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J Geriatr Oncol. Author manuscript; available in PMC 2016 May 01.

Published in final edited form as:

J Geriatr Oncol. 2015 May ; 6(3): 194–201. doi:10.1016/j.jgo.2015.01.004.

The Prevalence of Potentially Modifiable Functional Deficits and the Subsequent Use of Occupational and Physical Therapy by Older Adults with Cancer

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Abstract

Background—Occupational and physical therapy (OT/PT) services seek to reduce morbidity, mortality, and improve the quality of life of individuals; however, little is known about the needs and use of OT/PT for older adults with cancer. The goal of this study was to describe the

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Disclosures and Conflict of Interest Statements
The authors have no conflicts of interest to disclose.

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functional deficits and their associations with other factors, and to examine the use of OT/PT after a noted functional deficit.

Materials and Methods—This study analyzed data from an institution-based registry that included geriatric assessments of older adults with cancer linked to billing claims data. Logistic regression was used to model predictors of functional deficits. Use of OT/PT was determined and validated with medical chart review.

Results—529 patients with cancer, a median age of 71, 78% were female, 87% Caucasian, 57% married, 53% post-secondary education, 63% with breast cancer were included. In a multivariable model, the odds of having any functional deficits increased with age [5 year OR: 1.31, 95% CI: (1.10, 1.57)] were higher for those with a high school diploma versus those with advanced degrees [OR: 1.66, 95% CI: (1.00, 2.77)] and were higher for patients with comorbidities [OR: 1.15, 95% CI: (1.10, 1.21)]. Of patients with functional deficits only 9% (10/111) received OT/PT within 12 months of a noted deficit.

Discussion—The odds of having any potentially modifiable functional deficit were higher in patients with increasing age, comorbid conditions, and with less than a college degree. Few were referred for OT/PT services suggesting major underutilization of these potentially beneficial services.

Introduction

Advanced age is associated with a decline in functional ability, increase in morbidity, and cancer risk (1, 2). By 2030, approximately 70% of all cancers will be diagnosed within older adults (65 years of age and older) (1). Although large numbers of older adults are surviving cancer, most report having fair or poor health during and after cancer treatment and limitations in activities of daily living (ADL) and instrumental activities of daily living (IADL) both during and after treatment (1, 3-5). Furthermore, after treatment, most are unable to return to their previous levels of activity, a disability which is associated with decreased quality of life and increased morbidity and mortality (3, 4, 6-9). The goal of cancer rehabilitation is to improve functional status and quality of life. Questions remain, however, about the appropriate need for, access to, and predictors of usage of cancer rehabilitation with older adults (10).

Cancer rehabilitation comprises teams with multiple therapeutic skills with occupational and physical therapy as the main services. Occupational and physical therapy evaluations and interventions are designed to improve functional status, participation in activities, gait, and cognitive ability. Specifically, occupational therapy (OT) interventions seek to increase patients' participation in meaningful activities [a.k.a. occupations], ADL, IADL, and cognitive ability (11-13). Physical therapy (PT) interventions focus on improving physical functioning and gait impairment. Together these services have clearly been shown to reduce morbidity and improve quality of life (11-16).

There have been limited studies determining predictors of OT/PT related functional deficits, the subsequent receipt of OT /PT services, and the differences between those who need therapy and who receive OT/PT within older adults with cancer. Most have retrospectively evaluated the perceived need for rehabilitation services after cancer treatment ends (10,

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17-23). These studies lack information about the older patients and self-reported functional status that could predict the need for rehabilitation and the usage of OT/PT. It remains imperative to determine OT/PT related functional deficits for older adults with cancer because adults with functional deficits are likely to be at increased risk for hospital admission, longer stays, and/or higher readmission rates due to caregiver burden and difficulty with symptom control (24). Also, early identification of OT/PT related functional deficits could decrease disability and overall cost (25). Yet, identification of who can benefit from rehabilitation services and when to refer remains a barrier to care (10, 26).

Identifying cancer-related disability can be difficult because it is not often an acute event (such as stroke resulting in hemiplegia), but an accumulation of events over time, which slowly leads to disability and a loss of function. This gradual debilitation is harder to detect (24) and the need for a referral to a rehabilitation program is not as obvious. The geriatric assessment (GA) may be one way to identify patients who could derive the greatest benefits of OT/PT services (27). The GA detects problems not likely to be discovered in routine history and physical examinations and can inform interventions that can improve quality of life and mortality in older patients (28). It can predict the morbidity and mortality of older patients with cancer (9) as well as toxicities related to chemotherapy treatment (29, 30). In addition, the GA is feasible in both academic and community centers (31).

