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The Impact of Home Health Physical Therapy on Medicare Beneficiaries with a Primary Diagnosis of Dementia:

A secondary analysis of Medicare data

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Abstract

Background: Dementia is a leading cause of disability for adults over 65. Exercise intervention slows functional decline and improves balance, however the efficacy of physical therapy (PT) services for persons with dementia is unknown. The purpose of this study is to assess the effect of home health PT services on physical function for Medicare beneficiaries with a primary diagnosis of dementia.

Design: Observational cohort study using a combined Medicare data set of home health beneficiaries; we performed augmented inverse probability weighted regression with demographic, comorbidity, and symptom level characteristics analyzed as covariates.

Setting: Home health care, United States, 2012

Participants: Medicare beneficiaries who had a primary diagnosis of dementia and home health function evaluations at discharge, n = 1477.

Intervention: Physical therapy treatment, examined by 1) any PT and 2) PT visit number.

Measurement: improvement in composite activities of daily living (ADL) scores from home health admit to discharge.

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Results: Any PT increased the probability of improvement in ADLs by 15.2% ($p < 0.001$). Compared to 1–5 PT visits, 6–13 visits increased the probability of ADL improvement by 11.6% ($p < 0.001$).

Conclusion: PT intervention is beneficial for ADL function improvement in Medicare home health beneficiaries with a primary diagnosis of dementia.

Keywords

dementia; home health; physical therapy; propensity score; physical function

INTRODUCTION

Dementia is the leading cause of disability in over 5 million people over 65 in the United States,[1,2] and its prevalence is predicted to quadruple by 2050.[3] Persons with dementia experience progressive decline in not only cognitive but also physical function, resulting in poor coordination and balance, postural misalignment, and falls.[3,4] These impairments impact quality of life,[4] reduce caregiver well-being,[3,5] and increase healthcare costs,[6] however the effect of physical therapy (PT) rehabilitation services on dementia-associated decline is unclear. Persons with dementia (PWD) experience barriers to receiving healthcare, resulting in fewer rehabilitation services,[5,7,8] and providers report feeling ill-equipped to address the needs of this population with limited time and resources.[5,9] Further, rehabilitation studies typically exclude subjects with dementia diagnoses, rendering the effect of therapy services utilization for PWD unclear.[10]

The physical activity and exercise interventions provided by PT slow functional decline, improve balance, and reduce fall risk in PWD,[10–12] however the efficacy of home health PT for physical function improvement in PWD is unknown. Though PWD utilize more home health services relative to other setting options,[13] the Medicare Payment Advisory Commission recommends reducing payments to home health agencies. Beginning in 2020, home health care episodes will no longer consider therapy utilization as a factor in determining therapy reimbursement.[14] These factors may produce downward pressure on home health rehabilitation services utilization, generally discouraging therapy use and potentially increasing avoidable function decline for PWD.

The purpose of this observational cohort study is to determine the impact of home health PT services utilization on ADL function in individuals with a primary diagnosis of dementia. We also attempt to determine the amount of PT services utilization that results in the most ADL improvement in light of the recent policy change eliminating therapy visit number as a factor in payment. A prior study of the effect of home health PT in older adults after total knee arthroplasty showed greater patient function with PT utilization.[15] We hypothesized that any utilization of home health PT would result in a greater likelihood for improvement in ADL function in PWD. Determining whether skilled PT affects functional decline would help coordinate care services, determine appropriate therapy resource allocation, and maximize functional outcomes for PWD.

METHODS

Model, data and study population

We conducted an analysis on a combined data set comprised of the 2012 Centers for Medicare and Medicaid Services (CMS) Outcome and Assessment Information Set (OASIS) and the 2012 Home Health Research Identifiable File (RIF). At the time of analysis, 2012 data was most recently available; use of the current most recently available CMS data (from 2015) would not reflect significant changes or outcomes in either home health PT referral policy or standard PT practices. OASIS is an instrument used to collect home health agency performance data, where clinicians record patient information such as diagnoses, medications, functional status, living arrangement, and discharge disposition. The Home Health RIF includes claims information such as type of visit (i.e., nursing, physical therapy) and quantity of services.

