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Falls in the Community Dwelling Elderly with a History of Cancer

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Introduction

Each year, about one third of the elderly over 65 fall [1, 2], and fall-related injuries increase with age [3]. Falls lead to functional decline, hospitalization, institutionalization, higher health care costs, and decreased quality of life [4-6]; and rank as the sixth leading cause of death in older people [1]. Similarly, elderly are a special group with respect to rising incidence rates of cancer [7]. Cancer survivors are living longer but are continuing to encounter physical, psychosocial, and economic impacts until the end of life. The likelihood that an elderly cancer survivor experiences falls may be influenced by their cancer history [8-10]. Disparities in the occurrence of falls among cancer survivors are beginning to emerge in the literature [11-15], and there is a need to understand whether the diagnosis of cancer increases the burden of falls. The purpose of this study was to examine community dwelling elderly to identify if individuals with a history of cancer fall at a higher rate than those without a cancer diagnosis; and if falls were influenced by individual characteristics, symptoms, or functional status.

Conceptual Framework

The conceptual framework for this study was a synthesis of the Life-Course Model of Aging [16] and the Health Related Quality of Life model [17]. Early-life intrinsic biologic factors and mid-life medical care influence late-life health and disablement [16]. Factors contributing to late-life outcomes are extrinsic variations, social capital, financial capital, human capital, health behaviors, and health status. Emotional and psychological factors are causal at every level in the model and are bidirectional. Figure 1 delineates a mechanism for the study of falls in the elderly with cancer. The conceptual framework was used to derive the hypothesis. The primary null hypothesis used in this study was

that no correlation between characteristics, symptoms, functional status, cancer diagnosis and the health outcome of falls exists.

Review of Literature

A major risk factor for falling is aging [18], and the risk of being seriously injured in a fall increases with age. Annually, 1 in 3 Americans, or 33% of older adults 65 and older, fall, and 40% of those 80 and older fall [19, 20]. Additionally, elderly individuals often have comorbidities and disabilities which increase the occurrence of falls [21, 22].

Compounded with the general effects of aging, people are diagnosed with cancer at an older age and cancer survivors are living longer [23]. Evidence has shown that cancer-related fatigue [24, 25] and pain [26, 27] influences functional status in elderly survivors increasing the risk of falls [28]. Some evidence suggests that people with cancer fall more often than others [8-10] and that certain types of cancer [29, 30] or metastatic disease [30] may be associated with higher rates of falling. Three studies conducted in palliative care settings demonstrating the incidence rate of falls to be significantly higher [8 10 31]. Both the rate of falls and risk of falling may be significantly higher for cancer survivors [8, 9].

Studying the incidence and impact of falls is significant because 20% of the population in the United States are 65 years and older [32]. In 2006, health care utilization for older adults resulting from fall injuries included more than 1.8 million treated in emergency departments and more than 421,000 hospitalized [1]. According to the Center for Disease Control, direct medical costs related to falls totaled $179 million for fatal falls and $19 billion for nonfatal falls [33]. The known estimate of elderly cancer survivors is more than 6,000,000 [34]. Fifty-six percent of all new cancer diagnoses are among people 65 or older [21].

There are a host of risk factors related to falls in the elderly supported by evidence in the literature [35]. Besides known risk factors in aging, people with cancer have added multiple risk factors for falls that include; neurotoxicity [36], fatigue [24], depression [9], postural hypotension [37], hypoesthesia [37], delirium [8], impaired cognitive function [9, 38], pain [25], gait and balance problems [39], loss of bone density [37], weight loss [40], reduced muscle strength [37], and Vitamin D deficiency [41] .

Innovations in medical technology have led to earlier diagnoses and improved treatment of cancer [33], and consequently, people are living longer and developing chronic conditions. As the elderly population grows, cancer survivorship and the impact of falls and fall injuries will be felt on families and pervade our economic, health care, and social systems.

Little is known about whether the diagnosis of cancer increases the burden of falls in cancer survivors. The purpose of this study was to examine community dwelling elderly to identify if individuals with a history of cancer fall at a higher rate than those without a cancer diagnosis; and if falls were influenced by individual characteristics, symptoms, or functional status.

