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Gender, Pain, and Function Associated with Physical Activity After Hospitalization in Persons Living with Dementia

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Abstract

Background: The purpose of this study was to identify factors that are associated with physical activity after hospitalization in persons living with dementia.

Methods: Multiple linear regressions were conducted to test factors associated with objective activity levels (sedentary, low, moderate, and vigorous) among 244 patients living with dementia from a randomized controlled trial.

Results: Within 48 hours of hospital discharge, time in sedentary behavior was associated with increased pain (β=.164; p=.015). Time in low activity was associated with less pain (β=−.130; p=.049) and higher physical function (β=.300; p = <.001). Time in moderate activity was associated with increased physical function (β=.190; p=.008) and male gender (β=.155; p=.016). No significant associations of potential factors were found with time in vigorous activity.

Conclusions: Our findings suggest that managing or reducing pain, encouraging individual functional level, and gender could influence time spent in physical activity after an acute hospitalization in persons living with dementia.

Keywords

actigraphy; dementia; hospital discharge; older adults; physical activity

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Disclosure Statement

No potential conflict of interest was reported by the authors.

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Introduction

Recovering from acute hospitalization can pose significant challenges for older adults as they strive to readjust to their regular activities and restore their previous level of functioning.[1–3] About 30–60% of adults 65 years of age and older experience functional decline (a decrease in the ability to engage in activities of daily living) during their hospital stay, associated with prolonged periods of inactivity during hospitalization.[4–6] Loss of function may continue for months after hospitalization with 30–50% of older patients not being able to restore their baseline function within a year after discharge.[4–7] The consequences of functional decline include increased risk of hospital readmission,[8] long-term care placement,[9,10] reduced quality of life,[7] and early mortality.[4] In addition, medical costs increase proportionately with the level of functional impairment at one year after discharge, resulting in potential economic impact due to functional loss after hospitalization.[11]

Physical activity can help older adults return to baseline function following hospitalization.[3] Physical activity has several benefits for older adults as it can improve physical and cognitive function, boost mental health, reduce falls, prevent delirium, and lower risk of disease in older adults.[12,13] Despite the established benefits of physical activity, low physical activity is common in older adults after hospitalization from an acute illness.[1,3,14] Prior work has shown that low levels of physical activity in older adults can persist six months following hospitalization.[15] Some barriers to lack of physical activity among older adults after hospitalization can include poor cognitive function, physical limitations, social isolation, poor nutritional status, and psychological symptoms.[1,16,17] Persons living with dementia are even more susceptible to lower levels of physical activity after hospitalization due to increased risk of significant functional decline and delirium acquired during hospitalization.[18]

Physical activity is associated with a variety of factors including physical, cognitive, and psychological health, as well as demographic characteristics in older adults.[1,12,15,17,19–22] Demographic factors including male gender, younger age, and White race have been associated with increased physical activity.[17,19,20] In addition, clinical factors associated with higher levels of physical activity include increased physical function, less co-morbidity, lower depression, less behavioral symptoms, reduced pain, and decreased delirium severity.[1,12,15,20,21] However, these studies were focused on older adults without cognitive impairment.[1,12,15,17,19–21] Little is known about factors associated with physical activity in individuals living with dementia after hospitalization, who are at high risk for low activity during this transition period.

The purpose of this study was to examine demographic and clinical factors that are associated with physical activity after an acute hospitalization in persons living with dementia. It was hypothesized that male gender, younger age, White race, higher physical function, lower depression, less behavioral and psychological symptoms of dementia (BPSD), reduced pain, and decreased delirium severity would be associated with more physical activity after hospitalization. Findings from this study will identify factors to help

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inform targeted interventions to increase physical activity in persons living with dementia after hospitalization.

Methods

Design

This was a secondary analysis of a cluster randomized controlled trial testing Family centered Function-focused Care (Fam-FFC), registered in ClinicalTrials.gov identifier: NCT03046121. Fam-FFC is a nurse-family caregiver partnership model aimed to improve: 1) the physical and cognitive recovery in hospitalized persons living with dementia during hospitalization and the 60-day post-acute period; and 2) family care partner preparedness and experiences. The study protocol was approved by the University Institutional Review Board and has been published.[23]

