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Associations of sleep disturbance with physical function and cognition in older adults with cancer

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Abstract

Purpose—Although sleep disturbances are common in older adults, studies evaluating the prevalence of sleep disturbance and influence on functional outcomes in older adults with cancer are few. In this study, we examined the prevalence of sleep disturbance and its association with physical function and cognition in older adults with cancer.

Methods—Patients referred to the Specialized Oncology Care & Research in the Elderly clinics at the Universities of Rochester and Chicago from May 2011 to October 2015 who underwent a geriatric assessment (GA) and completed the sleep assessment were included. Presence of sleep disturbance was self-reported (yes/no). Physical function was assessed using Instrumental Activities of Daily Living (IADLs), physical activity (PA) survey, falls in the preceding six months, and Short Physical Performance Battery (SPPB). Bivariate and multivariable analyses were used to examine the associations between sleep disturbance with functional outcomes and cognition.

Results—We included 389 older patients. The prevalence of sleep disturbance was 40%. Sixty eight percent had ≥1 IADL impairment, 76% had PA limitation, 37% had ≥1 fall, 70% had impairment on SPPB, and 47% screened positive for cognitive impairment. On bivariate analyses, sleep disturbance was associated with IADL impairment (Odds ratio [OR] 1.96, 95% Confidence Interval [CI] 1.23-3.13, P=0.005) and PA limitation (OR 2.43, 95% CI 1.38-4.28, P=0.002). The associations remained significant on multivariable analyses. Sleep disturbance was not significantly associated with falls, impairment on SPPB and performance on the cognitive screen.

Conclusion—Sleep disturbance was associated with IADL impairment and PA limitation. It is important for oncologists to inquire about sleep problems, and these patients should also be screened for functional impairment if sleep disturbance was present.

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Keywords

sleep disturbance; physical function; cognition; older adults; cancer

Introduction

A large proportion of cancer is diagnosed in older adults.[1] It is estimated that 70% of all cancer diagnoses will occur in adults aged ≥ 65 by the year 2030.[2] With advances in cancer treatment, more older adults are able to undergo cancer treatments, and experience benefit. By 2040, the numbers of older patients with cancer will increase by almost two fold.[3]

A history of cancer increases the likelihood of having sleep disturbance.[4] Sleep disturbance is common, with a reported prevalence of between 30-72% in individuals with cancer.[5–7] In a convenience sample of older cancer patients aged 65 or older receiving treatment at a regional hospital, the prevalence of sleep disturbance was reported to be 60%.[8]

In the general geriatric population, presence of sleep disturbance is associated with poor physical function and may predict cognitive decline.[9,10] In cancer patients with sleep disturbance, there is higher rate of impairment in daytime functioning and cognitive functions such as concentration and memory.[11] On the other hand, studies evaluating the influence of sleep disturbance on functional outcomes in older adults with cancer are few. In a large cross-sectional study of 956 older cancer survivors, survivors with sleep disturbance reported more physical symptoms, problems performing activities of daily living, and more regular use of sleep medications. The majority of sleep medications have sedative properties, which in turn can lead to further impairment in cognition (i.e., concentration, memory) and physical function.[11]

In this study, our objective was to determine the prevalence of sleep disturbance in older adults with cancer who were evaluated in two university-based geriatric oncology clinics. These consultative clinics evaluate a more vulnerable population of older adults, most of whom are, receiving cancer treatment. We evaluated the relationships between sleep disturbance and physical function, as measured by validated subjective and objective tools within a geriatric assessment (GA). Our hypothesis was that sleep disturbance was associated with impairment in physical function. We also explored if sleep disturbance was associated with screened positive cognitive impairment.

Methods

Design, Setting, Population

The study cohort consisted of 389 older patients who were referred to the Specialized Oncology Care & Research in the Elderly (SOCARE) clinics at the University of Rochester Medical Center and University Chicago from May 2011 to October 2015. Older adults with cancer were referred to the SOCARE clinics to be evaluated by physicians who have expertise in geriatric oncology, and their assessments are used to assist with treatment decision-making and management of side effects and complications. As part of their evaluations, all patients underwent a sleep assessment and GA using validated tools to

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measure functional status, comorbidities, medications, psychological status, cognition, nutritional status and social support. Some patients received a brief version of the GA, which did not include the sleep assessment, as the referral was too close to the appointment or the self-reported portion of the GA was not received by the patients in mail. There were 680 patients seen from May 2011 to October 2015 and consented to the study. Of these, 208 patients received a brief GA and therefore were excluded as sleep was not assessed in these patients. We also excluded 83 patients who did not complete the sleep question.

