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Change in four measures of physical function among older adults during lung cancer treatment: A mixed methods cohort study

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Abstract

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Analysis and Interpretation of Data: All authors

Manuscript Writing: Singhal, Wong

Approval of Final Article: All authors

Declarations

Conflict of Interests

KPL and MLW reported conflicts of interest outside of the submitted work: KPL has served as a consultant for Pfizer and Seattle Genetics and has received speaker fees from Pfizer. MLW reported that an immediate family member is an employee of Genentech with stock ownership. MLW receives royalties from UpToDate. The remaining authors have no conflicts to report.

Prior Presentation

This work was presented as an oral presentation at the October 2019 Supportive Care in Oncology Symposium in San Francisco, California.

Introduction: Functional outcomes during non-small cell lung cancer (NSCLC) treatment are critically important to older adults. Yet, data on physical function and which measures best capture functional change remain limited.

Materials and Methods: This multisite, mixed methods cohort study recruited adults ≥65 years with advanced NSCLC starting systemic treatment (i.e., chemotherapy, immunotherapy, and/or targeted therapy) with non-curative intent. Participants underwent serial geriatric assessments prior to starting treatment and at 1, 2, 4, and 6 months, which included the Karnofsky Performance Scale (KPS, range: 0–100%), instrumental activities of daily living (IADL, range: 0–14), European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire Physical Functioning subscale (EORTC QLQ-C30 PF, range: 0–100), and Life-Space Assessment (LSA, range: 0–120). For all measures, higher scores represent better functioning. In a qualitative substudy, 20 patients completed semi-structured interviews prior to starting treatment and at 2 and 6 months to explore how treatment affected their daily functioning. We created joint displays for each interview participant that integrated their longitudinal KPS, IADL, EORTC QLQ-C30 PF, and LSA scores with patient quotes describing their function.

Results: Among 87 patients, median age was 73 years (range 65–96). Mean pretreatment KPS score was 79% (SD 13), EORTC QLQ-C30 PF was 69 (SD 23), and LSA was 67 (SD 28); median IADL was 13 (IQR 10–14). At two months after treatment initiation, 70% of patients experienced functional decline on at least one measure, with only 13% of these patients recovering at six months. At two and six months, decline in LSA was the most common (48% and 35%, respectively). Joint displays revealed heterogeneity in how well each quantitative measure of physical function captured the qualitative patient experience.

Discussion: Functional decline during NSCLC treatment is common among older adults. LSA is a useful measure to detect subtle functional decline that may be missed by other measures. Given heterogeneity in how well each quantitative measure captures changes in physical function, there is value to including more than one functional measure in geriatric oncology research studies.

Keywords

physical function; lung cancer; older adults; life-space mobility; instrumental activities of daily living; chemotherapy; immunotherapy; targeted therapy

1. Background

Non-small cell lung cancer (NSCLC) is the leading cause of cancer-related death in the US with 68% of cases diagnosed in adults age ≥65.¹ Older adults who receive systemic therapy are at risk for impaired physical function from both the cancer and the treatment,^{2–7} and functional decline is associated with worse quality of life and survival.^{2,8,9} In a study of older adults, >70% of those with cancer reported that they would not select a treatment that caused severe functional impairment, even if it improved survival.¹⁰ Despite the importance of function to older adults with cancer, data on functional outcomes during NSCLC treatment remain limited.^{11,12}

The American Society of Clinical Oncology and International Society of Geriatric Oncology recognize functional status as a core geriatric assessment domain and recommend its use to guide management of older adults receiving systemic therapy.^{13,14} Oncologists traditionally rely on performance status (e.g., Karnofsky Performance Status [KPS]), which evaluates ability to perform normal work and activity.^{15,16} However, KPS is not sensitive to impairments among older adults with cancer. For example, 69% of older adults with a normal KPS have 1 impairment identified when a geriatric assessment is conducted.¹⁷

To improve upon the limitations of the KPS, studies of function in older adults with cancer often evaluate activities of daily living (ADL) and instrumental activities of daily living (IADL), which measure difficulty and/or dependence with activities required for self-care and to live independently, respectively.^{2,18} Among non-older adult-specific studies of function in oncology, the European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ-C30)¹⁹ is commonly used to assess quality of life and includes a physical function (PF) subscale.²⁰ The EORTC QLQ-C30 PF, which is complementary to a traditional geriatric assessment, assesses the degree of difficulty or assistance patients need to perform various physical activities.

In addition, life-space mobility^{21,22} is a widely used measure in the general aging literature that has recently started gaining traction in oncology^{23,24} and geriatric oncology.^{11,25} Life-space mobility, which can be measured using the patient-reported Life-Space Assessment (LSA),²¹ describes an individual's ability to move within their environment from within their home to outside of town. Among older adults without cancer, LSA predicts quality of life,²⁶ healthcare utilization,²⁷ and mortality.²⁸ Because life-space mobility incorporates physical, social, and cognitive functioning, it represents a broader assessment of function than measures that evaluate performance of individual activities.¹¹

Given the multiple measures available to assess physical function, each of which captures a different aspect of this domain, we performed a mixed methods cohort study to characterize and compare changes in physical function during systemic NSCLC treatment among older adults using four measures: KPS, IADL, EORTC QLQ-C30 PF, and LSA. To integrate the patient perspective with the quantitative measures, we interviewed a subset of older adults with NSCLC to explore how functional changes impacted their daily lives.