We estimated propensity scores to control selection on observable characteristics. Differential selection into treatment groups is a common problem inherent in observational data and can lead to biased estimates. This approach minimizes potential bias by controlling for confounders that are available in our data. Specifically, we constructed inverse probability weights based on the propensity score to weight treated and untreated individuals in order to balance the differences in observed covariates between treated and untreated groups. However, propensity score methods do not address unmeasured confounding, which can bias our estimates of the treatment effect.

The study population consisted of Medicare fee-for-service beneficiaries over 65 years old with a primary ICD-9 diagnosis of dementia and an associated Medicare claim for home health services (n = 1953), excluding those who died or were institutionalized during their episode of care (n = 1477).

Outcomes

The primary outcome of interest was whether or not a PWD improved in ADL function during the home health episode of care (yes/no). ADL performance was operationalized at the initiation of care and at discharge from care using a validated composite score method that scores each ADL on a standardized 0–1 scale, with higher scores indicating more disability. Assessed ADLs in this scale included the M1800 series of OASIS ADL items: grooming, upper body dressing, lower body dressing, bathing, toilet transferring, toileting hygiene, transferring (bed, chair), ambulation/locomotion, feeding/eating, ability to plan/prepare light meals, and ability to use the telephone. A lower composite score at discharge indicates improvement in ADL function; a static or higher score at discharge would indicate maintenance or worsening of ADL function. The composite score method was developed and validated to capture overall performance across the function items of OASIS.[16,17] It has been used to measure change in function in populations receiving Medicare home health services.[18] The ADL function items in OASIS have been found to be valid against “gold standard” tools and reliable in interrater testing.[19,20]

We also derived mobility score from OASIS transfer and gait scores only, to determine whether a PWD improved in mobility score with PT intervention during the home health

episode of care (see Supplement). Mobility score is also tracked by CMS as a measure of home health agency quality, and typically considered the primary domain of PT intervention.

Covariates

We adjusted the analysis for variables that could potentially influence utilization of PT and improvement. These include sociodemographic factors (age, race, sex, urbanicity, geographic region), health factors (comorbidities, pain that interferes with movement on a daily basis, baseline function), and sociobehavioral factors (daily behavior injurious to self or others, daily cognitive assistance required, aggression, social frailty). Race was categorized as black, white, or other. Geographic regions were coded by US census category: Midwest, Northeast, South, and West. Rural or urban location of treating agency was determined using Medicare core-based statistical areas. Patient comorbidity burden was assessed using Functional Comorbidity Index (FCI) diagnoses.[21–23] Patients were categorized as either initiating their home health episode immediately following a stay at a facility (i.e., hospital or post-acute care) or directly from the community (i.e., primary care physician referral). Patients were categorized as socially frail if they lived alone and/or required assistance beyond that provided by current caregivers.[24,25]

Statistical Analysis

We conducted augmented inverse probability weighting to adjust for observed confounders. Logistic regression was used to estimate the probability of binary PT utilization (none vs any) and multinomial logistic regression was used to estimate the probability of each PT visit number category: 1–5, 6–13, and 14+ PT visits. The reference group was set as 6–13 visits, as this is the most frequent visit category in the data set. The inverse probability weights were calculated using the results of the respective specifications. We estimated a logistic regression of the probability of improvement in outcomes for any PT, and Poisson by multinomial logit for the probability of improvement by PT visit number category, as a function of the covariates and the respective PT utilization measures with and without inverse probability weighting (see Supplemental Table S1). We tested the validity of our specification using overlap graphs and calculating the standardized differences between the covariates with and without inverse probability weighting (see Supplemental Figures S1-S2). All analyses were conducted in Stata 15.1.