Demographics and Clinical Characteristics

We collected patient and clinical characteristics as part of the GA and from the medical chart review. Four independent investigators extracted the information. We collected self-reported demographic information including age, sex, race, marital status and education level from the GA. The presence of depression and comorbidity was ascertained from the GA. Depression was defined as present if patients scored 5 or above on the 15-item Geriatric Depression Scale (GDS).[12] Patients self-reported their comorbidity using the modified Older Americans Resources and Services Questionnaire (OARS) Physical Health subscale.[13] The questionnaire consists of 13 comorbid conditions (other cancer or leukemia, arthritis or rheumatism, glaucoma, emphysema or chronic bronchitis, high blood pressure, heart disease, circulation trouble in arms or legs, diabetes, stomach or intestinal disorders, osteoporosis, chronic liver or kidney disease, stroke, depression), and patients were asked how much each comorbidity interfered with their activities, rated from 1 to 3 on a Likert-scale (1, “not at all”; 2, “somewhat”; and 3, “a great deal.”). As in prior studies, we defined the presence of comorbidity if patients reported at least one illness that affected them by a “great deal”, or at least 3 illnesses that affected them by “somewhat”.[14]

Clinical characteristics including cancer type and stage were also recorded from medical chart review. Whenever possible, we extracted this information from the clinic notes on the same day as the GA was performed. However, if either the cancer type or stage were uncertain, this information was obtained from the medical chart within a month after the initial visit.

Independent variable

Presence of sleep problems was self-reported based on a dichotomous question “Do you have sleep problems now?”

Outcome Variables

The outcome variables included physical function and cognition, both of which were assessed as part of the GA. Function was assessed using Instrumental Activities of Daily Living (IADLs), physical activity (PA) survey, self-reported history of falls in the preceding six months, and Short Physical Performance Battery (SPPB). For IADL function, participants were asked if they had difficulty in any of the 7 IADLs: use of telephone, managing money, preparing meals, shopping for groceries, doing housework and transportation.[15] Impairment was considered present if they reported needing assistance with at least one of the IADLs.[16]

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Physical activity (PA) was measured using the patient-reported physical function survey from the Medical Outcomes Study Short Form Questionnaire (MOS-SF-36).[17–19] This survey consists of 10 activities, such as climbing several flights of stairs, walking more than one mile and lifting or carrying groceries. Patients were asked to describe whether they are "limited a lot", "limited a little", or "not limited at all" for each activity. Impairment was defined as self-report of at least one activity that was "limited a lot".

The SPPB is a performance-based physical assessment that evaluates lower extremity physical function.[20] It is comprised of a four-meter walk, repeated chair stands and a balance test. Each domain is scored from 0-4 with 0 being "unable to complete the task" and 4 being "at the highest level of performance."[21] Impairment was defined as a score of 9 or less out of a total score of 12 based on previous studies that demonstrate that scores 9 or below are associated with disability, nursing home placement and mortality.[22,23]

Two cognitive screening tools were administered: Blessed Orientation-Memory-Concentration (BOMC) and Montreal Cognitive Assessment (MoCA). BOMC is a weighted six-item instrument originally designed to screen for cognitive impairment. BOMC evaluates orientation, registration, and attention.[24] Higher score on BOMC indicates greater impairment. MoCA is a 30-point test that evaluates a number of cognitive domains including short-term memory recall, visuospatial abilities, executive function, attention, concentration, language and orientation.[25] Lower score signifies greater impairment. Patients were screened positive for impairment if they scored more than 4 on BOMC or less than 26 on MoCA.[26–30] All patients at University of Chicago received a MoCA, whereas patients at University of Rochester received a BOMC with or without a MoCA based on physician's judgement. For patients who had both BOMC and MoCA performed (N=16), MoCA was used to define impairment since it has better sensitivity and similar specificity compared to BOMC.[31]

Statistical analysis

Descriptive statistics (means, standard deviations, range and percentages as appropriate) were used to describe the sample. Bivariate analysis (chi-square and t-test) was used to examine the associations between sleep disturbance and the assessments of physical function (IADLs, physical activity, SPPB and falls) and performance on the cognitive screens. Separate multivariable models were used to evaluate the associations of sleep disturbance with all outcomes.

