4% (n=74)	Below Normative Score (1) 43.8% (n=159)	Above Normative Score (2) 35.8% (n=130)	Statistics
	Mean (SD)	Mean (SD)	Mean (SD)	
Male	21.6 (16)	32.1 (51)	36.2 (47)	χ^2=1.48, p=.961
Transgender[*]	0.0 (0)	0.6 (1)	0.0 (0)	
Ethnicity				
White	80.8 (59)	78.5 (124)	81.5 (106)	χ^2=1.80, p=.407
Asian or Pacific Islander	6.8 (5)	7.6 (12)	4.6 (6)	χ^2=4.59, p=.101
Black	6.8 (5)	6.3 (10)	6.9 (9)	χ^2=1.63, p=.442
Hispanic, Mixed, or Other	5.5 (4)	7.6 (12)	6.9 (9)	χ^2=2.30, p=.317
Married or partnered (% yes)	58.3 (42)	55.8 (87)	63.6 (82)	χ^2=18.90, p<.001 0 and 1 < 2
Lives alone (% yes)	27.8 (20)	35.5 (55)	24.0 (31)	
Child care responsibilities (% yes)	2.8 (2)	6.3 (10)	3.9 (5)	
Care of adult responsibilities (% yes)	6.5 (4)	6.3 (9)	2.5 (3)	
Currently employed (% yes)	9.6 (7)	17.6 (28)	33.9 (43)	
Income				KW, p=.002 0 and 1 < 2
< $30,000+	31.3 (20)	25.2 (34)	18.3 (21)	
$30,000 to <$70,000	25.0 (16)	31.1 (42)	18.3 (21)	
$70,000 to < $100,000	12.5 (8)	20.0 (27)	17.4 (20)	
$100,000	31.3 (20)	23.7 (32)	46.1 (53)	
Specific comorbidities (% yes)				
Heart disease	17.6 (13)	15.7 (25)	3.1 (4)	χ^2=14.45, p=.001 0 and 1 > 2
High blood pressure	56.8 (42)	45.9 (73)	40.0 (52)	χ^2=5.33, p=.070
Lung disease	31.1 (23)	22.0 (35)	11.5 (15)	χ^2=11.85, p=.003 0 > 2

Characteristic	Well Below Normative Score (0) 20.4% (n=74) Mean (SD)	Below Normative Score (1) 43.8% (n=159) Mean (SD)	Above Normative Score (2) 35.8% (n=130) Mean (SD)	Statistics
Diabetes	20.3 (15)	14.5 (23)	10.8 (14)	χ^2=3.47, p=.176
Ulcer or stomach disease	4.1 (3)	5.0 (8)	3.8 (5)	χ^2=0.27, p=.875
Kidney disease	1.4 (1)	3.8 (6)	0.0 (0)	χ^2=5.55, p=.062
Liver disease	8.1 (6)	6.3 (10)	7.7 (10)	χ^2=0.34, p=.845
Anemia or blood disease	8.1 (6)	10.7 (17)	7.7 (10)	χ^2=0.89, p=.642
Depression	24.3 (18)	20.1 (32)	10.8 (14)	χ^2=7.18, p=.028 0 > 2
Osteoarthritis	33.8 (25)	21.4 (34)	20.0 (26)	χ^2=5.64, p=.059
Back pain	47.3 (35)	23.9 (38)	16.9 (22)	χ^2=23.27, p<.001 0 > 1 and 2
Rheumatoid arthritis	5.4 (4)	2.5 (4)	3.8 (5)	χ^2=1.26, p=.532
Exercise on a regular basis (% yes)	36.6 (26)	68.4 (106)	79.8 (103)	χ^2=38.80, p<.001 0 < 1 and 2
Smoking, current or history of (% yes)	47.9 (35)	48.4 (76)	46.0 (58)	χ^2=0.17, p=.920
Cancer diagnosis				
Breast	20.3 (15)	23.9 (38)	23.8 (31)	χ^2=11.50, p=.074
Gastrointestinal	20.3 (15)	35.2 (56)	36.9 (48)	
Gynecological	28.4 (21)	18.2 (29)	22.3 (29)	
Lung	31.1 (23)	22.6 (36)	16.9 (22)	
Type of prior cancer treatment				
No prior treatment	21.1 (15)	22.2 (34)	27.1 (35)	χ^2=7.46, p=.280
Only surgery, CTX, or RT	28.2 (20)	37.3 (57)	35.7 (46)	
Surgery & CTX, or Surgery & RT, or CTX & RT	29.6 (21)	30.1 (46)	23.3 (30)	
Surgery & CTX & RT	21.1 (15)	10.5 (16)	14.0 (18)	