Sample

Data for 244 patients throughout six medical units in three community teaching hospitals in Pennsylvania were included. The sample for this study was selected based on the availability of physical activity data from the parent study. Patients were eligible to participate if they: 1) were ≥ 65 years; 2) spoke English or Spanish; 3) lived in a community prior to hospital admission; 4) had evidence of dementia based on a score of ≥ 2 on the AD8 Dementia Screening Interview[24] and a score of ≤ 25 on the Montreal Cognitive Assessment (MoCA)[25]; 5) indicated very mild to moderate stage dementia on the Clinical Dementia Rating Scale (CDR; score of 0.5 to 2.0)[26]; 6) demonstrated functional impairment on the Functional Activities Questionnaire (FAQ; score of ≥ 9)[27]; and 7) had a family care partner to participate as designated study partner. Patients were excluded from participation if they: 1) were admitted from a nursing home; 2) were receiving hospice services; or 3) had a neurological disorder associated with cognitive impairment other than dementia (e.g., brain tumor) or had evidence of a major acute psychiatric condition.

Procedures

Data were collected by trained research evaluators, blinded to the intervention through chart review (patient demographics, comorbidities, length of stay) and patient report (cognition) within 48 hours of hospital admission. Patient physical function, depression, BPSD, pain, and delirium severity were collected within 48 hours of hospital discharge through observation or family caregiver report. Additionally, within 48 hours of discharge, the MotionWatch 8 (MW8; activity monitoring device with an accelerometer)[28] was applied on the participant's non-dominant wrist.[29] The intended plan was for the patient to wear the MW8 for 24-hours consecutively over a one-time period. Only MW8 data with a minimum of 10 hours of wear time in a 24-hour period were included in this study.[30] Thus, the range of wear time of the MW8 for the sample in this study was 10–24 hours.

Measures

The independent variables included gender, age, race, physical function, depression, BPSD, pain, and delirium severity. Gender, age, and race were obtained from chart review. Physical function was assessed using the Barthel Index (BI), a 10-item instrument.[31] The BI evaluates

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performance in activities of daily living related to mobility, self-care, and bowel/bladder functions. Total scores range from 0 (total dependence) to 100 (total independence). Prior testing of the BI has established strong reliability and validity.[31]

Depression was measured using the Cornell Scale for Depression in Dementia (CSDD), a 19-item questionnaire that evaluates severity of depressive symptoms in five domains including mood-related signs, behavioral disturbances, cyclic functions, and ideational disturbance.[32] Each item is scored from 0 to 2 (0=absent, 1=mild, and 2=severe), and total scores can range from 0–38. Higher scores on the CSDD indicate greater depression symptoms; a score of 6 or greater indicates depression. The CSDD has acceptable reliability and validity.[32]

Behavioral and Psychological Symptoms of Dementia (BPSD) were evaluated using the Brief Neuropsychiatric Inventory (NPI-Q).[33] The measure consists of 12 domains: delusions, hallucinations, agitation/aggression, dysphoria/depression, anxiety, apathy, irritability, euphoria, disinhibition, aberrant motor behavior, sleep disturbances, and appetite and eating disturbances. Each domain/item was based on a three-point scale (1=mild, 2=moderate, and 3=severe) evaluating the severity of behavioral expressions. Total scores are the sum of each item and can range from 0 to 36. Higher scores indicate greater levels of BPSD severity. The NPI-Q has evidence of validity and reliability.[33]

Pain was measured using the Pain Assessment in Advanced Dementia (PAINAD), a 5-item observational instrument.[34] The assessment consists of five domains including breathing independent of vocalization, negative vocalization, facial expression, body language, and consolability. Items are scored from 0 (no pain) to 2 (severe pain). Total scores range from 0 to 10; 1 to 3=mild pain, 4 to 6=moderate pain, and 7 to 10=severe pain. The PAINAD has demonstrated good psychometric properties; concurrent validity (Kendall's $\tau = 0.73$) and interrater agreement ($\kappa = .74$).[35]

Delirium severity was measured using the Confusion Assessment Method Short Form (CAM-S).[36] CAM-S consists of 4-items and evaluates acute onset, inattention, disorganized thinking, and altered level of consciousness. Items are scored from 0 to 7, and higher scores denote greater delirium severity. Prior research of the CAM-S has demonstrated strong psychometric properties.[36]

The outcome variable was physical activity which was measured using four actigraphy-derived variables via the MW8 (sedentary behavior, low activity, moderate activity, and vigorous activity). The device collected data in 1-minute epochs. Activity counts are the unit of measurement, evaluated by the number of times the waveform crosses 0 for each period being measured. We used activity levels based on prior study cut points for older adults: sedentary (≤ 178 counts per minute), low activity (≥ 179–561 counts per minute), moderate (≥ 562–1019 counts per minute minute), and vigorous activity (≥ 1,020 counts per minute).[29] The MW8 has established evidence of feasibility, construct validity, and predictivity in persons living with dementia.[37]