Methods

This retrospective, cross-sectional study carried out secondary analysis of the MDS. The purpose of the study was to examine the occurrence of falls in low income community dwelling settings, with or without a history of cancer diagnosis. The study was approved by the Internal Review Board of the sponsoring university. The sample included low income and community-dwelling patients 65 years of age and older classified who were enrolled in the Home and Community Based Service (HCBS)

program during 2007. The median age of enrollees in the HSCB program was 72; with multiple comorbidities: 75% with arthritis, 69% with hypertension, 67% with heart disease, 39% with diabetes, and 15% with cancer. Eligibility for admittance to the HCBS includes financial eligibility below 300% of the Federal Poverty Level and a required level of care similar to that a nursing facility level of care requirements (assistance with activities of daily living [ADL] and instrumental activities of daily living [IADL] needs) [42]. In addition, those persons who were members of Health Maintenance Organizations were excluded.

Instrument and Measures

This secondary analysis focused on patient level data from the Minimum Data Set (MDS). The MDS is a person-centered assessment with uniform standards for the collection of minimum essential nursing data, enabling clinicians to assess multiple domains [42]. The MDS in the HCBS program was modified in 1993 from the nursing home version, to inform and guide comprehensive care and service planning for community-dwelling elderly [42]. The information on the MDS contains a combination of self-report by the patient and clinical validation by a Registered Nurse, which is collected in person, in the patient's home upon entry into the HCBS program, and then every 180 days thereafter [42]. The MDS validity and reliability is reported in an international trial, with independent dual assessment of 241 patients using 780 assessments, with a Kappa of .74 [43].

The MDS data used in this study was obtained from one assessment closest to the date of December 31st, 2007. Variables in this study included: number of falls, age,

gender, race/ethnicity; the diagnosis of cancer, ADLs, IADLs, cognitive skills, vision, incontinence, pain and depression. On the MDS, a fall is defined as an unexpected event in which the participant comes to rest on the ground, floor, or lower level. Falls are measured in ordinal frequency from 0 to 9 over the past 6-months, and for this study a faller was defined as a person who had at least one fall. Age is measured as a continuous variable, gender is dichotomous, and race/ethnicity is coded per census criteria. The remainder of the variables were ordinal: ADLs for bathing as independent, supervised, assisted, or total dependence; IADLs for activity difficulty level as none, some, or great; cognitive for daily decision making as independent, modified, impaired, or impaired; vision ability to see as adequate or levels of impairment; urinary continence as usually, occasionally, frequently or incontinent; depression or feelings of sadness as none, weekly, or daily; and pain as none, less than daily, or daily.

Statistical Analysis

Descriptive statistics were used to examine subject characteristics. Association between each categorical variable and falls was tested by using a univariate logistic regression model. A multivariate regression model was developed to determine significant interactions between the variables and falls. Multivariate regression is commonly used to fit mathematical models to data by tuning the free parameters of the model to provide a good fit [44]. In this model, falls was the dependent variable. The independent variables were the following: age, gender, race/ethnicity; the diagnosis of cancer, ADLs, IADLs, cognitive skills, vision, incontinence, pain and depression. Statistical calculations were conducted by using SPSS software.

Results

7448 participants were enrolled in the HCBS program in 2007. The mean age was 80.92 years old, with 76.4% females, 74.3% white and 22% African American. Table 1 shows the demographic characteristics. A total of 2125 (28.5%) had experienced a fall, with 1123 (53%) had one fall and 1002 (47%) had more than one fall. A total of 967 (13.0%) had cancer; and of those with cancer, 263 (27.2%) had a fall.

First, separate bivariate logistic regression models were used to examine the cross-sectional relationship between age, gender, race, cancer, ADLs, IADLs, cognitive status, vision, incontinence, depression, pain and falls respectively. Chi-square tests revealed the following results: race ($p < .0001$), ADL ($p=.032$), IADL ($p=.021$), cognitive skill status ($p=.002$), impaired vision ($p=.030$), incontinence ($p=.023$), depression ($p=.000$), and pain ($p=.000$) were significant predictors of one or more falls during 2007;

while age ($p=.677$), gender ($p=.149$), and cancer ($p=.732$) were not significant. Pain was the only indicator that was inversely associated with falls in these models, with the more pain experienced, the more falls.