Patient demographics (age, sex, race, marital status and education level) and clinically relevant variables (cancer types, stages, presence of comorbidity) as well as the presence of sleep disturbance were included in the models. Depression was included as a covariate given that it has been shown to be associated with impairment in physical function, cognition, and sleep.[32–35] We evaluated effect modification of sleep disturbance with cancer types, stages, depression and presence of comorbidity via interaction terms. All analyses were carried out using SAS statistical software (Version 9.3, Cary, NC). All participants provided informed consent. The project was approved by University of Rochester's Research Subjects Review Board and the University of Chicago's Institutional Review Board.

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Results

Demographics and clinical characteristics

From May 2011 to October 2015, a total of 389 patients underwent a GA and completed the sleep assessment question (yes/no). The median age of the patients was 81 years (SD 6.9, range 55-97); four patients were between the ages of 55-64 and were referred for evaluation of age-related concerns. Fifty-five percent were male and half were married. Almost 75% of the patients were white, and 76% had high school education or above. The most common types of malignancies were genitourinary (30%), gastrointestinal (25%) and lung (18%). Forty-eight percent of patients had advanced cancer (stage III or IV). Thirty-one percent of patients had significant symptoms of depression (≥5 on the GDS). Comorbidity was present in 70% of patients. Patient characteristics are described in Table 1.

Forty percent of patients (154/389) reported sleep disturbance based on the dichotomous question “Do you have sleep problems now?”. Impaired physical function was common: 68% of patients reported needing assistance with at least one of their IADLs, and 76% reported limitations in physical activity. Thirty-seven percent reported at least one fall in the preceding six months, and 70% had a score of 9 or less on SPPB. Overall, 47% screened positive for cognitive impairment (Table 2).

Associations between sleep disturbance and function

On bivariate analyses, sleep disturbance was associated with impairment in IADLs [Odds ratio (OR) 1.96, 95% Confidence Interval (CI) 1.23-3.13, P=0.005] and PA limitation (OR 2.43, 95% CI 1.38-4.28, P=0.002). The associations remained significant after adjusting for demographic variables, cancer characteristics, comorbidity and depression. Having sleep disturbance was associated with IADL impairment (adjusted [A] OR 1.97; 95% CI 1.17-3.31, P=0.01) and PA limitation (AOR 2.40; 95% CI 1.25-4.61, P=0.009) (Table 3). No significant interactions were found between sleep disturbance and cancer types, stages, depression and presence of comorbidity. Sleep disturbance was not associated with falls and impairment on SPPB on bivariate or multivariable analyses. Similarly, sleep disturbance was not associated with performance on the cognitive screens (Table 2).

Associations of demographics and clinical characteristics with physical function and cognition

Several demographics and clinical characteristics were associated with impairment in physical function and performance on the cognitive screen (Table 4). Compared to limited stage disease, advanced stage cancer was associated with IADL impairment (OR 2.16, 95% CI 1.28-3.73, P=0.004), falls (OR 2.34, 95% CI 1.40-3.94, P=0.001) and cognition (OR 1.89, 95% CI 1.10-3.25, P=0.02). Presence of comorbidity was associated with impairment in all functional domains. Worse performance on the cognitive screen was more common among older patients, non-white patients, and those who did not complete high school.

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Discussion

In a cohort of older adults seen at two geriatric oncology clinics, the prevalence of sleep disturbance was high (40%). After adjusting for demographics and clinical characteristics, sleep disturbance was associated with IADL impairment and PA limitation. Sleep disturbance was not associated with screening positive for possible cognitive impairment in the study population.

There are limited studies that assess the prevalence of sleep disturbance in the older cancer population. In the general geriatric population, large epidemiologic studies demonstrated that 7-50% of older adults reported some forms of sleep disturbance, and the prevalence differed depending on how sleep was assessed.[36–38] In the cancer population, the prevalence varies from 30-72% depending on the cancer type, cancer stage, treatment received and time since completion of treatment.[6,7,39,40] In two population-based studies of older cancer survivors, the prevalence was between 19-25%.[4,11] On the other hand, in a cross-sectional study that included a convenience sample of older cancer patients (mean age=68.8) receiving chemotherapy or radiotherapy at a regional hospital, the prevalence of sleep disturbance was close to 60%.[8]

Impairment in physical function is common in older adults in cancer. Multiple studies have demonstrated that up to 49% of older patients with cancer have poor physical function.[41–44] Older patients with cancer who have impairment in physical function are more likely to develop toxicity while undergoing chemotherapy.[42] Poor physical function also predicts future disability and mortality.[20,45,46] Therefore it is important to identify possible modifiable factors associated with poor physical function in order to develop successful interventions.