In this study we used a previously validated, brief geriatric assessment tool (27) to: (1) describe the functional deficits in a sample of older adults with cancer, (2) to examine the predictors of functional deficits in this population, and (3) to examine the frequency of referral to OT/PT services when a functional deficit was noted.

Materials and Methods

Study Design, Enrollment and Data Collection

We examined data that were collected for a large hospital-based observational cancer cohort registry (protocol LCCC 0916, NCT01137825). The “Carolina Senior: Registry for Older Adults” is an institutional review board approved University of North Carolina (UNC) Health Care Registry for older adults that contains data from a comprehensive GA. Adults were identified and recruited through the UNC Health Care oncology outpatient clinics (2009-2013) with the following eligibility criteria: age 65 years and older, able to consent to complete a GA, and English reading and writing proficiency. Eligibility was further restricted to older adults with completed clinician and patient-reported sections of the GA. Participant registry data was linked to a billing claims database (Carolina Data Warehouse [CDW]), to determine the use of OT/PT in inpatient and outpatient settings. (32).

GA administration was comprised of a clinical evaluation and patient-reported measures as previously described (27). The full GA was either completed the day of enrollment or the patient-reported portion was sent home with the patient with a stamped envelope to return to study coordinator. The clinical evaluation portion included the following measures: the Blessed Orientation-Memory-Concentration (BOMC) test, the Karnofsky Performance Status tool (KPS), and the “Timed Up and Go” (TUG) test. The BOMC consists of six questions designed to screen for cognitive impairment (33). The KPS is a general measure of

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patient independence in carrying out normal activities and self-care needs (34-36). The TUG is a performance test of physical mobility, and measures how long it takes the patient, in seconds, to stand up from a standard arm chair, walk a distance of approximately 10 feet, turn, walk back to the chair, and sit down again (37, 38).

The GA patient-reported questionnaire section was comprised of: the Instrumental Activities of Daily Living (IADL, 7 questions) (39), a subscale of the Multidimensional Functional Assessment Questionnaire (MFAQ); a subscale of the Medical Outcomes Study (MOS) Physical Health (PH, 10 items) (40, 41); self-reporting version of the KPS (42); a question asking how many times a person has fallen in the last 6 months (43); and a co-morbidity scale (the Physical Health Section of the Older Americans Resources and Services [OARS]) (44). Both the IADL questions and the ADL items used a 3-point Likert scale to measure the degree to which an activity can be performed independently. On the KPS the patient rates his or her level of functional independence on a scale of 0-8, where higher indicates more independence. A brief section on nutrition followed, as well as an assessment of psychological distress and wellbeing, 17 questions from The Mental Health Index and evaluations of social functioning (via the 4 question MOS Social Activity Limitations Measure) and social support (via the 12 item MOS Social Support Survey: Emotional/ Information and Tangible subscales) (40, 45).

The primary outcome of OT/PT related functional deficit status was defined based on scores within the GA and included at least one of following: any fall within 6 months, any limitation on the IADL and physical health assessment or social activities scale (39-41, 45) a score of 14 seconds or longer on the TUG (27, 32, 37, 38), and/or a score of 11 or greater on the BOMC (33, 46). Need for OT/PT was defined as at least one functional deficit. Please refer to Table 1 for more detail on the types of functional deficits, corresponding therapy service recommended and the potential treatments provided.

The Carolina Senior Registry was then linked to the University of North Carolina Healthcare (UNCH) administrative database using an honest broker. This database contained billing codes from across UNCH, including many different clinics and the North Carolina Cancer Hospital. Occupational and physical therapy users were defined as patients who had at least one billing claim for either occupational and/or physical therapy service using current procedural terminology (CPT), the International Classification of Diseases, Ninth Revision, clinical modification section (ICD-9-CM), and Healthcare Common Procedure Coding System (HCPCS) codes. We included codes that best defined OT/PT services from inpatient, inpatient acute rehabilitation, and outpatient care; however, we only used outpatient therapy codes to delineate use of OT/PT. This was inclusive of all evaluations and treatments for rehabilitation as well as palliative and end of life care provided by OT/PT (10). The GA registry data set was merged with the billing data file, and only the patients confirmed to have completed the GA within 1 month of clinic visit were included. Written informed consent was obtained from all study participants and this work was approved by the University of North Carolina Institutional Review Board (IRB).