To better understand how specific features of each variable explain falls in the HCBS sample, significant factors in the final model will be discussed in relation to association with falls (see Table 1 and Table 3). All odd ratios (ORs) were expressed per 95% of the distribution of the parameter. For female versus male (reference group) (OR 1.20, 95% confidence interval [CI] 1.06-1.37, $p = 0.005$) indicating male gender was associated with fewer falls. For African American versus unknown race (reference

group) (OR 0.61, CI 0.37-1.00, p = 0.040) indicating the African American was associated with fewer falls. For ADLs: supervision with transfer versus total dependence (reference group) (OR .97, CI 0.44-2.13, p = 0.018); for assistance with transfer for bathing versus total dependence (reference group) (OR 1.49, CI 0.67-3.34, p = 0.018); and some assistance with bathing versus total dependence (reference group) (OR 0.91, CI 0.42-1.97, p < 0.000) assistance with ADLs for bathing was associated with more falls. For continence versus incontinence (reference group) (OR 0.95, CI 0.77-1.17, p < 0.000); and frequently incontinent versus incontinence (reference group) (OR 1.34, CI 1.08-1.66, p = 0.001) indicating incontinence was associated with more falls. For no depression experienced versus depression daily (reference group) (OR .58, CI 0.46-0.75, p < .000) indicating depression was associated with more falls. Finally, for some pain versus pain daily (reference group) (OR 0.75, CI 0.65-0.86, p = .0111) indicating pain is associated with falls. In summary, these findings suggest that in the community dwelling elderly in this sample, males, who are white, dependent in ADLs, incontinent, depressed, and have daily pain, are more likely to fall.

A multivariate regression model with Maximum Likelihood Estimates with a Wald Chi-square was then used to examine interactions among the variables in order to construct the final model for this study. MLE is a method fitting mathematical models to data by freeing parameters of the model to provide a good fit [44]. In separate MLE models, adjusting for the same covariates mentioned above (see Table 2 and 3) significant factors in the final model in this study on falls included: race, gender, ADLs, incontinence, depression, and pain. Factors that did not influence falls in the final model

included: cancer, age, IADLs, and vision. In summary, the findings were somewhat different than findings in the literature and will be discussed in the following.

Discussion

This study was performed with the intention to better understand whether cancer influences falls in the community dwelling elderly. Additionally, this study was a first step in developing a conceptual framework specific to disability, disablement, and falls in community dwelling elderly with cancer.

Contrary to findings in other studies where patients may not volunteer or may forget to offer information concerning falls [45], the MDS seemed to be an effective instrument to measure a fall, incorporating questions that prompted recall of a fall in this sample. Furthermore, this study demonstrated that assessing falls using the MDS can offer information about Relative Risks in the community dwelling elderly.

The elderly in the HCBS program fall at a rate of occurrence of 28.5%, a high rate. The population was vulnerable (mean age 80.92 and 76.4% female), and diverse (25.7% non-white). This is an unusually high percentage of non-whites in a study sample, which historically has ranged from three to 10%, in randomized clinical trials [46]. Additionally, the population examined had relatively compromised functional status (84.6% needing ADL assistance and 98.7% needing IADL assistance).

Little research has been conducted concerning falls in people with cancer; therefore comparing the results of this study to established norms is difficult. In two studies in the inpatient palliative care setting,18% [8] and 10% [10] of the cancer patients

had a fall. These findings may be a result of limited amount of time out of bed, which is different when compared to the activity level of most community dwelling elderly. In a study of independent, high-functioning community dwelling elderly in an outpatient cancer program, 23% fell [9]. While these rates are similar to the findings in this study, the samples had distinctly different levels of functioning (high-functioning compared to low-functioning). This pattern in distinctly different populations supports the notion that fall screening should take place in all populations, not just the obviously disabled.

Although the fall prediction model needs refinement and testing; cancer, IADLs, vision, and age were not found to be significant in the final model in this study. These findings are not consistent with geriatric medicine and nursing literature, and will each be discussed in the following paragraphs.