Characteristic	Well Below Normative Score (0) 20.4% (n=74)	Below Normative Score (1) 43.8% (n=159)	Above Normative Score (2) 35.8% (n=130)	Statistics
	Mean (SD)	Mean (SD)	Mean (SD)	
Length of CTX cycle				
14 days	32.4 (24)	37.3 (59)	31.8 (41)	χ^2=2.12, p=.714
21 days	54.1 (40)	52.5 (83)	58.9 (76)	
28 days	13.5 (10)	10.1 (16)	9.3 (12)	

Abbreviations: CTX = chemotherapy, kg = kilograms, KW = Kruskal Wallis; m^2 = meter squared, RT = radiation therapy, SCQ = Self-Administered Comorbidity Questionnaire, SD = standard deviation

*Chi Square analysis and post hoc contrasts done without the transgender patient include in the analyses

Table 3

Differences in Quality of Life Scores at Enrollment Among the Physical Function Latent Classes

Characteristic	Well Below Normative Score (0) 20.4% (n=74)	Below Normative Score (1) 43.8% (n=159)	Above Normative Score (2) 35.8% (n=130)	Statistics
	Mean (SD)	Mean (SD)	Mean (SD)	
Medical Outcomes Study – Short Form-12				
Physical functioning	9.6 (15.4)	42.7 (26.9)	81.1 (22.6)	F=223.92, p<.001 0 < 1 < 2
Role physical	25.2 (19.2)	46.0 (24.0)	73.6 (22.3)	F=114.77, p<.001 0 < 1 < 2
Bodily pain	55.6 (33.1)	78.1 (24.7)	94.0 (13.6)	F=61.24, p<.001 0 < 1 < 2
General health	35.9 (27.8)	64.8 (23.1)	75.7 (22.8)	F=63.71, p<.001 0 < 1 < 2
Vitality	26.4 (22.6)	40.5 (25.6)	62.6 (22.5)	F=58.78, p<.001 0 < 1 < 2
Social functioning	43.2 (33.9)	66.7 (30.6)	82.0 (25.5)	F=39.56, p<.001 0 < 1 < 2
Role emotional	68.7 (34.1)	72.4 (27.8)	85.8 (20.8)	F=12.24, p<.001 0 and 1 < 2
Mental health	73.8 (20.3)	73.2 (22.0)	78.5 (17.9)	F=2.69, p=.069
Physical component summary score	26.2 (6.6)	39.8 (6.5)	50.6 (5.9)	F=325.23, p<.001 0 < 1 < 2
Mental component summary score	49.9 (11.9)	49.2 (11.5)	51.8 (9.3)	F=1.92, p=.148
Quality of Life Scale – Patient Version				
Physical well-being	6.0 (1.6)	6.9 (1.6)	8.0 (1.3)	F=44.23, p<.001 0 < 1 < 2
Psychological well-being	5.0 (1.8)	5.8 (1.9)	6.4 (1.8)	F=13.52, p<.001 0 < 1 < 2
Social well-being	5.4 (1.8)	6.4 (1.8)	7.3 (1.6)	F=25.44, p<.001 0 < 1 < 2
Spiritual well-being	4.9 (2.3)	5.0 (2.1)	4.8 (2.1)	F=0.25, p=.776
Total quality of life score	5.3 (1.5)	6.0 (1.4)	6.7 (1.3)	F=23.04, p<.001 0 < 1 < 2

Abbreviation: SD= standard deviation