Several studies have investigated how sleep disturbance affects physical function in the geriatric population. In a large cross-sectional study involving older adults in the community, the co-occurrence of sleep disturbance and one or more physical health problems was associated with poor quality of life and disability.[47] Similarly, patients with sleep disruption often have co-existing mental problems such as depression, which is associated with poorer physical function.[47–49] In our study, we adjusted for comorbidity and depression in the multivariable models, but sleep disturbance remained significantly associated with IADL impairment and PA limitation. Sleep disturbance may have its own unique contribution to physical function; however, the exact mechanism by which sleep directly affects physical function is unclear.[47] Plausible mechanism include increased stress hormone (catecholamines, ACTH and cortisol) in patients with sleep disturbance which can lower the immune system leading to development of health problems affecting physical function.[50,51] Sleep disturbance also increases secretion of pro-inflammatory cytokines such as IL-6, which is associated with functional decline.[52]

In this study of older adults, sleep disturbance was not associated with performance on the cognitive screens. Multiple studies have demonstrated that patients with sleep disturbance have deficiencies in a number of cognitive domains such as concentration, executive functioning, attention and memory, compared to controls.[53–55] Sleep disturbance also affects

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the activation of the frontal and parietal cortexes as well as the thalamic region of the brain on functional brain imaging.[56,57] Several reasons may explain the null findings in the present study. It is possible that sleep disturbance was not reported accurately in patients who screened positive for cognitive impairment. Cognition was assessed using screening instruments (BOMC and MoCA), and therefore may not reflect patients' actual neuropsychological status. In a prior study involving community-dwelling seniors, patients with mild cognitive impairment had no difference in self-reported sleep behaviors. However, when sleep was measured objectively (by movement in bed at night, wake after sleep onset and times up at night), the study found that those with primary complaint of declining memory (amnestic) had less disturbed sleep than those with impairment in other domains (non-amnestic).[58] Other studies using objective measures such as polysomnography or actigraphy data reported no differences in sleep disturbance between healthy controls and patients with mild cognitive impairment associated amnesia.[59,60] In our study, we did not investigate sleep disturbance according to the presence of amnesia. Therefore, the differential impact of sleep disturbance on cognition based on the presence of amnesia needs to be explored in future studies.

Our study adds to the literature on the prevalence of sleep disturbance in older adults with cancer, and a large proportion of our patients were above age 80. Our study also emphasizes the impact of sleep disturbance on physical function in the geriatric oncology population, similar to prior studies in older adults.[9,61] Many oncologists, however, do not enquire about sleep problems.[62] Similarly, many patients do not report their sleep disturbances to their oncologists.[63] When reported, sleep disturbances are usually not addressed during routine cancer care.[62] Therefore, it is important for oncologists to inquire about sleep problems, and these patients should also be screened for functional impairment if sleep disturbance was present.

Our study is limited by its cross-sectional study design; therefore we cannot evaluate for causality. The presence of sleep disturbance was self-reported, and not measured objectively. Sleep was assessed using a dichotomous question (yes/no) that has not been validated previously. In addition to that, we did not diagnose sleep disorders. Future studies should incorporate a more reliable and valid tool of assessing sleep such as the Pittsburgh Sleep Quality Index or Epworth Sleepiness Scale (ESS), or use objective assessment such as polysomnography or actigraphy data.[64]

In conclusion, we found an association between sleep disturbance and self-reported IADL impairment and PA limitation. Future prospective studies should establish the causal relationship between sleep and impairment in physical function.