The covariates included length of stay, cognition, and comorbidities, which have been previously found to influence physical activity in older adults.[1,14,20] Length of stay

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(including admission date to discharge date) and comorbidities (evaluated with the Charlson Comorbidity Index [CCI])[38] were extracted through chart review. Cognition was measured using the MoCA,[25] which evaluates executive functioning, orientation, memory, abstract thinking, and attention. The total score of the MoCA ranges from 0–30, and a score of less than 26 indicates mild cognitive impairment (MCI). The MoCA has demonstrated excellent sensitivity and specificity in detecting MCI,[25] and it has been shown to be a valid and reliable tool in culturally diverse populations.[39]

Data Analysis

Descriptive statistics were performed to describe participant characteristics using proportions and means. Data were assessed for missing values, presence of outliers, and normality. We conducted multiple stepwise linear regressions to test the association of potential predictors (gender, age, race, physical function, depression, BPSD, pain, and delirium severity) and covariates (length of stay, cognition, and comorbidities) with time spent in each level of physical activity (sedentary behavior, low activity, moderate activity, and vigorous activity). A step method of entry-level probability of F set at $p = .05$ and removal level at $p = .10$ was utilized. We entered the covariates in the model first, followed by the predictor variables. No issues with multicollinearity were identified since variance inflation factors were less than 10 and tolerance values were greater than 0.10. Statistical significance level was set to $p \leq 0.05$ and all analyses were conducted using SPSS (version 25; IBM Corp, Armonk, NY).

Results

Table 1 shows the descriptive characteristics of 244 participants from the Fam-FFC study. Participants were Black (51.2%) and White (48.8%); most were female (59.8%), non-Hispanic (98.4%), widowed (44.7%), high school graduates (36.9%), and had a mean age of 81.51 (SD=8.36). The participants had an average of 3.8 (SD=2.4) comorbidities and an average score of 10.8 (SD=7.0) on the MoCA indicating moderate to severe cognitive impairment. Among the participants, the mean length of hospital stay was 6.0 (SD=4.1) days. The sample had low levels of delirium and pain based on a mean CAM-S score of 0.7 (SD= 1.3) and mean PAINAD score of 0.7 (SD=1.4), respectively. Additionally, the participants had mild BPSD (NPI-Q; mean score of 7.1, SD=6.0), some depression (CSDD; mean score of 7.6, SD=6.0), and moderate functional impairment (BI; mean score of 66.7 (SD=27.1). On average, within 48 hours of discharge, the participants spent 1200.5 (SD=239.1) minutes in sedentary behavior, 218.9 (SD=183.6) minutes in low activity, 16.7 (SD=46.0) minutes in moderate activity, and 3.9 (SD=23.8) minutes in vigorous activity. Thus, among the participants, 83.3% of time was spent on sedentary behavior, 15.2% of time was spent in low activity, 1.2% of time was spent in moderate activity, and 0.3% was spent in vigorous activity.

Table 2 shows the factors associated with sedentary behavior, low activity, moderate activity, and vigorous activity within 48 hours of hospital discharge. While controlling for length of hospital stay, cognition, and comorbidities, time in sedentary behavior was associated with increased pain (β=.164; p=.015). Time in low activity was associated with less pain

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(β=−.130; *p*=.049) and higher physical function (β=.300; *p* = <.001). Time in moderate activity was associated with increased physical function (β=.190; *p*=.008) and male gender (β=.155; *p*=.016). No significant associations of potential factors were found with time in vigorous activity.

Discussion

The present study examined demographic and clinical factors associated with physical activity in persons living with dementia after an acute hospitalization. This study found that on average, 83.3% of the participants' time was spent in sedentary behavior after hospital discharge, confirming that persons living with dementia have low levels of physical activity following hospitalization and there is a need to increase physical activity in this population.[18]

The hypothesis in this study was partially supported in that we found male gender, less pain, and increased physical function at discharge were associated with higher levels of physical activity after hospitalization. However, age, race, depression, BPSD, and delirium severity were not significantly associated with physical activity. Our findings are consistent with other work in older adults without cognitive impairment who have varying medical conditions.[1,15,20,21] For example, a systematic review found that that men have significantly more participation in activity compared to women after a cardiac event.[20] In addition, previous studies have found that physical limitations such as increased pain and walking difficulties are associated with lower physical activity in older adults after hospitalization.[1,15,21]

Our study adds to prior work with objective data examining demographic and clinical factors associated with physical activity in persons living with dementia after an acute hospitalization. The findings underscore the need to incorporate education that includes physical activity engagement adapted to individual functional ability during hospital discharge planning. Future research is recommended to include a longitudinal examination of factors associated with physical activity in persons living with dementia beyond the immediate period after hospitalization.