2. Methods

2.1. Study design and participants

Details of our “Lung cancer in older adults: Treatment toxicity through the patient’s lens” study (Lens Study) have been previously published.¹¹ Briefly, this is an observational cohort study that recruited older adults with advanced NSCLC from three sites within one Comprehensive Cancer Center (academic, Veterans Affairs, and safety-net oncology clinics). Patients were age ≥ 65, diagnosed with stage III-IV or recurrent NSCLC, starting a new systemic treatment (i.e., chemotherapy, immunotherapy, and/or targeted therapy) with non-curative intent, spoke English and/or a Chinese dialect, and able to provide informed consent. Patients undergoing surgery and/or thoracic radiation were excluded. Functional status was assessed pretreatment and at one, two, four, and six months or until treatment

discontinuation, whichever occurred earlier. For this analysis, we excluded patients who did not have any follow-up function data and patients who enrolled after February 29, 2020 due to the impact of the COVID-19 pandemic on their life-space mobility. This study was approved by the University of California, San Francisco Institutional Review Board and the San Francisco Veterans Affairs.

For the qualitative substudy, we conducted semi-structured interviews with 20 English-speaking patients to understand the patient experience of functional change during NSCLC treatment.¹¹ To represent a diverse range of pretreatment function, relatively fit and more frail patients were purposively sampled based on the treating oncologists' clinical impressions of their pretreatment function. Participants were interviewed prior to treatment initiation and at two and six months. Interviews were audio record and professionally transcribed. Additional details of our qualitative substudy including the interview guide were previously published.¹¹

2.2. Measurements

Patients completed a demographic survey and we abstracted clinical characteristics from the medical record. Patients completed a geriatric assessment²⁹ prior to treatment initiation to assess function (Katz ADL,³⁰ Older Americans Resources and Services [OARS] IADL,³¹ Timed Up and Go,³² Short Physical Performance Battery,³³ falls in the last six months³⁴); comorbidity (OARS Physical Health Subscale³¹); nutrition (body mass index,³⁴ involuntary weight loss³⁵); cognition (Montreal Cognitive Assessment³⁶); mood (Mental Health Inventory-13³⁷); and social support (Medical Outcomes Study Social Support Survey³⁸). Symptoms were assessed using the EORTC QLQ-C30¹⁹ and Lee Fatigue Scale.^{39,40}

Quantitative Outcome Measures of Function—Function was quantitatively evaluated prior to treatment initiation and at one, two, four, and six months using four measures: clinician-rated KPS,^{15,16} OARS IADL,³¹ EORTC QLQ-C30 PF subscale,¹⁹ and LSA.²¹ Higher scores indicate better function for all four measures.

Clinician-rated KPS classifies patients based on their ability to perform normal activities. KPS scores range from 0–100% and we defined functional decline as a decrease of 10 points, which is clinically meaningful.^{41,42}

The OARS IADL assesses dependence in using the telephone, shopping, navigating transportation, preparing meals, doing housework, and managing medicine and money. The OARS IADL scale is scored 0–14 and we defined functional decline as a decrease of 1 point, which is clinically meaningful.⁴³

The EORTC QLQ-C30 PF subscale contains 5 items assessing ADL dependence, need to stay in a bed/chair, and tolerance for different activities. Responses are transformed to a 0–100 scale and we defined functional decline as a decrease of 10 points, which is clinically meaningful.⁴⁴

The LSA assesses how often patients move through five life-space levels in their environment (within the home to outside of town) and whether they required assistance.

In the general older adult population, decline in LSA score is associated with increased healthcare utilization and mortality.^{27,45} Scores range from 0–120 and we defined functional decline as a decrease of 10 points, which is clinically meaningful.^{45,46}

2.3. Quantitative Analysis

All statistical analyses were performed using Stata/SE 17.⁴⁷ We summarized pretreatment patient characteristics using descriptive statistics.

To evaluate changes in functional status during NSCLC treatment, we first evaluated each quantitative measure individually. Mean scores and standard deviations (SD) were calculated for each measure at each time point. Using the definitions of functional decline described above, we categorized each patient's trajectory for each measure as stable/improved or functional decline from a) prior to treatment initiation to two months and b) two to six months. We focused on these three time points because they corresponded with the qualitative interviews. Patients who died during follow up were categorized as experiencing functional decline with a KPS, IADL, EORTC QLQ-C30 PF, and LSA score of zero at the next assessment. For cases where one-month quantitative function data were available but two-month data were missing due to patient symptoms, treatment discontinuation, withdrawal of consent, or censoring due to the COVID-19 pandemic, one-month results were carried forward to two months. Similarly, for cases where four-month quantitative function data were available but six-month data were missing, four-month results were carried forward to six months. For LSA scores only, we carried the last assessment obtained on or before February 29, 2020 forward to subsequent assessments because the COVID-19 pandemic shelter-in-place orders likely decreased participant's life space unrelated to their underlying mobility.

To summarize change in physical function across all four quantitative measures, we evaluated functional decline in any of the quantitative measures a) prior to treatment initiation to two months and b) from two to six months. At two months, patients who experienced a decline in any of the four measures were categorized as "decline." All others were categorized as "stable" at two months. Among patients who had stable function at two months, patients were categorized as a) still "stable" or b) "decline" at six months if they experienced a decline in any of the four measures. Among patients who had functional decline at two months, patients were categorized at six months as a) "recovery" if they demonstrated recovery in all measures that they previously declined in (e.g., KPS returned to within 10 points of the pretreatment score), b) "no recovery" if they remained stable without recovery or further decline, or c) "additional decline" if they experienced a decline in any of the four measures between two and six months (e.g., further decline of 10 points in KPS).

