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Differences Between Moderate to Severely Cognitively Impaired Fallers versus Non-fallers in Nursing Homes

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Abstract

INTRODUCTION: The purpose of this study was to test differences in psychotropic medication, function, physical activity, agitation, resistiveness to care, co-morbidities and depression among moderate to severely cognitively impaired nursing home residents who were fallers versus non-fallers.

METHODS: This was a secondary data analysis using baseline data from a randomized controlled trial testing the Function and Behavior Focused Care Intervention across 12 nursing homes. The sample included 336 older adults, the majority of whom were female and white.

RESULTS: There was a significant difference in the total number of comorbidities, agitation, the total number of psychotropic medications, depressive symptoms, and physical activity between those who fell and those who did not fall (Pillai-Bartlett Trace = 4.91, $p < .001$).

DISCUSSION: Findings support prior work except with regard to medication use, cognition and function. Due to inconsistent findings, additional research is recommended particularly with regard to use of specific drug groups and medications.

Keywords

Dementia; Function; Falls; Antipsychotics; Antidepressants; Anxiolytics; Nursing home residents

Repeatedly it has been noted that older adults, particularly those with cognitive impairment in nursing home settings, have a high rate of falls [1–3]. The rate of falls varies depending on the study population and how falls are reported with rates ranging from 4%–22% of the residents falling [1, 3, 4] or rates of 0.6 to 3.6 bed per year [2]. Older studies describing falls noted higher rates at 43% of residents falling with this increasing to 50% for those over the age of 80 [5]. Falls, particularly among those with cognitive impairment, result in disability, reduced quality of life, functional decline, fear of falling and high cost of health care. Serious injuries, including fractures or head trauma, occur in approximately 5–10% of those who fall [6–8]. Injury associated with a fall is even more likely for those with cognitive

impairment [8] as is a higher rate of morbidity and mortality after the fall when compared to those who are cognitively intact[9].

By definition, a fall is a multifactorial event caused by several risk factors that culminates in the person coming to rest inadvertently on the ground or lower level than he/she was previously seated, standing or lying[10]. Risk factors for falls include limited physical function, impaired vision, impaired cognition and mood, physical illness, such as orthostatic hypotension, medication side effects, and environmental hazards. For older adults with cognitive impairment living in long term care facilities the risk factors also include the type and severity of the dementia, behavioral symptoms such as wandering, psychological factors including agitation and depression, psychotropic medication use, restraints, and disease specific changes that alter gait and balance[11–19]. With regard to the use of psychotropics among nursing home residents, a Canadian study found that higher dosages in some drugs present greater risk than others (e.g., quetiapine and risperidone increasing the risk versus olanzapine which was not associated with falls) [20]. The use of restraints increased the risk of falls if the restraints were placed across the individual's trunk; conversely full bed rails were associated with fewer falls [18]. Demographic factors such as age and sex were not consistently associated with falls among cognitively impaired older adults [14].

Cognitive impairment, specifically the decline in executive function[21, 22], has consistently been associated with an increased risk of falls. Other previously noted risk factors associated with falls in cognitively impaired institutionalized older adults have not been well validated through repeated studies on large numbers of residents. In some cases, findings are contradictory. For example although the Steinberg and colleagues [23] showed that wandering was protective for falls a more recent study suggested that wandering increased the risk of falls[13]. Similar contradictions are noted with regard to the relationship between psychological factors such as anxiety and depression and falls. An earlier study by Brody et al [24] noted that there was no relationship between agitation and depression and falls while a recent study by Whitney et al[15] noted a significant association. The purpose of this paper, therefore, was to test if there were differences among moderate to severely cognitively impaired nursing home residents who were fallers versus not fallers in the use of psychotropic medication, function, physical activity, agitation, resistiveness to care, co-morbidities and depression.