RESULTS

Patient characteristics can be found in Table 1. Of the entire sample, 62% received at least one PT visit, with a median of 4 visits. Patients who received skilled PT had higher baseline disability, were more likely to have started home health after hospitalization or post-acute care stays, were more likely to have severe pain that interfered with movement on a daily basis, were more likely to have a fall risk, and were less likely to have disruptive behavioral symptoms. Of those who utilized PT, 6–13 was the most common visit number (52%), followed by 1–5 visits (41.3%) and 14+ visits (6.7%).

Outcomes by Any Physical Therapy Utilization

Overall, use of physical therapy was associated with greater likelihood of improvement in ADL function as measured by a decrease in composite ADL scores (Figure 1, Table 2). Without PT, the probability of improvement was 60% (95% CI 55.8–65.2, $p < 0.001$). Receipt of PT was associated with a 15.2 percentage point greater (95% CI 10.0–20.4, $p < 0.001$) probability of ADL function improvement. This reflects a 25.3% greater probability of improving.

Two measures of propensity score adjustment success are covariate balance and group overlap.[26,27] Covariate balance measures the difference observed in covariates between groups after propensity weights have been applied; differences below 0.10 are considered successfully balanced. Overlap graphs display the population densities of each group that are available for comparison after propensity weights have been applied. In our analyses, the weighted standardized differences of all covariates between Any-PT and No-PT groups were well below 0.10 and the overlap graph revealed substantial overlap between the two groups as can be seen in Supplemental Figure S1. The standardized mean differences of covariate balance (with and without inverse probability weighting) and the overlap between the treatment and control groups are reported in the supplemental appendix.

Outcomes by PT visit number

The likelihood of improvement was greater with increasing PT utilization (Table 2). Patients who received 6–13 PT visits had 80.3% probability of ADL function improvement (95% CI 74.7–86.7 $p < 0.001$). The probability of improvement was 68.7 percentage points for patients who received 1–5 PT visits (95% CI 64.5–74.1, $p < 0.001$), reflecting a 6.9% lower probability of improving relative to receiving 6–13 visits. The probability of function improvement was 88.9% for patients with 14+ PT visits (95% CI 81.5–99.5, $p = 0.05$), reflecting a 9.3% greater probability of improving relative to receiving 6–13 visits.

The magnitude of improvement was the same when 1–5 PT visits was used as the referent group. After propensity weighting, all covariates balanced to within 0.01 between those who received 6–13 and 1–5 PT visits (Supplemental Figure S2). All covariates balanced to below 0.10 between those who received 6–13 and 14+ PT visits. There was excellent overlap between all groups.

DISCUSSION

These findings support previous research establishing the importance of physical therapy intervention for improving function in persons with dementia.[10,12] Functional improvement is a quality metric for home health agencies on CMS Home Health Compare. Recent changes to the home health payment model emphasize value-based purchasing, which incentivizes functional improvement by adding payment to agencies with high rates of improvement. In this study, skilled PT utilization is significantly associated with greater mobility and ADL function in individuals with a primary diagnosis of dementia. Only 62% of the sample received any PT, supporting previous research showing that home-based

services are important but often overlooked components of health service utilization for PWD.[28]

Limitations of this analysis primarily concern our inability to correct for selection on unobservable variables influencing treatment allocation, such as measures of clinician bias or patient refusal to participate. Nor was it possible to account for varying types of dementia in the analysis, given the subjective nature of dementia diagnosis and screening as performed in clinical practice.[29] Finally, this is a relatively small data set for health services study, and we were therefore unable to perform an analysis with specification term interactions (which would necessitate loss of data due to small cell sizes within interactions).

Patients in the sample who received more PT responded in a dose-dependent manner to a point, with moderate doses appearing to be most beneficial. Patients who received 6–13 PT visits demonstrated the most ADL function improvement; receiving fewer visits was significantly associated with lower likelihood of improvement while those receiving 14+ visits had a higher probability of improvement, however the value was statistically insignificant ($p = 0.05$). Only 61 individuals in the sample received 14+ PT visits, which may have been a factor in the insignificant value of improvement for this group. Receiving any PT significantly increased the probability of functional improvement in the sample population. Our results suggest patients with a primary diagnosis of dementia should receive a PT evaluation at minimum as standard of care.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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We declare no conflicts of interest.