To evaluate associations among the four quantitative measures of function at each time point, we calculated Pearson's correlation coefficients between each pair of scores prior to treatment initiation and at two and six months. Patients who died were excluded from the correlation as their functional outcomes were set to zero. To visualize differences in quantitative measures of function at the two-month assessment, we grouped patients who experienced functional decline on any measure in a four-circle Venn diagram with each circle representing the measure(s) that detected the decline.

2.3. Mixed Methods Analysis

Interview transcripts were independently reviewed by at least two investigators (SS, SZ, MLW) using thematic analysis⁴⁸ to identify descriptions of functional changes and how these changes impacted patients' daily lives. Functional decline was defined as decline in ability to perform ADLs, IADLs, or other previous activities. Patients who described new symptoms that did not limit their function were coded as having stable function. Disagreements were resolved through consensus (SS, SZ, MLW). Using a convergent mixed methods design, joint displays were created for each patient with complete quantitative and qualitative data. The joint displays integrated the four quantitative measures of function over time with illustrative quotations of the patient experience. We selected exemplar joint displays to represent a range of comparisons between the quantitative and qualitative data.

3. Results

3.1. Demographics and Clinical Characteristics

From 8/2017 through 2/2020, 87 patients met the inclusion criteria and were included in our two-month analysis (Supplemental Figure). At six months, 19 patients were off study due to treatment discontinuation (22%), four died prior to the two-month assessment (5%), and two withdrew consent (2%), resulting in 62 patients (71%) for our six-month analysis.

Pretreatment characteristics are shown in Table 1. Median age was 73 years (IQR 68–80, range 65–96). Patients were predominantly English-speaking (84%) and received prior lung cancer treatment (72%). During the study, 34% of patients received immunotherapy, 33% targeted therapy, 22% chemoimmunotherapy, and 10% chemotherapy alone.

3.2 Pretreatment Geriatric Assessment and Symptom Characteristics

Most patients (68%) were dependent in 1 IADL prior to treatment initiation, but only 18% were dependent in 1 ADL (Table 1). The mean pretreatment KPS score was 79% (SD 13), EORTC QLQ-C30 PF was 69 (SD 23), and LSA was 67 (SD 28; Table 2). Median IADL was 13 (IQR 10–14).

3.3 Change in Physical Function

Changes in individual measures of function are shown in Table 2. At two months, functional decline ranged from 24% of patients declining in IADL to 48% declining in LSA. From two to six months, 22% of patients declined in EORTC QLQ-C30 PF while 35% declined in LSA. At both time points, decline in LSA was the most common.

When evaluating functional decline in any of the four quantitative measures, functional decline was common with 70% (61 patients) experiencing decline at two months (Figure 1). Among these patients, 59% (23 out of 39 patients who declined at two months and had data at six months) experienced additional decline at six months, while 13% (5 out of 39) experienced functional recovery. Among the 30% (26 patients) with stable function at two months, 26% (6 out of 23 who were stable at two months and had data at six months) remained stable at six months while 74% (17 out of 23) developed functional decline. At six months, a total of 82% had declined from their pretreatment baseline function.

3.4 Correlations Between Quantitative Measures of Physical Function

At the pretreatment assessment, IADL and LSA scores were most strongly correlated (correlation coefficient $r=0.75$; Table 3) while KPS and LSA were the least ($r=0.48$). At two months, IADL and EORTC QLQ-C30 PF scores were most strongly correlated ($r=0.72$) while KPS and LSA were the least ($r=0.42$). At six months, IADL and EORTC QLQ-C30 PF scores were most strongly correlated ($r=0.80$) while KPS and LSA were the least ($r=0.41$).

Of the 61 patients with functional decline on at least one measure at two months, 53 had complete data with two-month KPS, IADL, EORTC QLQ-C30 PF, and LSA scores. Figure 2 depicts the number of patients who experienced functional decline at two months and by which quantitative measure. Twenty-five patients (47%) had functional decline in only one measure while four patients (8%) had decline in all four. LSA detected the most patients with decline in only one measure.

3.5 Mixed Methods Results

Twenty patients participated in the qualitative substudy. Two patients transitioned to hospice care prior to their two-month interview and were not included in this analysis because we lacked patient descriptions of their functional changes. Joint displays representing different patterns of functional change are shown in Figure 3.

Figure 3A shows function over time for a 79-year-old woman receiving chemoimmunotherapy who experienced decline in all four quantitative measures at two months, which was consistent with her qualitative experience: “The worst is just the feeling like you could just stay in bed all day long because you are just wiped out.” She subsequently had functional recovery at six months as reflected in her IADL, EORTC QLQ-C30 PF, and LSA scores and her qualitative description: “I go to Safeway. I put the groceries in the cart. I unload them.”

Figure 3B shows function over time for a 74-year-old woman receiving chemotherapy who experienced functional decline at two months in LSA only, which was confirmed during her interview: “That first week I came home [from the hospital], I was out of it. I was just laying around, had no energy, zip.” She experienced further functional decline at six months with decreased KPS, IADL, and EORTC QLQ-C30 PF scores, which was reflected in her description: “Even just [to] get up and function for the day, it’s a struggle.”