In our study, the examined factors accounted for 8.2% of variance for sedentary behavior, 18.1% of variance for low activity, 11.1% of variance for moderate activity, and 6.0% of variance for vigorous activity; the low variances suggest the need to explore additional factors. Thus, future research should examine factors such as social influences (e.g., social support), self-efficacy, motivation, nutritional status, living environment, and socio-economic status that could influence physical activity following hospital discharge.[1,17,40]

In contrast to prior research,[1,12,17,19] age, race, depression, BPSD, and delirium severity were not significantly associated with physical activity in our study. These findings should be assessed with caution because most of our sample had lower levels of depression, BPSD, and delirium severity. It is possible that higher levels of depression, BPSD, and delirium severity could be associated with physical activity in persons living with dementia post-hospitalization. Additionally, we did not examine social, environmental, or disease-

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related factors among our participants which could influence demographic characteristics and physical activity during post-hospitalization transition.[17,19] Future work should include a more in-depth analysis of the contribution of these factors and physical activity in persons living with dementia after hospitalization.

Strengths and Limitations

A strength of this study was the inclusion of an underrepresented population, hospitalized persons living with dementia, who were identified through a rigorous assessment process. In addition, the study examined physical activity after an acute hospitalization, which has been underexamined in this vulnerable population.

Limitations of this study include the use of secondary analysis and cross-sectional data. Thus, we did not examine other factors that could influence physical activity in persons living with dementia after hospitalization such as living environments, social support, active medical conditions, health and social services provided, medications, and mental health issues. In addition, we only used objective measures of physical activity, and self-reported or informant-reported physical activity were not evaluated. Future studies should include measures to capture subjective aspects of physical activity such as perceived barriers and facilitators to engage in activity. Although the physical activity data in this study provides some understanding of the physical activity of persons living with dementia immediately post hospitalization, it does not adequately reflect their physical activity post hospitalization in general. Lastly, the generalizability of our results was limited by the population consisting of patients from only three hospitals in one state.

Conclusions

Despite these limitations, our findings suggest that reducing or managing pain may decrease time spent in sedentary behavior and increase time spent in physical activity after an acute hospitalization in persons living with dementia. Additionally, there is a need to encourage physical activity that is adapted to the individual's functional level after hospitalization (with the goal of maximizing function). Gender should also be recognized as a factor that could influence time spent on physical activity; findings suggest that gender-related preferences should be explored. Our findings inform strategies to increase physical activity in persons living with dementia following hospitalization. It is recommended that physical activity is given further attention during discharge planning to help support the needs of persons living with dementia and minimize functional decline after hospitalization. Future research is warranted to further extend this work by examining types of physical activity after an acute hospitalization in persons living with dementia.

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Table 1.

Participant Characteristics (N=244)

Characteristics		N (%)	Mean (SD)
Gender	Female	146 (59.8)	
	Male	98 (40.2)	
Race	White	119 (48.8)	
	Black	125 (51.2)	
Ethnicity	Not Hispanic or Latino	240 (98.4)	
	Hispanic or Latino	4 (1.6)	
Education	Less than high school	47 (19.3)	
	High school graduate	90 (36.9)	
	Some college or technical school	37 (15.2)	
	College graduate	33 (13.5)	
	Graduate or professional school	27 (11.1)	
	Unknown	10 (4.1)	
Marital Status	Married	76 (31.1)	
	Single	19 (7.8)	
	Divorced	33 (13.5)	
	Widowed	109 (44.7)	
	Separated	3 (1.2)	
	Unknown	4 (1.6)	
Age, year (range 65–101)			81.5 (8.3)
Length of Stay, days (range 1–27)			6.0 (4.1)
Physical Function (BI, range 3–100)			66.7 (27.1)
Cognition (MoCA, range 0–25)			10.8 (7.0)
Comorbidities (CCI, range: 0–12)			3.8 (2.4)
Delirium Severity (CAM-S; range 0–6)			0.7 (1.3)
Pain (PAINAD, range 0–7)			0.7 (1.4)
Depression (CSDD, range, 0–36)			7.6 (6.0)
Behavioral and Psychological Symptoms (NPI-Q, range 0–30)			7.1 (6.0)
Physical Activity (MW8 counts, range 5–801.6)			118.0 (103.1)
Sedentary Behavior (MW8 minutes, range 602–2186)			1200.5 (239.1)
Low Activity (MW8 minutes, range 18–986)			218.9 (183.6)
Moderate Activity (MW8 minutes, range 0–371)			16.7 (46.0)
Vigorous Activity (MW8 minutes, range 0–284)			3.9 (23.8)