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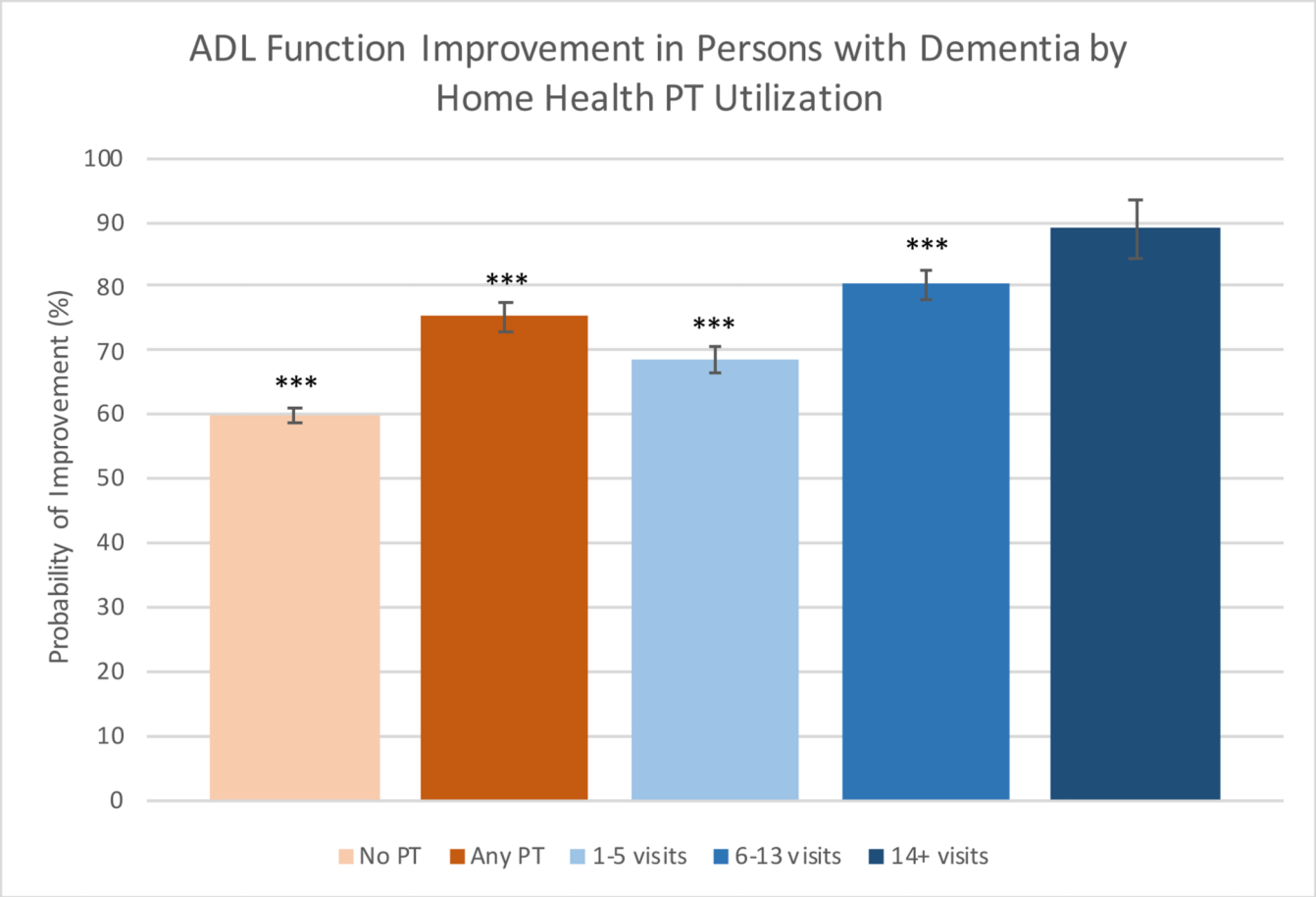

Figure 1.
Probability of improvement, weighted. (Range error bars = standard error, *p < 0.05, **p < 0.01, ***p < 0.001.)