Approximately half of the patients included in the use of OT/PT analysis had their medical charts reviewed by the first author (MP) to add to the validity of the billing records. The

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review consisted of examining the charts for medical notes by the oncologist mentioning, recommending, or referring to either OT/PT within a month before and a month after the GA.

Statistical Analysis

Descriptive statistics were used to describe the study population. Univariable and multivariable logistic regression were performed to model predictors of having a functional deficit which indicated a need for OT/PT. Covariates included cancer type, treatment status (pre-treatment, during and post-treatment), comorbidities, and demographic information (sex, race, marital status, education, age, and employment status). Due to the small fraction of OT/PT use, no modeling was done for this outcome, and summary statistics are reported. In order to maintain confidentiality of results due to the small number of adults seen by OT or PT we combined OT/PT for all of our descriptions. Inpatient and outpatient OT/PT were separated for descriptive analyses; however, only outpatient OT/PT was used in computation of appropriate use, as inpatient therapy could potentially be due to another non-cancer illness. All analyses were done using SAS version 9.3 (Cary, NC).

Results

Demographic and Clinical Characteristics

There were 529 patients with cancer enrolled in the Carolina Senior Registry who met the inclusion criteria and formed the study cohort. Descriptive statistics for demographic characteristics are shown in Table 2. The median age was 71 years (Range: 65-97, SD: 6.64). Eight-seven percent were Caucasian American, 57% married, 53% reported some post-secondary education, 81% were retired, and 79.9% had more than three or more co-morbid conditions. Overall, 14 different cancer types were represented, with breast cancer (63%) making up the majority. One hundred and sixty (30%) patients were pre-treatment (seen before definitive treatment), 212 (40%) were seen during treatment and the remaining 157 (30%) were post treatment. Most patients (64.5%) had at least one functional deficit and 41% had at least two functional deficits all potentially requiring OT/PT. Forty percent of older adults were identified as having a deficit in physical health and 35% limited with IADL. One-hundred and twenty-eight (25%) experienced one or more falls in the six months prior to filling out the survey. One hundred and fifty-eight (30%) were unable to complete the TUG in less than 14 seconds. Eighty-eight (17%) were identified as experiencing a deficit in social activities. Twenty-four (5%) were considered to have a deficit due to their BOMC scores.

Univariable and Multivariable Model for Factors Associated with Functional Deficit Status

Univariable comparisons of OT/PT related functional deficit percentages between patients with different demographic characteristics were assessed. We found differences in functional status for age category [5 year OR: 1.07, 95% CI: (1.04, 1.11)], different levels of race [OR: 2.07, 95% CI: (1.11, 3.86)], widowed versus married [OR: 2.36, 95% CI: (1.45, 3.83)], level of education (high school graduate versus advanced degree) [OR: 2.20, 95% CI: (1.38, 3.51)], employment (disabled/medical leave versus retired) [OR: 4.34, 95% CI: (1.50, 12.52)], and number of comorbidities [OR: 1.18, 95% CI: (1.13, 1.24)]. Sex, types of cancer,

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and treatment stage were not found to differ among older adults with and without OT/PT related functional deficits.

In a multivariable model including all patient characteristics (Table 3), only older age, level of education, and increasing number of comorbidities retained their significant association with the having a deficit ($p < 0.05$). Odds of having any deficits increased with age [5 year OR: 1.31 95% CI: (1.10, 1.57)] were higher for those with a high school diploma versus those with advanced degrees [OR: 1.66, 95% CI: (1.00, 2.77)] and for additional each comorbidity [OR: 1.15, 95% CI: (1.10, 1.21)]. Sex, race, marital status, employment status, type of cancer, and treatment stage were not found to be significantly associated with functional deficit status.

Use of Occupational and Physical Therapy

Of the 529 patients, 341 had a functional deficit, and 116 of those returned a completed GA within one month of their clinic visit. Five patients received OT/PT in the previous year, 1.8% (2/111) received OT/PT within 1 month after completing the GA and 9% (10/111) received OT/PT within a year after the GA.

We examined a random sample of 65 charts. Please refer to flowchart in Figure 1 for more detail. Of the 65, nine were confirmed by both chart review and our billing data as to receiving OT/PT. Out of the remaining 55, two had notes commenting on physical therapy (one patient who recently fell and was referred to orthopedics for possible physical therapy and a second with metastatic disease to brain and bone who was noted to be receiving physical therapy elsewhere). The other remaining 53 patients with potentially modifiable functional deficits did not have any comments in the clinical notes, referrals, or billing codes for OT/PT receipt.