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Table 1
Demographics and clinical characteristics of the study cohort

Characteristics		N = 389 (%)
Age in years, mean (SD, range)		81 (6.9, 55-97)
	≤80	161 (41.4)
	>80	229 (58.9)
Gender	Female	176 (45.2)
	Male	213 (54.8)
Race[a]	White	289 (74.3)
	Non-White	96 (24.7)
Marital status[b]	Married	192 (49.4)
	Widowed	115 (29.9)
	Other	72 (18.5)
Educational status[c]	>High School	176 (45.2)
	=High School	120 (30.8)
	<High School	82 (21.1)
Primary cancer type	GU	117 (30.1)
	GI	98 (25.2)
	Lung	71 (18.3)
	Other	103 (26.5)
Stage	Limited (I, II)	141 (36.2)
	Advanced (III, IV)	188 (48.3)
	Undetermined	60 (15.4)
Comorbidity[d*]	Yes	271 (69.7)
	No	113 (29.0)
Depression[e#]	Yes	119 (30.6)
	No	264 (67.9)

[*] Comorbidity was assessed using the modified Older Americans Resources and Services Questionnaire Physical Health subscale, and defined as present if patients reported at least one illness that affected them by a “great deal”, or at least 3 illnesses that affected them by “somewhat”.

[#] Depression was defined as present if patients scored 5 or above on the 15-item Geriatric Depression Scale.[12]

[a] 4 missing;

[b] 10 missing;

[c] 11 missing;

[d] 5 missing;

[e] 6 missing

Abbreviations: SD, standard deviation; GU, genitourinary; GI, gastrointestinal

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Table 2
Prevalence of functional and cognitive impairment in the study cohort

Impairment	N = 389 (%)
IADL impairment[a@]	266 (68.4)
PA limitations[b#]	296 (76.1)
Falls[cˆ]	143 (36.8)
SPPB≤ 9[d&]	273 (70.2)
Cognitive impairment[e*]	182 (46.8)

Abbreviations: IADL, instrumental activities of daily living; PA, physical activity; SPPB, short physical performance battery

@Impairment was considered present if they reported needing assistance with at least one of the IADLs (use of telephone, managing money, preparing meals, shopping for groceries, doing housework and transportation).[15]

#Impairment was present if patients self-report of at least one activity that was “limited a lot” on the Medical Outcomes Study Short Form Questionnaire.[18]

ˆFalls in the preceding six months.

&Impairment was defined as a score of 9 or less out of a total score of 12 on SPPB.

*Impairment was defined as a score more than 4 on BOMC or less than 26 on MoCA. MoCA was used to defined impairment if patients had both BOMC and MoCA performed.[27,29]

a4 missing;

b15 missing;

c12 missing;

d38 missing;

e31 missing

Abbreviations: IADL, instrumental activities of daily living; PA, physical activity; SPPB, short physical performance battery; BOMC, Blessed Orientation-Memory-Concentration (BOMC); MoCA, Montreal Cognitive Assessment

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Table 3
Frequency of impairment in patients with versus without sleep disturbance

Impairment	Outcome Frequency (%)		Unadjusted ORs (95% CI)	P-Value
	Sleep disturbance present (N=154)	Sleep disturbance not present (N=235)		
IADL impairment	77.5	63.7	**1.96 (1.23-3.13)**	**0.005**
Significant PA limitation	87.3	73.8	**2.43 (1.38-4.28)**	**0.002**
Falls	40.3	36.4	1.18 (0.77-1.80)	0.45
SPPB≤ 9	80.7	75.9	1.32 (0.78-2.24)	0.29
Cognitive impairment	50.7	50.9	0.99 (0.65-1.51)	0.97

Abbreviations: IADL, instrumental activities of daily living; PA, physical activity; SPPB, short physical performance battery

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Table 4

Multivariable analyses showing associations of various patient and clinical characteristics with function