Figure 3C shows function over time for a 77-year-old woman receiving chemoimmunotherapy who experienced decline at two months in IADL only. Her qualitative description confirmed the quantitative IADL decline: “The tiresome and exhaustion are starting. So today, I was not feeling like eating food.” She experienced further functional decline in IADL at six months, which was also evident during her interview: “Housework also I can’t do. Laundry, I can do my laundry.”

Figure 3D shows function over time for an 86-year-old woman receiving immunotherapy whose EORTC QLQ-C30 PF and LSA scores declined at two months. However, she described her functional status as stable: “I’ve been to a dinner several times. I’ve been

to concerts also. It's not much worse than it was." Her IADL and LSA scores declined at six months, which was consistent with her description: "[I'm doing] not very much I'm afraid. [I'm] at the hospital, and there's not much to do, and I've been a lot in bed."

4. Discussion

In this mixed methods cohort study of older adults with advanced NSCLC receiving systemic treatment, functional decline was common with 70% of patients experiencing decline in at least one quantitative measure at two months and 82% by six months. Among the patients who experienced functional decline at two months, only 13% recovered by six months. To the best of our knowledge, our study is the first to characterize functional changes among older adults with advanced NSCLC using multiple quantitative measures and the first to integrate qualitative patient descriptions with quantitative trajectories.

Among the measures we used to quantify function, LSA detected functional decline during NSCLC treatment most frequently, which was sometimes not detected by other measures. For example, the 74-year-old woman receiving chemoimmunotherapy in Figure 3B experienced decline in only LSA at two months—which was consistent with her qualitative description—while the other measures were stable to improved. In studies of older adults living in the community, lower LSA scores are associated with subsequent development of ADL difficulty/dependence.^{49,50} Compared to more traditional measures of function such as ADL, LSA is a more holistic measure as it evaluates function in the context of a person's actual environment beyond the home, and therefore reflects physical, cognitive, social, and environmental factors.⁵¹ Our results suggest that LSA may be able to detect more subtle, early functional changes before the development of decline in other measures such as KPS or IADL. Decline in life-space mobility before decline in other measures of function that focus more on daily activities within the home is consistent with Webber et al.'s hierarchical framework for mobility in older adults.⁵²

In addition to demonstrating that the LSA captured unique aspects of functional decline, we found that the LSA was the least correlated with KPS. KPS is widely used by oncologists to assess performance status but misses impairments identified on more thorough geriatric assessments.^{17,53,54} In a study of adults age 18, a minority of whom had cancer, there was a similarly weak correlation between LSA and the Australia-modified KPS.⁵⁵ Therefore, we recommend that KPS alone should not be used to evaluate for functional decline during NSCLC treatment in older adults. Furthermore, our findings in combination with the literature suggest that routine assessment of life-space mobility in oncology may help detect functional changes that may otherwise be missed. Clinicians can efficiently assess this by asking patients how far they have gone outside of the room where they sleep (for frail patients) or outside their home (for more fit patients).²¹

Through our longitudinal mixed methods design, our joint displays provided a unique lens into how patients experience functional changes during NSCLC treatment and how that compares to quantitative measures. A prior qualitative study that explored how older adults in a primary care setting defined functional decline found that patients described distinct components including loss of strength, mobility, and memory.⁵⁶ When available, qualitative

patient descriptions of functional changes can provide the rich context of their lives and enhance quantitative findings. Our team previously used joint displays to compare life-space mobility with the older patient experience of NSCLC treatment.¹¹ In the present study, we take these joint displays one step further to add longitudinal data for three additional quantitative measures, which revealed heterogeneity in how well each measure captures the patient perspective. Of note, we did not evaluate patient descriptions of functional decline as the gold standard in our analysis due to the interview substudy's small sample size. Future research asking patients who develop functional decline if treatment harms were "worth it" compared to benefits^{57, 58} would be valuable in further understanding treatment preferences among older adults.

Given our findings of wide variation in the prevalence of functional decline based on which quantitative measure is used, we recommend leveraging at least two measures when evaluating functional changes among older adults with cancer in research because no single measure fully captures the patient experience. Selection of the optimal measures to assess functional decline is dependent on the specific patient population and treatment(s) of interest. For example, among a more fit population of older adults with cancer, the LSA may be needed to detect more subtle functional changes. In contrast, IADL may be sufficient to characterize functional changes in a frailer population of older adults with cancer. Understanding if the sensitivity of different functional measures differs based on patient characteristics is an important area for further research.

This study has several limitations. Our study included a modest sample size and was conducted at three sites within a single institution with a primarily English-speaking population, which may limit the generalizability of our findings. However, 16% spoke a Chinese dialect, which is often excluded in most geriatric oncology studies. While our study did include performance-based measures of function (e.g., Short Physical Performance Battery), ceiling effects limited its ability to detect change over time in this population. Therefore, we did not include performance-based measures in our analysis. Lastly, we did not evaluate pretreatment factors associated with functional decline, which will be the basis for future work as we continue this ongoing cohort study.