Discussion

Increasing age, number of comorbidities, and the level of education were significantly associated with increased odds of having a functional limitation. Furthermore, those with functional limitations do not appear to be receiving OT/PT services for their potentially modifiable limitations. To our knowledge, this is the first study to examine the factors associated with functional deficit with the GA to determine the appropriate need for OT/PT for older adults with cancer.

The quality of and access to care provided to cancer survivors continues to be a primary concern (47, 48). Calls for specific attention to older adults with cancer have been made, with recommendations of comprehensive cancer rehabilitation and interventions to improve quality of life and long-term survivorship (47, 48). Functional deficits in this population are associated with increased cost and burden of care, lengthened hospital stays, increased readmission rates (due to care giver burden and poor symptom control) and higher institutionalization (24). This study demonstrates that older adults are not utilizing OT/PT during and after cancer treatment, and are leaving the identified potentially modifiable OT/PT related functional deficits unrecognized and untreated.

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Measurement of a decrease in functional status by the GA, beyond the common and general performance status tests (e.g. KPS), may reveal problems relevant to cancer care that are both amendable, and may otherwise go unrecognized (9, 49). In this sample, a majority (65%) of older adults with had a least one functional deficit defined with specific sections of the GA and chosen as being amenable by OT/PT. Admittedly, the attempt to identify the rehabilitation (OT/PT) related functional deficits of adults with cancer is not new. In the 1970's a seminal prospective study of 805 adults with cancer found 35% with generalized weakness, 30% with ADL impairment, and 25% with difficulty ambulating (19). These researchers initiated a national push toward cancer rehabilitation centers and education; however, an interest in cancer rehabilitation treatment, education, and research never took hold in American health care (17). Recently, a large cross-sectional study of 2,200 Danish adults with cancer were asked about their perceived need for rehabilitation, and 39% felt they did not receive the care they needed (22). There are clearly many barriers to OT/PT that still exist. Clinicians who could potentially refer to OT/PT report a general lack of understanding of the services, a perception that rehabilitation is inappropriate for adults with cancer, and overall difficulty with knowing when to refer and to whom (50). The GA, specifically how it was used for this study, provides an assessment that targets modifiable functional deficits in a way that can be easily identified by oncology clinicians in real time (31) .

The statistical analyses determining associations with OT/PT related functional deficits revealed some interesting results. Within the univariable analyses there were significant differences in functional status between different categories of age, race, marital status, education, employment and number of comorbidities. However, after adjusting for the other covariates marital status, race and employment became non-significant factors associated with having a functional deficit. The sample was split among the stage of cancer treatment with 30% in both pre and post and the remaining 40% assessed during treatment. The lack of association of treatment stage with functional status deficits suggest that deficits can be found in all patients regardless of where they are in their cancer treatment. In the multivariable analyses we found chronological age to be associated with having a functional deficit. The literature is mixed on the true association of chronological age and functional status. Two explanations for our results are: (1) advanced age has been found to be significantly related to increased fear of falling, which can lead to activity restriction and functional decline (51) and/or (2) the way we defined functional deficits in a tailored fashion to determine need for OT and PT. This finding speaks to the need for evaluation and/or screening for functional deficits, especially within those of older ages in order to refer to the appropriate service when needed.

We also found level of education to be a significantly associated with OT/PT related functional deficits, which is consistent with larger population based work. Adults with lower levels of education participate in less activity after cancer diagnosis and have greater unmet rehabilitation needs (20). Lastly, we found number of comorbidities to be associated with higher odds of having a functional deficit. However, this is different than previous research that suggests functional status and comorbidity are not associated (52). In our study, we had a larger sample size, and used different measures of comorbidity and functional status. We were able to assess functional status from a variety of measures beyond ADL and IADL and

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we were able to demonstrate that, at least in our population, the number of comorbidity and the presence of function deficit were significantly associated.

This study was limited to encounters at a single institution; patients may have received OT/PT in other settings not captured with our dataset. Racial/ethnic minorities were underrepresented compared to the North Carolina population (12 % versus 22%). In North Carolina, OT utilization was not significantly related to race (10). Also, we do not have socioeconomic status (SES) information however; level of education could be considered a proxy for SES. This may have altered our modeling results as researchers have found that socio-economic status strongly influences whether or not an older adult with cancer has a perceived unmet need for cancer rehabilitation (27). Lastly, the multivariable analysis does not include stage of disease (localized vs advanced or curative vs palliative) since it was not available in this dataset. This variable would have provided more detail and should be included in further research concerning functional limitations.