Table 1.

Unweighted patient characteristics

Sample (percent ±SE) N = 1477	Any PT N = 916	No PT N = 561	Difference
Age 85+ (55.8 ±0.1)	58.1 ±0.2	51.9 ±0.2	−6.2 ±0.3 *
Age 65–84 (44.2 ±0.1)	41.9 ±0.2	48.1 ±0.2	6.2 ±0.3 *
Female (74.0 ±1.1)	75.1 ±1.4	72.2 ±1.9	−2.9 ±2.4
White (85.4 ±0.9)	83.7 ±1.2	88.8 ±1.3	5.0 ±1.9 **
Black (9.0 ±1.5)	10.4 ±1.0	6.8 ±1.0	−3.6 ±1.5 *
Other race (5.6 ±0.6)	6.0 ±0.8	4.8 ±0.9	−1.2 ±1.2
South (45.5 ±2.7)	43.6 ±1.6	48.7 ±2.1	5.1 ±2.7
Northeast (21.5 ±1.1)	21.7 ±1.4	21.2 ±1.7	−0.05 ±2.2
Midwest (21.4 ±1.1)	22.0 ±1.4	20.1 ±1.7	−1.9 ±2.2
West (11.6 ±0.8)	12.7 ±1.1	10.0 ±1.2	−2.7 ±1.7
Rural (13.5 ±0.9)	12.6 ±1.1	15.0 ±1.5	2.4 ±2.8
Baseline function (5.82 ±0.04)	6.0 ±0.1	5.5 ±0.1	−0.5 ±0.1 ***
Fall Risk score (1.75 ±0.01)	1.8 ±0.02	1.7 ±0.03	−0.1 ±0.03 **
Outpatient origin (67.4 ±1.2)	61.8 ±1.6	76.5 ±1.8	14.7 ±2.5 ***
5+ medications (79.6 ±1.0)	80.8 ±1.3	77.5 ±1.8	3.2 ±2.2
Social frailty (42.0 ±1.3)	43.1 ±1.6	40.3 ±2.1	−2.8 ±2.6
Injurious behavior (41.2 ±1.3)	38.4 ±1.6	45.8 ±2.1	7.4 ±2.6 **
Daily severe pain (30.8 ±1.2)	34.4 ±1.6	25.0 ±1.8	−9.4 ±2.5 ***
Daily cognitive assistance required (31.1 ±1.2)	29.7 ±1.5	33.3 ±2.0	3.6 ±2.5
Aggressive behavior (16.6 ±1.0)	12.9 ±1.1	22.6 ±1.8	9.8 ±2.0 ***
Depression (46.5 ±1.3)	45.9 ±1.6	47.6 ±2.1	1.7 ±2.7
Probability of mobility improvement	53.2 ±2.8	37.8 ±6.3	−15.4 ***
Probability of ADL function improvement	80.8 ±2.5	67.4 ±5.8	−13.4 ***

* $p < 0.05$,

** $p < 0.01$,

*** $p < 0.001$

Table 2.

Weighted probability of improvement by PT utilization, standard errors in parentheses.

			Treatment Effect:				Treatment Effect:	
	No PT	Any PT	Any PT vs. No PT	1–5 visits	6–13 visits	14+ visits	1–5 vs. 6–13	14+ vs. 6–13
ADL Function	60.0*** (2.2)	75.2*** (2.7)	15.2*** (2.7)	68.7*** (3.1)	80.3*** (1.9)	88.9 (4.9)	−11.6*** (3.1)	8.6 (4.4)

* $p < 0.05$,

** $p < 0.01$,

*** $p < 0.001$