In conclusion, functional decline is common among older adults with advanced NSCLC receiving systemic treatment with only a minority of patients recovering to their pretreatment baseline. When possible in research, function should be assessed with more than one measure to better capture the treatment experience through the patient's lens. Of the quantitative measures we assessed, LSA is a useful measure to detect more subtle, early functional changes, which may facilitate implementation of early interventions to mitigate the risk of further decline and allow for improved shared decision making regarding dose modifications or early treatment discontinuation.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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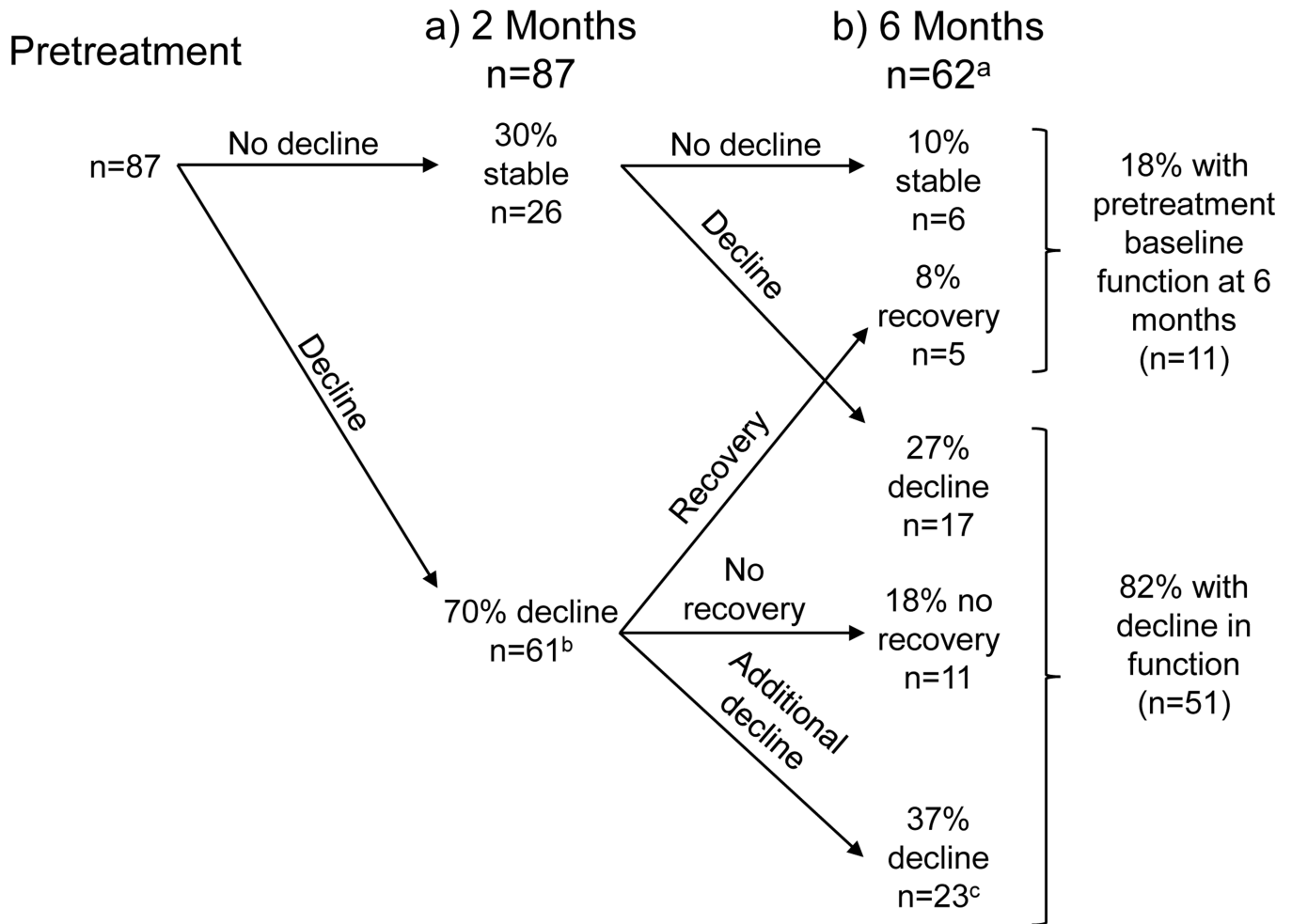


Figure 1:

Changes in function among older adults with NSCLC from a) prior to treatment initiation to two months and b) two to six months. Functional decline was defined as clinically meaningful decline in KPS (10-point decrease), IADL (1-point decrease), EORTC QLQ-C30 Physical Function (10-point decrease), or Life-Space Assessment (10-point decrease).

Abbreviations: EORTC QLQ-C30, European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire; KPS, Karnofsky Performance Status; NSCLC, non-small cell lung cancer; OARS IADL, Older Americans Resources Instrumental Activities of Daily Living

^a25 patients were not included in the six-month assessment: 19 off treatment, 4 died, and 2 withdrew consent between the two- and six-month assessments