Note: MoCA, Montreal Cognitive Assessment; CCI, Charlson Comorbidity Index; CAM-S, Confusion Assessment Method Short Form; PAINAD, Pain Assessment in Advanced Dementia; CSDD, Cornell Scale for Depression in Dementia; NPI-Q, Brief Neuropsychiatric Inventory; BI, Barthel Index; MW8, MotionWatch 8.

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Table 2.

Multiple stepwise linear regression analyses of factors associated with physical activity levels (N=244)

Factors	β	SE	B	*p*	R^2	Adjusted R^2
Model: Sedentary Behavior: $F_{8, 232}$ =2.598; p=0.010						
Gender (ref: Female)	.061	44.487	42.131	.345	.082	.051
Age	.039	2.737	1.598	.560		
Race (ref: White)	−.104	43.161	−70.673	.103		
Physical Function	−.117	.859	−1.465	.089		
Depression	.033	5.294	1.826	.730		
BPSD[a]	.010	5.254	0.562	.915		
Pain	**.164**	**16.280**	**39.911**	**.015**		
Delirium Severity	1.701	18.412	31.701	.086		
Length of Hospital Stay	.032[b]	-	-	.629		
Cognition	−.043[b]	-	-	.563		
Comorbidities	.085[b]	-	-	.202		
Model: Low Activity: $F_{9,231}$ =5.661; p<.001						
Gender (ref: Female)	.005	24.068	1.907	.937	.181	.149
Age	−.034	1.542	−.778	.614		
Race (ref: White)	−.078	24.405	−29.969	.221		
Physical Function	**.300**	**.483**	**2.133**	**<.001**		
Depression	−.041	2.847	−1.293	.650		
BPSD[a]	.009	2.873	.274	.924		
Pain	**−.130**	**9.128**	**18.013**	**.049**		
Delirium Severity	−.068	10.181	−9.932	.330		
Length of Hospital Stay	.030[b]	-	-	.869		
Cognition	.134	1.965	3.660	.064		
Comorbidities	.090[b]	-	-	.905		
Model: Moderate Activity: $F_{9,231}$ =3.217; p=.001						
Gender (ref: Female)	**.155**	**5.734**	**13.922**	**.016**	.111	.077
Age	−.020	.367	−.106	.773		
Race (ref: White)	−.096	5.814	−8.450	.147		
Physical Function	**.190**	**.115**	**.308**	**.008**		
Depression	−.049	.678	−.356	.600		
BPSD[a]	−.009	.684	−.066	.924		
Pain	−.038	2.217	−1.204	.588		
Delirium Severity	.018	2.425	.610	.802		
Length of Hospital Stay	.083[b]	-	-	.869		
Cognition	.110	.468	.685	.144		
Comorbidities	−.063[b]	-	-	.905		

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Factors	β	SE	B	*p*	R^2	Adjusted R^2
Model: Vigorous Activity: $F_{11,229}$ =1.460; p=.148						
Gender (ref: Female)	.061	2.114	1.944	.359	.066	.021
Age	.119	.142	.224	.117		
Race (ref: White)	−.120	2.138	−3.750	.081		
Physical Function	.064	.043	.037	.385		
Depression	.065	.251	.168	.506		
BPSD[a]	.018	.250	.047	.853		
Pain	−.064	.813	−.719	.377		
Delirium Severity	−.010	.892	−.120	.893		
Length of Hospital Stay	**.193**	**.260**	**.734**	**.005**		
Cognition	.096	.173	.213	.221		
Comorbidities	−.035	.435	−.227	.602		

Note: Length of hospital stay, cognition, and comorbidities are covariates.

a=Behavior and Psychological Symptoms.

b=Excluded from stepwise regression.