We hypothesized that there would be a difference between individuals who had had at least one fall in the prior 4 months and those that had no falls with regard to total numbers of psychotropic medications given (antipsychotics, antidepressants and anxiolytics, anti-seizure medications, sedative/hypnotics), co-morbidities, agitation, depression, function and time spent in physical activity. In addition, testing for differences between fallers and non-fallers with regard to exposure to each type of psychotropic medications (e.g., antipsychotics, antidepressants) was done.

Methods

This was a secondary data analysis using baseline data from a randomized clinical trial testing the effectiveness of the Function and Behavior Focused Care intervention. The study

included 12 nursing homes in Maryland with approximately 20 to 40 residents recruited from each setting. The study was approved by a University based Institutional Review Board.

Sample

Residents were eligible to participate if they were 55 years of age or older, able to speak English, currently living in the nursing home, and scored 15 on the Mini Mental State Examination (MMSE) [25]. Residents were excluded from the study if they were receiving Hospice or sub-acute rehabilitation. If the resident did not pass the Evaluation to Sign Consent [26], he/she was asked to sign or verbally assent to participate and the proxy was contacted to complete the consent process. A total of 1512 residents were screened for participation. Of these 1014 (67%) were potentially eligible based on initial screening and 498 (33%) were not eligible as they were in hospice, rehabilitation, in the hospital, or younger than 55 years of age. A total of 527 (52%) of the 1014 potentially eligible residents or their proxies refused to provide consent or the proxies were simply not reachable. A total of 487 (48%) of the residents (or their proxies) consented to participate and were randomized. Additional screening for cognition resulted in 146 (30%) of those consented being deemed ineligible due to scoring greater than 15 on the MMSE. In addition, 2 individuals withdrew from the study and 3 died following consent leaving a total of 336 participants enrolled.

Measures

The following descriptive information was obtained: age, marital status, gender, race, education, and number of co-morbidities based on chart abstracting. Falls at baseline were obtained from the designated facility staff along with whether or not the individual was sent to the emergency room or admitted to the hospital associated with the fall and/or if there was a fracture or other type of serious injury such as head trauma. Function was based on the Barthel Index (BI) [27] a 14 item measure that assesses an individual's ability to perform basic activities of daily living such as bathing, dressing, and ambulating. A total score of 100 indicates complete independence in self-care. There is sufficient evidence for the reliability and validity of the Barthel Index when used with older adults, individuals with progressive neurological conditions, and when proxy respondents were utilized to report the functional abilities of dementia patients [28, 29]. Verbal report of function was obtained from the nursing assistant who was assigned to the resident's care on the day of data collection. The nursing assistants also provided verbal reports of the time spent in activity based on the Physical Activity Survey for Long Term Care (PAS-LTC)[30]. The PAS-LTC consists of 66 physical activities commonly performed by residents in a long term care setting. Activities are divided into mobility (e.g., walking to the dining room), personal care activities (e.g., bathing and dressing), structured exercise (e.g., activity classes or therapy), recreational activities (e.g., reading, knitting), and repetitive activities (wandering, folding and unfolding towels). Prior use of this measure, provided evidence for inter-rater reliability ($r=.82-.94$, $p<.05$), and validity based on a statistically significant relationship with actigraphy readings ($r=.55-.60$, $p<.05$) [30].

Depressive symptoms were measured using the Cornell Scale for Depression in Dementia (CSDD), a 19 item survey designed to assess depressive symptoms in individuals with dementia [31]. A score above 10 signifies a probable major depression, and a score above 18 indicates a definite major depression. There is sufficient evidence of reliability and validity of the CSDD [31, 32]. Agitated behaviors were measured using the Cohen-Mansfield Agitation Inventory (CMAI), which is a survey of disturbing behaviors commonly found in long term care residents with dementia [33, 34]. The 14 item version of the CMAI (short form) uses a 5-point Likert scale to rate the frequency of behavioral symptoms in individuals with cognitive impairment, and is based on the factor structure of the original CMAI inventory. Prior research provided evidence of the reliability and validity of this measure [33, 34]. Resistiveness to care was measured using the Resistiveness to Care scale which involves direct observation of a care interaction [35]. The items on the Resistiveness to Care Scale include 13 behaviors exhibited by older adults with dementia that may occur during care interactions with staff, such as turning away, pulling away, pushing away, hitting, saying no to care opportunities, crying, etc. There is support for the validity and reliability of the instrument (Mahoney et al., 1999; Galik et al., 2017).