A limited amount of literature has suggested that individuals with a history of cancer are more likely to fall [8, 9, 30]; this was not found in the present sample. This study identified a cancer diagnosis based on information on the MDS. The cancer diagnosis was categorized in three manners. The first was no cancer. The second was cancer with treatment which includes chemotherapy or radiation, or both. Finally, the third was cancer without treatment (more than likely treatment was finished or the patient was transferred to hospice care). No information on cancer was available on date of diagnosis, type, stage, or specific treatment, all of which are known to influence the functional status of cancer survivors. Additionally, fewer falls for cancer patients in this sample may be explained by the inclusion of younger ambulatory survivors or older terminal bedridden patients who are known to fall less. Furthermore, Medicaid recipients who have cancer yet are not diagnosed may have caused an underestimation of the fall

rate in cancer survivors. This confirms the need for future research to examine in more detail how cancer date of diagnosis, type, stage, or specific treatment may be associated with falls in elderly cancer survivors.

Age was not predictive of falls in the present sample. This finding is consistent with the literature in geriatric medicine and nursing. Chronological age is not a known limiting factor for disability and disablement [47]. IADL was not predictive of falls in the present sample, although the literature consistently supports IADLs as a significant predictor of fall risk and falls [37]. In this sample, 98% of the study participants had a need for assistance with IADLs, which led to saturation of the model, as no comparison was available for those who did not need IADL assistance. Therefore, further study is needed with a sample that varies around the dimension of IADLs. Vision was also not predictive of falls in the present sample, although the literature supports poor vision as a predictor of fall risk [48]. However, vision problems are often related to other problems such as poor gait and balance, when an elderly individual gets up at night to use the bathroom, and a fall occurs, and further study is needed to clarify the cause of the fall.

Limitations

As stated previously, a limitation of this study included the ability to determine whether a specific cancer diagnosis, such as lung, breast, prostate, or colon cancer placed individuals at a higher risk for falls. In addition, the effect of cancer stage, recurrence, or if treatment phase placed individuals at fall risk could not be determined. A final limitation of this study was the ability to determine comorbidities that may have placed individuals at a higher risk for falls. These limitations should be considered in future nursing research.

An examination of the burden of falls in the elderly with cancer could lead to research on delineation of barriers to promoting fall-prevention strategies that could be implemented to improve the delivery and financing of care for this population. Competing clinical demands exist, and the multi-factoral nature of falls requires coordination, and a multifaceted approach that does not adhere to the traditional disease model that drives most medical care [49]. Nursing is in a position to focus on this problem.

Conclusion

Falls in the community dwelling elderly with cancer, has significant potential for physical and psychological consequences. Nurses, particularly those delivering HCBS services, must be attuned to the prevalence and risk of falls occurring. Many of the health problems that increase the chance of falling are known and are treatable. Nursing can play a vital role in conducting fall screening and risk assessment to identify those at risk for falls, directing educational efforts to patients in need of fall precaution teaching.

Findings from this study will be used to shape future studies. Ultimately, findings from the study of this topic will be used to provide useful approaches for nursing practice to assess those who are at risk. Additionally, findings will be used to allocate valuable nursing time towards those patients who “need” more intense management of preventive measures. Finally, findings will be used to design effective models of care that will assist elderly cancer survivors to live in the community.

Figure 1. Framework for the Study of Cancer on Falls in Community Dwelling Elderly