Variables		IADL Impairment (N=356)		PA Limitation (N=347)		Falls (N=350)		SPPB (N=327)		Cognitive Impairment (N=332)	
		Adjusted ORs (95% CI)	**P-value**	**Adjusted ORs (95% CI)**	**P-value**	**Adjusted ORs (95% CI)**	**P-value**	**Adjusted ORs (95% CI)**	**P-value**	**Adjusted ORs (95% CI)**	**P-value**
Sleep disturbance	Yes	**1.98 (1.18-3.35)**	**0.01**	**2.27 (1.18-4.36)**	**0.02**	1.19 (0.75-1.81)	0.46	1.05 (0.58-1.90)	0.87	1.02 (0.61-1.70)	0.95
Gender	Female	1.02 (0.57-1.81)	0.95	1.22 (0.62-2.42)	0.56	0.92 (0.53-1.58)	0.76	0.95 (0.49-1.85)	0.88	1.07 (0.60-1.91)	0.82
Age	≤80	1 (ref)		1 (ref)		1 (ref)		1 (ref)		1 (ref)	
	>80	1.17 (0.71-1.93)	0.53	1.52 (0.84-2.75)	0.16	1.31 (0.82-2.09)	0.26	1.20 (0.68-2.12)	0.54	**1.89 (1.14-3.16)**	**0.01**
Race	White	1 (ref)		1 (ref)		1 (ref)		1 (ref)		1 (ref)	
	Non-white	1.17 (0.64-2.12)	0.62	**0.44 (0.22-0.86)**	**0.02**	0.66 (0.37-1.17)	0.15	1.22 (0.59-2.52)	0.59	**6.67 (3.38-13.18)**	**<0.0001**
Marital Status	Married	1 (ref)		1 (ref)		1 (ref)		1 (ref)		1 (ref)	
	Widowed	1.59 (0.88-2.90)	0.13	1.47 (0.73-2.97)	0.28	1.00 (0.58-1.75)	0.99	1.99 (0.96-4.10)	0.06	1.25 (0.70-2.25)	0.45
	Other	1.06 (0.55-2.03)	0.87	**2.52 (1.01-6.27)**	**0.05**	1.22 (0.66-2.28)	0.52	1.72 (0.77-3.84)	0.19	0.80 (0.41-1.59)	0.53
Education level	>High School	1 (ref)		1 (ref)		1 (ref)		1 (ref)		1 (ref)	
	=High School	1.72 (0.97-3.03)	0.06	1.83 (0.89-3.75)	0.10	0.94 (0.55-1.58)	0.80	1.37 (0.72-2.60)	0.33	**2.00 (1.14-3.48)**	**0.01**
	<High School	1.47 (0.76-2.85)	0.25	1.24 (0.58-2.67)	0.57	0.79 (0.42-1.48)	0.47	2.25 (0.99-5.10)	0.05	**3.05 (1.54-6.03)**	**0.001**
Primary cancer subtype	Other	1 (ref)		1 (ref)		1 (ref)		1 (ref)		1 (ref)	
	Lung	1.36 (0.66-2.82)	0.41	0.75 (0.31-1.80)	0.51	1.32 (0.65-2.65)	0.44	1.98 (0.86-4.59)	0.11	1.58 (0.74-3.38)	0.23
	GI	1.26 (0.60-2.66)	0.54	1.52 (0.60-3.87)	0.38	1.02 (0.49-2.11)	0.96	1.57 (0.68-3.64)	0.30	2.18 (0.99-4.82)	0.05
	GU	1.24 (0.60-2.57)	0.57	0.64 (0.27-1.54)	0.32	1.59 (0.79-3.20)	0.19	1.42 (0.63-3.20)	0.40	1.59 (0.75-3.41)	0.23
Stage	Limited	1 (ref)		1 (ref)		1 (ref)		1 (ref)		1 (ref)	
	Advanced	**2.16 (1.28-3.63)**	**0.004**	**1.93 (1.02-3.64)**	**0.04**	**2.34 (1.40-3.94)**	**0.001**	0.85 (0.46-1.57)	0.60	**1.89 (1.10-3.25)**	**0.02**
	Unknown	**3.10 (1.43-6.73)**	**0.004**	2.23 (0.90-5.51)	0.08	1.86 (0.93-3.73)	0.08	1.76 (0.69-4.49)	0.24	1.83 (0.87-3.85)	0.22
Comorbidity	Yes	**2.08 (1.22-3.54)**	**0.007**	**2.73 (1.47-5.08)**	**0.001**	**2.14 (1.23-3.70)**	**0.007**	**2.75 (1.51-4.99)**	**0.0009**	1.04 (0.59-1.83)	0.90
Depression	Yes	1.28 (0.73-2.25)	0.38	1.86 (0.89-3.90)	0.10	0.86 (0.52-1.42)	0.55	1.03 (0.54-1.98)	0.92	1.22 (0.71-2.10)	0.47

Abbreviations: IADL, instrumental activities of daily living; PA, physical activity; SPPB, short physical performance battery; OR, odd ratio; CI; confidence interval; GU, genitourinary; GI, gastrointestinal