In addition, we considered the impact of medications that are known to increase the risk of falls among older adults. These included use of an antidepressant, an antipsychotic, anxiolytics, anti-seizure medications, or sedative/hypnotics.

Data Analysis

Descriptive analyses were done to describe the sample. A multivariate analysis of variance was done to determine if there was a difference between individuals who had had at least one fall in the prior 4 months and those that had no falls with regard to total numbers of psychotropic medications given (antipsychotics, antidepressants and anxiolytics, anti-seizure medications, sedative hypnotics), co-morbidities, agitation, resistiveness to care, depression, function and time spent in physical activity. A second model was tested to explore the association between participants who were taking any of the individual psychotropic medications and having experienced a fall. The Pillai-Bartlett trace was used to determine multivariate significance. The Box's M was used to test the assumption of homoscedasticity using the F distribution, and Mauchly's Tests of Sphericity were used to determine that the variance/covariance matrix of the dependent variables was circular in form. In all cases when Mauchly's test was significant the Geisser-Greenhouse correction was used. A p value of less than 0.05 was used to determine significance.

Results

As shown in Table 1, the residents were mostly female (n=242,72%) and white (n= 199, 59%), with a smaller percent black (n=133, 40 %) or Asian (n= 4, 1%). A little over a quarter of the sample were still married (n= 93, 27%) and the remaining were never married, widowed, divorced or separated. The mean age of residents was 82.6 (SD= 10.1) and the mean MMSE was 7.8 (SD=5.0). Approximately a third of the sample experienced a fall within the prior 4 months (N=98, 29%). Of those that fell, 59 (18%) had one fall, 27 (8%) had two falls, 8 (2%) had three falls, 3 (1%) had four falls, 4 had five falls (1%), 2 had six

falls (1%), 1 had seven falls (.5%) and 3 (1%) had eight falls. Overall there were a total of 211 falls and of these 2 falls (1%) required that the resident be sent to the hospital and admitted, there were 2 falls in which the residents were sent to the emergency room, there was 1 fall that resulted in a fracture (1%), and there were 206 (97%) falls that resulted in no injury and no hospitalization associated with the fall.

The majority of participants received at least one psychotropic medication (N=243, 72%). Of those that received psychotropic medications, 68 received at least one anxiolytic (20%), 107 (32%) at least one anti-seizure medication, 60 (18%) at least one antipsychotic medication, and 172 (51%) were on at least one antidepressant. There were no participants who were taking a sedative/hypnotic medication.

Overall the participants had 3 co-morbidities (mean = 2.9, SD=1.6), the mean total number of resistive behaviors was .8 (SD=1.9), mean agitation was 20.0 (SD=6.3) out of a range of 14 to 70, mean score on the Barthel Index was 45.7 (SD=27.5) indicating significant functional impairment among participants, a mean of 4.2 (SD=4.0) on the Cornell Scale for depression in dementia indicating that overall, there was no evidence of depression. The participants engaged in a mean of 133.4 (SD=192.7) minutes of physical activity over a 24 hour period as reported based on the activities within the PAS-LTC.