The strengths of this study include the relatively large dataset for clinical and patient-reported evaluation measures linked to billing claims within a specific population of older adults with cancer. This is the first analysis to examine need for cancer rehabilitation using systematic administration of the GA followed by an examination into the actual use of that service. These results outline the great need for intervention and referrals to OT/PT in this population. Early identification of OT/PT related functional deficits with the GA may lead to increased referrals to OT/PT and potentially decreased disability and cost (47). In future research, these results could inform an interventional study using the GA as a screening tool for early identification for OT and PT service use to decrease the barrier of access, decrease morbidity, and improve quality of life.

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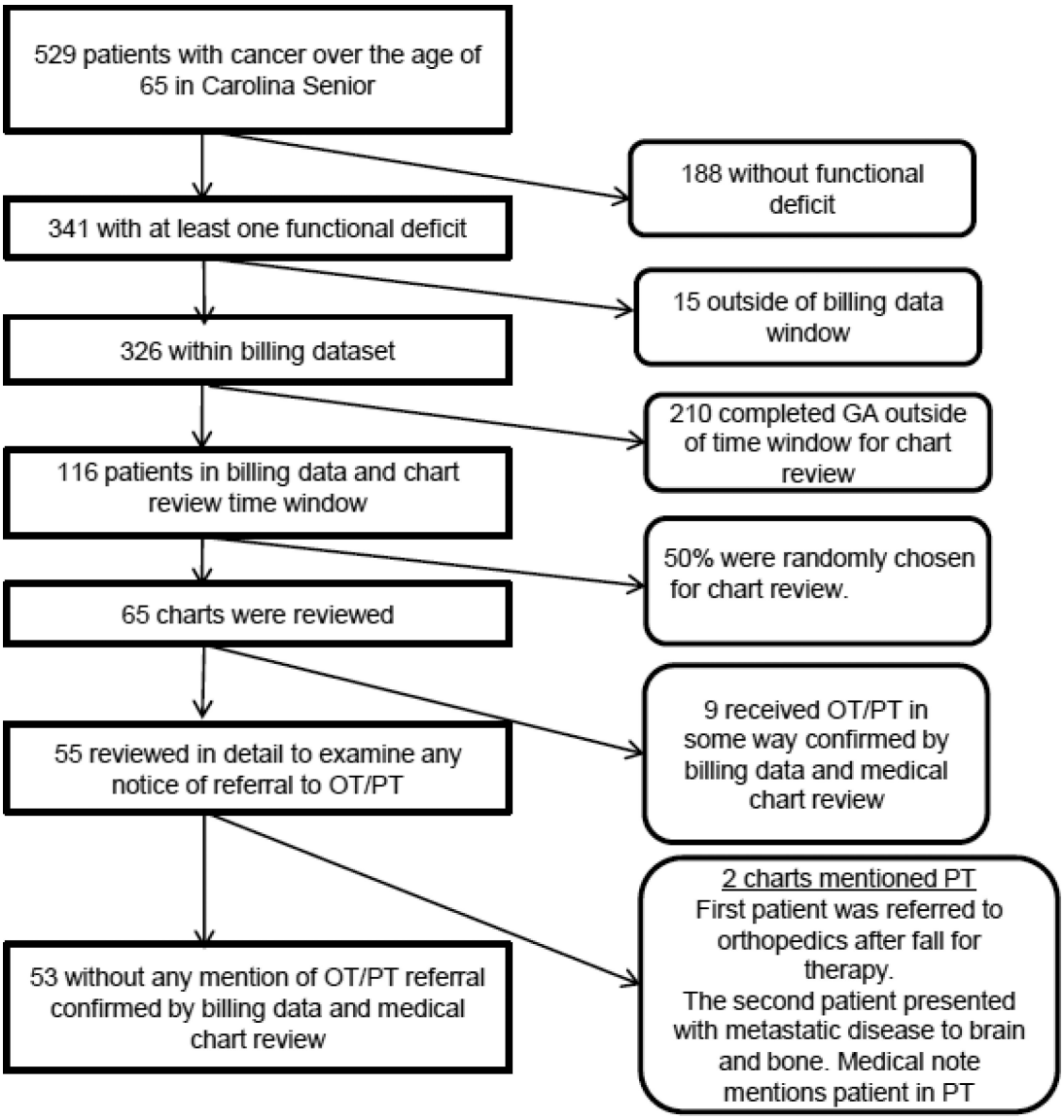

Figure 1.
Participant Flow Chart for the Medical Chart Review Analysis.