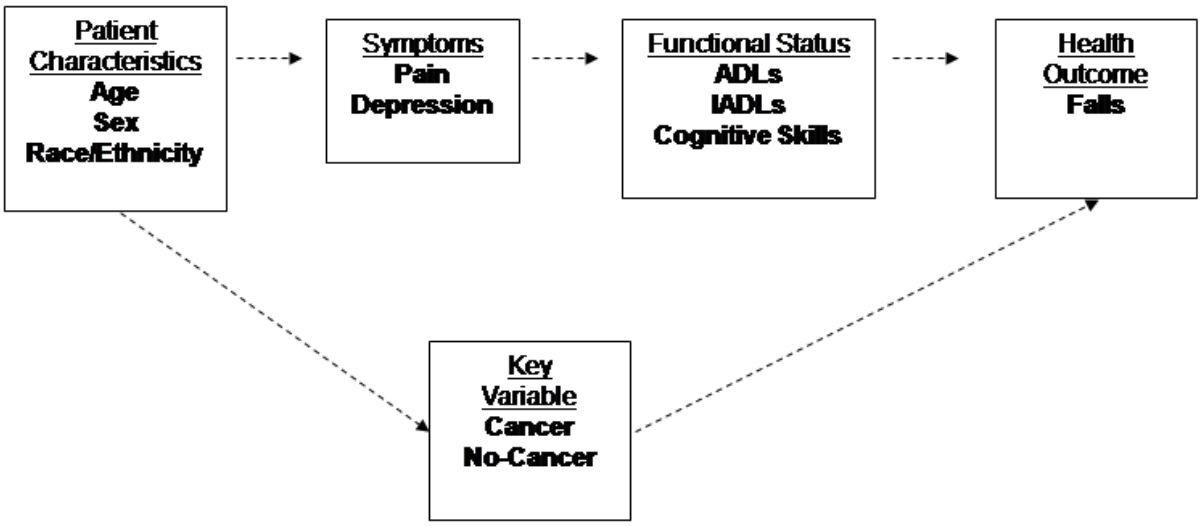

Table 1. Characteristics of Nonfallers and Fallers in Community Dwelling Elderly in the HCBS Program

Characteristic	Nonfallers n %*	Fallers n %*	Total n % *
Age Groups			
65-69	649 (12.2)	261 (12.8)	910 (12.2)
70-74	818 (15.4)	319 (15.6)	1137 (15.3)
75-79	960 (18.0)	354 (17.4)	1341 (17.6)
80-84	1144 (21.5)	438 (21.5)	1582 (21.2)
85-89	940 (7.7)	356 (17.5)	1296 (17.4)
90-94	545 (10.2)	207 (10.2)	752 (10.1)
≥95	267 (5.0)	104 (5.1)	371 (5.0)
Gender			
Female	4087 (71.8)	1533 (28.2)	5620 (76.4)
Male	1236 (70.3)	506 (29.7)	1742 (23.6)
Race or ethnicity			
White	3799 (71.4)	1670 (81.9)	5469 (74.3)
African American	1318 (24.8)	300 (14.7)	118 (22.0)
American Indian	11 (.2)	5 (.2)	16 (0.2)
Asian and Pacific Islander	28 (.5)	5 (.2)	33 (0.4)
Unknown	101 (1.9)	35 (1.7)	136 (1.8)
Hispanic	66 (1.2)	24 (1.2)	88 (1.2)
Cancer			
No diagnosis of Cancer	4588 (71.8)	1762 (27.6)	6350 (86.3)
Cancer not subject to treatment	419 (74.8)	138 (24.7)	557 (7.9)
Cancer subject to treatment	285 (68.9)	125 (30.3)	410 (5.8)
ADL (bathing assistance)			
Independent	887 (16.7)	264 (12.9)	1151 (19.0)
Supervision	433 (8.1)	137 (6.7)	570 (7.9)
Assistance Transfer Only	212 (4.0)	90 (4.4)	302 (4.3)
Assistance part of Bathing	2650 (49.8)	1229 (60.3)	3879 (50.3)
Total Dependence	1107 (20.8)	301 (14.5)	1408 (18.5)
IADL (how difficult it is to do an activity independently)			
No Difficulty	74 (1.4)	20 (1.0)	94 (1.3)
Some Difficulty	924 (17.4)	317 (15.5)	1241 (17.0)
Great Difficulty	4515 (81.1)	1690 (82.9)	6028 (81.7)
Cognitive skills (daily decision making)			
Independent	2069 (38.7)	659 (32.3)	2728 (36.9)
Modified Independence	1628 (30.6)	710 (34.8)	2338 (32.6)
Moderately Impaired	1199 (22.5)	516 (25.3)	1707 (23.2)
Severely Impaired	401 (7.5)	137 (6.7)	538 (7.3)
Vision			
Adequate	3127 (58.7)	1141 (56.0)	4268 (57.9)
Impaired	1547 (29.1)	615 (30.2)	2162 (29.7)
Moderately Impaired	344 (6.5)	148 (7.3)	492 (6.7)
Highly Impaired	176 (3.3)	89 (4.4)	265 (3.7)
Severely Impaired	109 (2.0)	38 (1.9)	147 (2.0)
Incontinence			
Continent	2096 (39.4)	698 (34.2)	2794 (37.7)
Usually Continent	825 (15.5)	331 (16.2)	1156 (15.8)
Occasionally Incontinent	762 (14.3)	341 (16.7)	1103 (14.9)