There was no statistically significant association between the fallers and non-fallers based on age, gender, education, race, or cognition, therefore we did not control for these variables in the multivariate analysis. As shown in Table 2, there was a significant difference in total number of co-morbidities, agitation, total number of psychotropic medications, depressive symptoms, and time spent in physical activity between those who fell and those who did not fall (overall Pillai-Bartlett Trace was 4.91, $p<.001$). Specifically, those who did not fall had more co-morbidities ($F=4.3$, $p=.01$), less agitation ($F=6.1$, $p=.01$), fewer psychotropic medications ($F=4.0$, $p=.01$), fewer depressive symptoms ($F=6.9$, $p=.01$) and spent less time in physical activity ($F=4.6$, $p=.01$) than those who fell. There was no difference between the groups with regard to function ($F=2.3$, $p=.08$), resistiveness to care ($F=1.0$, $p=.50$) or cognition ($F=.66$, $p=.57$). When testing the use of psychotropic medication classes individually, the overall multivariate test was non-significant (Pillai-Bartlett Trace = 1.38, $p=.21$). There was no difference among fallers versus non-fallers as to whether or not they received an anti-seizure medication, anti-depressant, anxiolytic, anti-psychotic medication.

Discussion

The findings from this study supported prior work exploring differences between fallers and non-fallers in samples of cognitively impaired residents in nursing home settings. Specifically, we found that those who experienced a fall had fewer comorbidities, more agitation and depression, spent more time in physical activity and were on more psychotropic medications than those who did not experience a fall [14,16, 19, 24,36, 37]. In contrast to prior work, we did not find differences in the groups with regard to function and cognition. We anticipate that the lack of difference in cognition was due to the fact that they all had impaired executive function and thus were all equally at risk for falls[21]. Likewise with regard to function, all of the participants needed help with the majority of their

activities of daily living and were therefore less likely to be engaging in these activities independently which is when falls are most likely to occur.

In terms of medication use and falls, study findings consistently note that there is a relationship between being on a psychotropic medication and falling [1, 14, 15]. There is less consistency in terms of which medication group or even which drug within a drug group puts residents' at greatest risk for falls. Some studies have shown that exposure to an anxiolytic, antipsychotic or antidepressant can individually put the resident at risk for falls [16, 19, 20]. It has further been suggested that dosing of specific antipsychotics may influence risk of falls[20]. For example, exposure to high dose quetiapine and high dose risperidone increased the risk of falls among nursing home residents while olanzapine, regardless of dose, was not associated with fall risk. Ongoing research is needed to continue to explore the individual impact of psychotropic medications and individual drugs within each of the drug groups on risk of falling. In addition, consideration of the reason for the use of the drugs should be included in future work as it may impact the risk of experiencing a fall. For example, if the drug is being used appropriately for agitation or depression then treatment may actually help decrease the risk of falling. Conversely, if a drug is being given inappropriately or is ineffective or insufficient to treat the underlying target symptom, then the use of the drugs may increase risk of falling.

In our sample, more time spent in physical activity was noted among our group of fallers. The PAS-LTC included meaningful activities such as performance of functional tasks (e.g., toileting), engaging in recreational activities, exercise activities as well as repetitive physical activities such as wandering, sorting and rearranging things, folding and unfolding items such as towels, or taking on and off clothing. When the subtotal for Repetitive Physical Activity from the PAS-LTC was considered individually there was a significant difference ($F=4.09$, $p=.04$) in time spent in these activities between those who fell (mean = 36.63, $SD=91.80$) and those who did not fall (mean = 18.24, $SD=56.15$). This does not support prior findings suggesting that wandering is protective against falls[23]. It is possible, however, that the protective value of wandering among community dwelling older adults with dementia may be reversed in situations in which gait is unsteady, the resident has poor attention and orientation, or is anxious or agitated [13, 15] which is often more common among nursing home residents with moderate to severe cognitive impairment.

The overall time spent in physical activity among all residents was only 135.11 minutes or approximately two hours and 15 minutes per day. The remaining time 21 hours and 45 minutes was spent sitting or lying. This level of physical activity certainly does not meet the recommended requirements of 30 minutes of moderate physical activity for older adults [38]. Moreover it suggests that, although challenging to establish, there is a need to increase the time these individuals are spending in participating in personal care tasks, in recreational activities, and monitored opportunities for physical activity. Interventions such as those used in Function and Behavior Focused Care are effective in helping staff to evaluate the resident's underlying physical and cognitive ability and appropriately match functional and physical activities to his or her level of capability [39, 40].