^b61 patients includes 4 patients who died

^c23 patients includes 2 patients who died

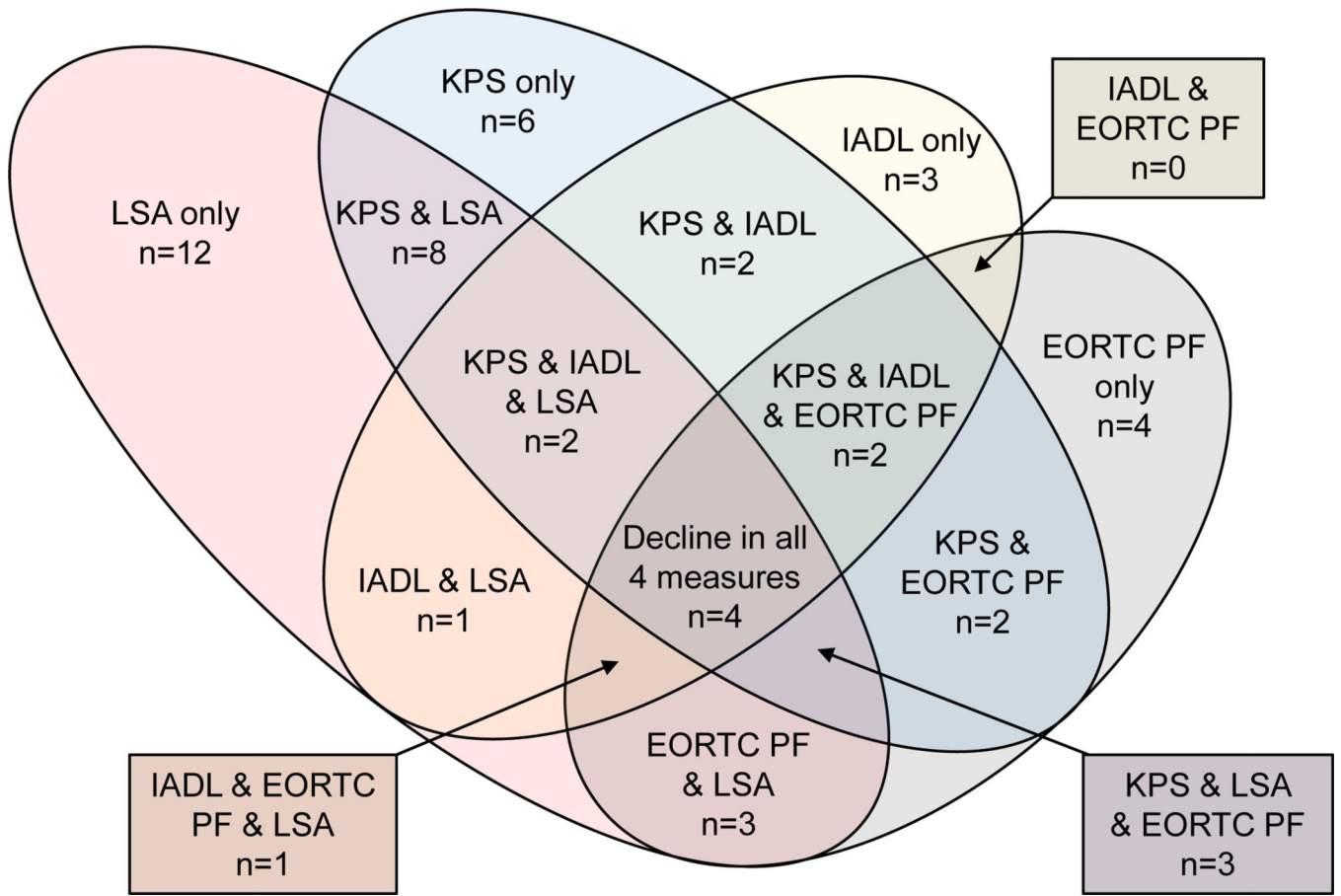
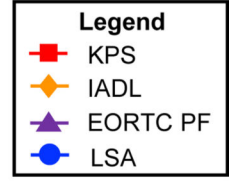
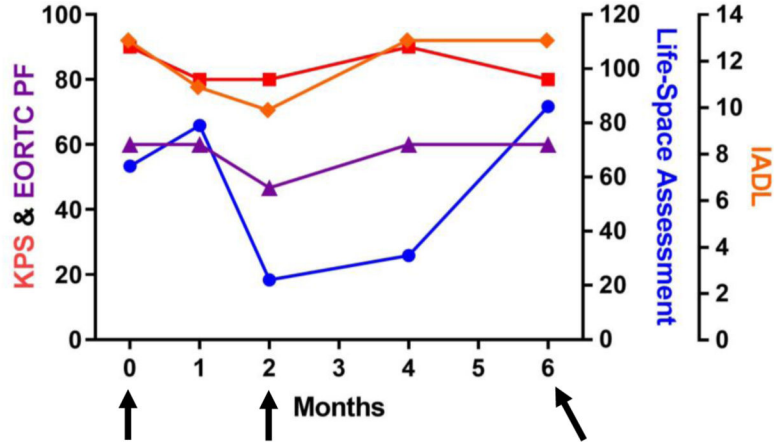


Figure 2: Functional decline at 2 months by quantitative measure (n=53). Excluded patients missing any quantitative measure at two months or died prior to two-month assessment. Abbreviations: EORTC PF, European Organisation for the Research and Treatment of Cancer Quality of Life Questionnaire Physical Function; IADL, Instrumental Activities of Daily Living; KPS, Karnofsky Performance Status; LSA, Life-Space Assessment