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Table 1

Defining Functional Status Deficits, Service Recommendations and Potential Treatments Provided

OT/PT Related Functional Status Variables	Service	Potential Treatments Provided
Physical Health	Physical and Occupational Therapy	Therapeutic exercise; Therapeutic activity; Self-care management
IADL	Occupational Therapy	Self-care management; Therapeutic activity
Cognitive decline	Occupational Therapy	Cognitive therapy; Self-care
Balance (TUG scores)	Physical and Occupational Therapy	Therapeutic exercise; Gait training; Neuromuscular re-education; Self-care; Therapeutic activities
Social Limitations	Occupational Therapy	Self-care management; Therapeutic activity
Falls	Occupational and Physical Therapy	Therapeutic activity; Self-care management; Therapeutic exercise

Note. This list is not inclusive of all treatments or deficits but was designed to give a brief description of the potential treatments OT/PT could provide for the variables listed.

Abbreviations: IADL, instrumental activities of daily living; TUG, timed up and go

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Table 2

Characteristics of Sample

Variable	N (%)
Sex	
Male	119 (22.5)
Female	410 (77.5)
Age (years)	
[65-70)	216 (40.8)
[70-75)	146 (27.6)
[75-80)	82 (15.5)
[80-85)	51 (9.6)
85+	34 (6.4)
Race	
Caucasian American	459 (86.8)
African American	64 (12.1)
Other	6 (1.1)
Marital Status	
Single, never married	15 (2.8)
Married	301 (57.1)
Separated/Divorced	88 (16.7)
Widowed	123 (23.3)
Education	
Less than high school	34 (6.4)
High school graduate	216 (40.9)
Associate/Bachelor's degree	158 (29.9)
Advanced degree	120 (22.7)
Employment	
Disabled/medical leave	35 (6.7)
Employed	63 (12.0)
Retired/homemaker	425 (80.8)
Student	3 (0.6)
Co-morbidities	
0	41 (7.8)
1	3 (0.6)
2	61 (11.7)
3+	418 (79.9)
Type of Cancer	
Breast	331 (62.6)
Lung	49 (9.3)
Leukemia, Lymphoma, Myeloma	68 (12.9)
Other	81 (15.3)
Treatment Stage	

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Variable	N (%)
Pre-treatment	160 (30.2)
During treatment	212 (40.1)
Post-treatment	157 (29.7)

Note. $N = 529$.

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Table 3

Functional Deficit Status: Odds Ratios

	OR	95% CI	p - value
Sex			
Female	1.00		
Male	1.49	0.79-2.82	0.22
Age (5 years)	1.31	1.10-1.57	0.003**
Race			
Caucasian American	1.00		
African American	1.31	0.64-2.67	0.46
Other	0.27	0.03-2.38	0.24
Marital Status			
Married	1.00		
Separated/Divorced	1.09	0.62-1.91	0.77
Single, Never Married	0.92	0.27-3.20	0.90
Widowed	1.49	0.85-2.60	0.16
Education			
Advanced degree	1.00		
Associates/Bachelor's	1.12	0.66-1.91	0.67
High School Graduate	1.66	1.00-2.77	0.05*
Less than high school	1.69	0.66-1.91	0.30
Employment			
Retired	1.00		
Disabled/Medical Leave	2.73	0.87- 8.61	0.09
Employed	0.98	0.55-1.82	0.99
Student	0.65	0.05-8.20	0.73
Co-Morbidities	1.15	1.10-1.21	<0. 0001**
Type of Cancer			
Breast	1.00		
Leukemia, Lymphoma, Myeloma	0.86	0.52-2.08	0.69
Lung	1.21	0.54-2.49	0.64
Other	0.80	0.40-1.59	0.52
Treatment Stage			
Pre-treatment	1.00		
During Treatment	1.31	0.79-2.17	0.30
Post-Treatment	1.19	0.71-2.01	0.50

Note. $N = 521$

*Indicates that a p-value is significant at the 0.05 level.

**Indicates that a p-value is significant at the 0.01 level.

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