Although over half of the sample experienced a fall resulting in a total of 211 falls, only 2% of these resulted in an injury. While the overall rate and percentage of residents falling is similar to prior research [41], the rate of injury is much lower than previously reported [41]. Risk factors for injuries associated with falls have included increasing age (particularly those 80 years of age and older), female gender, being ambulatory and inappropriate footwear [41]. It is possible that there was less injury associated with falls in this sample due to a relatively young mean age. It is also possible that injuries were defined differently across the studies (i.e. , some studies consider skin tears an injury while others consider only head trauma or fractures as injuries). In our study, we defined injuries as those that involved a hospitalization and/or resulted in a known fracture. This also may explain our lower rates of injuries associated with falls.

Study Limitations

This study was limited by virtue of being a secondary data analysis using baseline data and thus was not developed to compare fallers and non-fallers among moderate to severely impaired residents. The sample included in this study was selective in that these individuals consented to participate in research and there was no evidence of depression, limited agitation, and little resistiveness to care. Additionally, because a thorough cognitive assessment battery was not conducted, we were unable to explore differences based on severity of cognitive impairment and type of dementia. The measures used in this study were based on direct observation and/or verbal report by the nursing assistant working with the resident on the day of testing. Thus, our findings may have been biased by those subjective reports. Despite these limitations, the study provides support for previously established risk factors for falls among cognitively impaired nursing home residents. Further, the findings of this study suggest a need for future research in the area of medication use and falls and in ways in which to safely increase time spent in physical activity among these residents

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Table 1

Demographic Description of the Sample

Variable	N (%)
Gender	96 (28%)
Male	245 (72%)
Female	
Race/Ethnicity	134(39%)
Black	203(60%)
White	4(1%)
Asian	23 (7%)
Hispanic	318 (93%)
Yes	
No	
Marital Status	93(28%)
Married	47(14%)
Never married	131(38%)
Widowed	42(12%)
Divorced	3 (1%)
Separated	24 (7%)
Unsure	

Table 2

Description of the Sample and Results of the Multiple Analysis of Covariance

Variable	Falls Mean (SD)	No Falls Mean (SD)	Total Group Mean (SD)	F (p [*])
Total Number Comorbidities	2.6(1.6)	3.1(1.6)	2.9(1.6)	4.3(.01)
Barthel Index: Activities of Daily Living	50.7(28.4)	44.1(27.0)	46.0(27.6)	2.3(.08)
Cohen Mansfield Agitation Index	22.2(7.2)	19.3(5.9)	20.1(6.4)	6.1(.01)
Resistance to Care	1.9(5.0)	2.0(4.7)	1.9(4.8)	1.0(.50)
Total Number of Psychotropic Medications	.28(.58)	.18(.45)	.21(.49)	4.0(.01)
Cognition	7.8 (5.0)	7.7(5.1)	7.7(5.1)	0.67(.57)
Cornell Depression Scale	5.2 (3.8)	3.8(4.0)	4.2(4.0)	6.9(.01)
Physical Activity Survey	186.7(319.4)	114.1(107.5)	135.3(196.9)	4.7(.01)

* Significant at the 0.05 level

Table 3

Results of the Multiple Analysis of Covariance for individual Drug Group Use

Variable	Falls Mean (SD)	No Falls Mean (SD)	Total Group Mean (SD)	F (p [*])
Anti-Seizure Medication	.46(.72)	.41(.73)	.43(.73)	17.32(.01)
Antidepressant Medication	.54(.50)	.50(.50)	.51(.50)	.81(.49)
Anxiolytic Medication	.24(.43)	.18(.39)	.20(.40)	.54(.65)
Antipsychotic Medication	.23(.43)	.15(.36)	.17(.38)	3.31(.02)

*
Significant at the 0.05 level