(A) 79-year-old woman receiving chemoimmunotherapy

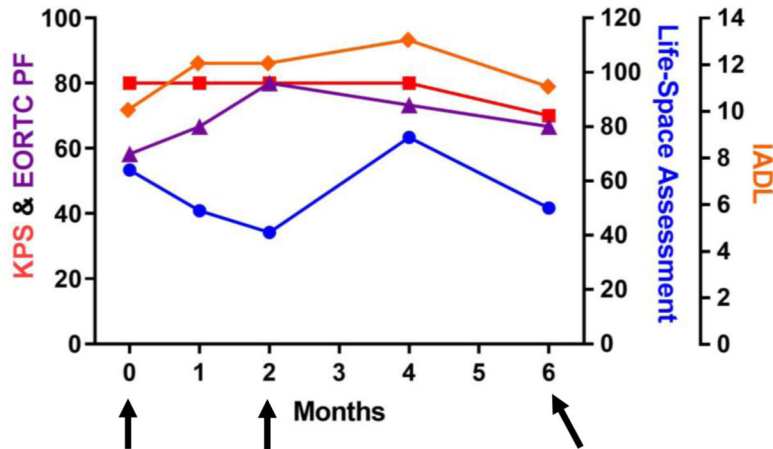


“I have breakfast. I go to the bathroom. I shower. I drive. I do my emails while I put on my makeup, and I usually am out the door.”

“The lack of energy, the fatigue, the malaise. [...] The worst is just the feeling like you could just stay in bed all day long because you are just wiped out.”

“I can do the laundry, make the bed, wash my hair. Blow dry my hair. I have a grocery cart. I go to Safeway. I put the groceries in the cart. I unload them.”

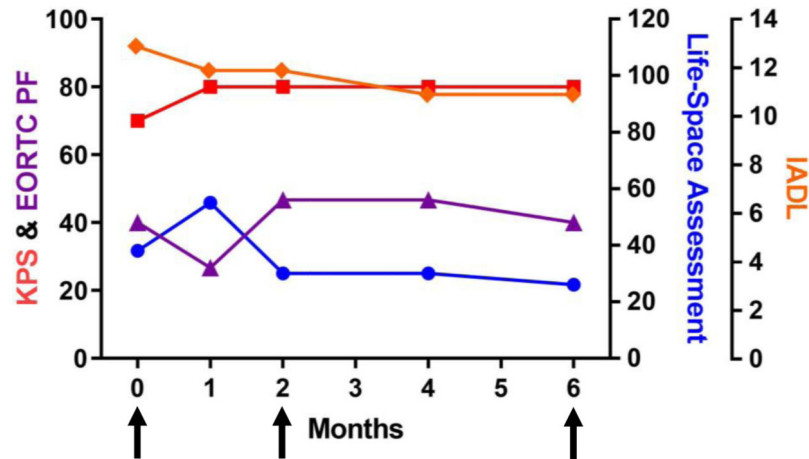
(B) 74-year-old female receiving chemotherapy



“On a good day, I can do a little. I get real tired real fast no matter what I do. I do some dishes and I’m ready to sit down.”

“That first week I came home [from the hospital], I was out of it. I was just laying around, had no energy, zip.”

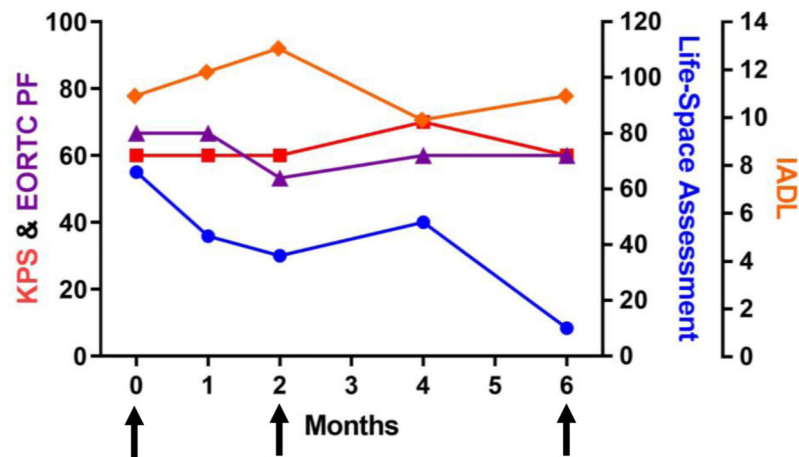
“Even just [to] get up and function for the day, it’s a struggle.”

(C) 77-year-old woman receiving chemoimmunotherapy

"I am very happy with what I do within the house. I go here and there and then do whatever my grandson needs."

"The tiresome and exhaustion are starting. So today, I was not feeling like eating food."

"Housework also I can't do. Laundry, I can do my laundry."

(D) 86-year-old woman receiving immunotherapy

"I'm not quite as active as I used to be... I feel like lying down a little more often."

"I've been to a dinner several times. I've been to concerts also. It's not much worse than it was."

"[I'm doing] not very much I'm afraid. [I'm] at the hospital, and there's not much to do, and I've been a lot in bed."

Figure 3:

Joint displays. Joint displays integrating quantitative plots of function with qualitative patient descriptions of functional changes. (A) 79-year-old woman receiving chemoimmunotherapy with qualitative and quantitative functional decline in all four measures at two months and recovery in IADL, EORTC PF, and LSA at 6 months. (B) 74-year-old woman receiving chemotherapy with qualitative and quantitative decline in LSA at two months and qualitative and quantitative decline in KPS, IADL, and EORTC PF from two to six months. (C) 77-year-old woman receiving chemoimmunotherapy with qualitative

and quantitative decline in IADL at two and six months. (D) 86-year-old woman receiving immunotherapy with quantitative decline in EORTC PF and LSA at two months (with stable qualitative function) and subsequent qualitative and quantitative decline in IADL and LSA from two to six months.