Frequently Incontinent	976 (18.3)	474 (23.2)	1450 (19.9)
Incontinent	621 (11.7)	177 (8.7)	798 (10.7)
Depression			
Not Exhibited in Last 30 days	4130 (77.6)	1377 (67.5)	5507 (74.9)
Exhibited up to 5 days/Wk	959 (18.0)	514 (25.2)	1473 (20.4)
Exhibited daily/Almost Daily	182 (3.4)	121 (5.9)	303 (4.7)
Pain			
No Pain	1453 (27.3)	455 (22.3)	1908 (25.7)
Pain Less Than Daily	1341 (25.2)	421 (20.6)	1762 (24.7)
Pain Daily	2474 (46.5)	1138 (55.8)	3612 (49.6)

* A small number of values are missing and n % does not always equal 100

Table 2. Multivariate Logistic Regression Analysis of Maximum Likelihood Estimates in Final Model Predicting Falls

Parameter	DF*	Estimate	Standard Error	Wald Chi-Square
Intercept	1	-0.9991	0.1626	37.7521
Age	1	-0.0025	0.0034	0.5347
Gender	1	0.0924	0.0326	8.0522
Race: White	1	0.2674	0.1428	3.5067
Race: African American	1	-0.3104	0.1509	4.2345
Race: American Indian	1	0.1926	0.5134	0.1408
Race: Asian/Pacific	1	-0.4932	0.4248	1.3480
Race: Hispanic	1	0.1633	0.2158	0.5727
ADL: Independent	1	-0.1567	0.0937	2.7967
ADL: Supervision	1	-0.1260	0.1102	1.3065
ADL: Supervision transfer	1	0.3051	0.1290	5.5979
ADL: Assistance Bathing	1	0.2703	0.0783	11.9115
ADL: Total Dependence	1	-0.1961	0.0950	4.2626
Continent	1	-0.1732	0.0483	12.8467
Usually Continent	1	-0.0011	0.0605	0.0004
Frequently Incontinent	1	0.1166	0.0604	3.7264
Incontinent	1	0.1753	0.0541	10.4958
Depression: none	1	-0.2964	0.0499	35.2299
Depression: exhibited	1	0.0540	0.0561	0.9270
No Pain	1	-0.0644	0.0439	2.1464
Pain	1	-0.1130	0.0445	6.4528

*DF=degrees of freedom

Table 3. Multivariate Logistic Regression Analysis of Odds Ratio Estimates in Final Model Predicting Falls

Effect	Point Estimate	95% Wald Confidence Limits	
Gender: Male vs* Female	1.203	1.059	1.367
Age	0.998	0.991	1.004
Race			
White vs Unknown	1.091	0.675	1.763
African American vs Unknown	0.612	0.373	1.004
American Indian v vs Unknown	1.012	0.282	3.631
Asian Pacific vs Unknown	0.510	0.174	1.492
Hispanic vs Unknown	0.983	0.530	1.824
ADL			
Independent vs Total Dependence	0.942	0.434	2.044
Supervision vs Total Dependence	0.971	0.442	2.134
Transfer vs Total Dependence	1.494	0.669	3.339
Assist Bathing vs Total Dependence	0.905	0.417	1.967
Incontinence			
Continent vs incontinent	0.946	0.768	1.165
Usually Continent vs Incontinent	1.123	0.895	1.411
Occasionally Continent vs Incontinent	1.264	1.008	1.585
Frequently Incontinent vs Incontinent	1.340	1.082	1.660
Depression			
No depression vs depressed	0.583	0.456	0.747
Some depression vs depressed	0.828	0.638	1.076
Pain			
No pain vs pain frequently	0.785	0.687	0.897
No pain vs pain daily	0.748	0.653	0.856

*vs means versus

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