Abbreviations: EORTC PF, European Organisation for the Research and Treatment of Cancer Quality of Life Questionnaire Physical Function; IADL, Older Americans Resources and Services Program Instrumental Activities of Daily Living; KPS, Medical Doctor Karnofsky Performance Status.

Table 1:

Patient Characteristics (N=87)

Demographic and clinical characteristics	n (%)
Age, years	
65–69	26 (30)
70–74	25 (29)
75–79	14 (16)
80+	22 (25)
Female	50 (57)
Race	
Asian	26 (30)
Black	4 (5)
White	55 (63)
More than one race	2 (2)
Primary language	
English	73 (84)
Chinese dialect	14 (16)
Education	
High school or less	19 (24)
College	37 (46)
Graduate level	24 (30)
Partnered	50 (60)
Lives alone	18 (21)
Smoking status	
No history of tobacco use	29 (33)
History of tobacco use	54 (62)
Active tobacco use	4 (5)
Histology	
Adenocarcinoma	72 (83)
Squamous cell	11 (13)
Other	4 (5)
Stage	
IIIA-C	6 (7)
IVA	33 (38)
IVB	48 (55)
Brain metastasis	23 (26)
Any prior lung cancer treatment	63 (72)
Prior lung cancer treatments	
Prior radiation	38 (29)
Prior chemotherapy	34 (26)
Prior targeted therapy	26 (20)
Prior immunotherapy	17 (13)

Demographic and clinical characteristics	n (%)
Prior surgery	15 (12)
Current treatment	
Immunotherapy	30 (34)
Targeted therapy	29 (33)
Chemotherapy and immunotherapy	19 (22)
Chemotherapy	9 (10)
Pretreatment geriatric assessment and symptom characteristics	n (%)
Dependent in 1 ADL	16 (18)
Dependent in 1 IADL	55 (68)
Timed Up and Go 13.5 seconds	28 (34)
Short Physical Performance Battery score 9	39 (45)
Fall(s) in last 6 months	12 (15)
3 comorbidities	32 (37)
Low hemoglobin (<10 g/dl for women, <11 g/dl for men)	11 (13)
Creatinine clearance <60 ml/min	31 (37)
Montreal Cognitive Assessment score <26	57 (66)
Involuntary weight loss in last 6 months	47 (59)
BMI <21 kg/m ²	20 (23)
MHI-13 depression score 12	29 (40)
MHI-13 anxiety score 6	53 (74)
Poor tangible social support	32 (42)
High morning fatigue	30 (39)
High evening fatigue	23 (30)
Low morning energy	61 (79)
Low evening energy	35 (46)
Pain (quite a bit or very much)	20 (27)
Shortness of breath (quite a bit or very much)	19 (25)

Abbreviations: ADL, activities of daily living; BMI, body mass index; IADL, instrumental activities of daily living; MHI, Mental Health Inventory.

Missing data: education n=7, partnered n=3, IADL n=5, timed up and go n=4, fall(s) n=7, hemoglobin n=1, creatinine clearance n=2, weight loss n=7, depression n=14, anxiety n=14, social support n=9, morning fatigue/energy n=9, evening fatigue/energy n=10, pain n=12, shortness of breath n=11

Table 2:

Functional decline by individual quantitative measures

Quantitative Measure	Pretreatment		2 Months			6 Months		
	n	Mean (SD)	n	Mean (SD)	% of patients with decline	n	Mean (SD)	% of patients with decline
Karnofsky Performance Status (scale 0–100)	87	79 (13)	87	71 (22)	41%	61	77 (20)	23%
IADL (scale 0–14) (median, IQR)	83	13 (10–14)	83	13 (10–14)	24%	58	13 (10–14)	26%
EORTC QLQ-C30 PF (scale 0–100)	77	69 (23)	78	66 (26)	29%	58	70 (25)	22%
Life-Space Assessment (scale 0–120)	87	67 (28)	87	57 (32)	48%	60	62 (31)	35%

Functional decline was defined as clinically meaningful decline in KPS (10-point decrease), IADL (1-point decrease), EORTC QLQ-C30 Physical Function (10-point decrease), or Life-Space Assessment (10-point decrease).

Abbreviations: EORTC QLQ-C30 PF, European Organisation for the Research and Treatment of Cancer Quality of Life Questionnaire Physical Function; IADL, instrumental activities of daily living; IQR, interquartile range.

Table 3:

Correlations between quantitative measures of physical function decline

	Pretreatment, n=87			2 Months, n=83			6 Months, n=56		
	KPS	IADL	EORTC QLQ-C30 PF	KPS	IADL	EORTC QLQ-C30 PF	KPS	IADL	EORTC QLQ-C30 PF
IADL	0.52	---	---	0.51	---	---	0.61	---	---
EORTC QLQ-C30 PF	0.59	0.69	---	0.52	0.72	---	0.62	0.80	---
LSA	0.48	0.75	0.70	0.42	0.71	0.54	0.41	0.70	0.60

Pearson's correlation coefficient reported.

Abbreviations: EORTC QLQ-C30 PF, European Organisation for the Research and Treatment of Cancer Quality of Life Questionnaire Physical Function; IADL, instrumental activities of daily living; KPS, Karnofsky Performance Status; LSA, Life-Space Assessment

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