

## RESEARCH ARTICLE

# Home health utilization association with discharge to community for people with dementia

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**Abstract**

**Introduction:** The objective of this study was to identify home health utilization factors associated with successful discharge to community after home health care for patients with and without Alzheimer's disease and related dementias (ADRD).

**Methods:** This was a retrospective study of 100% national Medicare home health data files (2016 to 2017). Multilevel logistic regression was used to study the relationship of home health utilization with a modified definition of successful discharge to community (M-SDC) after home health (no readmission or discharge within 30 days). Significant interactions were identified using backward selection. The associations between domains were examined in a model stratified by ADRD, with and without controlling for mobility, self-care, and caregiver assistance.

**Results:** The cohort consisted of 535,691 patients, 18.0% with ADRD. The overall M-SDC rate was 92.1%. The likelihood of M-SDC was increased when physical therapy services were provided, episodes of care were longer than 15 days, and the total number of therapy visits was greater than 10. The likelihood of M-SDC decreased when speech therapy, nursing, and home health aide services were provided and when patients were discharged early. When controlling for mobility, self-care, and caregiver support, length of home health episode was the only characteristic that showed a significant interaction with ADRD.

**Discussion:** The results of this study indicate that the provision of physical therapy services and moderate lengths of care and volume of visits are associated with increased likelihood of M-SDC. A decreased likelihood of M-SDC when speech therapy, nursing, and home health aide services are delivered may be a proxy indicator of patient acuity and disease severity and needs to be further investigated. An important next step in understanding home health access and outcomes for people with ADRD is to examine the impact of the Patient-Driven Groupings Model on home health utilization characteristics, especially length of episodes.

**KEYWORDS**

Alzheimer's disease and related dementias, community discharge, home health

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### Highlights

- Most people remain in the community after discharge from home health.
- Likelihood of modified successful discharge to community (M-SDC) increased with physical therapy, longer episodes, and more than 10 visits.
- Likelihood of M-SDC decreased with speech therapy, skilled nursing, home health aide visits, and early discharge.
- Longer home health episodes increased likelihood of M-SDC for people with Alzheimer's disease and related dementias.

## 1 | INTRODUCTION

Home health agencies are an important source of short-term rehabilitation, therapy, and skilled nursing services for older adults. A total of 3.3 million Medicare beneficiaries received home health care in 2019.<sup>1</sup> While not required by Medicare, approximately one-third of all home health episodes occur after the patient is discharged from a hospital or skilled nursing facility.<sup>2</sup> Many patients prefer home health over post-acute care in an inpatient setting because services are provided in the person's home.<sup>3</sup> Medicare also does not require a deductible or copayment for home health services.<sup>4</sup>

In 2019, Medicare spent nearly \$18 billion on home health services.<sup>4</sup> The Centers for Medicare and Medicaid Services has implemented several policies intended to reduce spending on post-acute care. From October 2000 to December 2019, home health agencies were paid according to a prospective payment system that covered all the services that were provided over a 6-day period. The payment rate was determined according to the patient's clinical and functional characteristics and the expected number of therapy visits. This incentivized home health agencies to increase the amount of therapy provided. From 2001 to 2018, the average number of therapy visits per 60-day episode of care increased 54% from 5.2 visits to 8.0 visits whereas skilled nursing and home health aide visits decreased 22% (10.5 to 8.2) and 74.5% (5.5 to 1.4), respectively.<sup>4</sup>

In January 2020, the Centers for Medicare and Medicaid Services implemented the Patient-Driven Groupings Model (PDGM).<sup>5</sup> The PDGM was designed to place greater emphasis on a patient's clinical, health, and functional characteristics when determining the payment rate.<sup>6</sup> PDGM also shortens the payment period from 60 days to 30 days and the expected number of therapy visits is no longer considered in the payment calculation.<sup>6</sup> Additionally, the payment rate is reduced after the first 30-day period.<sup>6</sup> These features of the PDGM have potentially important implications for medically complex patients who may require longer home health stays or a greater number of home health visits before being discharged to the community.

One such population is older adults with Alzheimer's disease and related dementias (ADRD). Nearly one-third of home health recipients have been diagnosed with ADRD.<sup>7</sup> Home health allows for a person with ADRD to receive care in a familiar setting and the potential to receive additional support from a family member or other caregiver.

This may contribute to better outcomes for older adults with ADRD. Home health has been associated with lower 30-day episode payments and lower 30-day readmissions for older adults with ADRD compared to those who received post-acute care in a skilled nursing facility.<sup>8</sup> Home health can also allow for a family member or other informal caregiver to assist the patient with managing medications, dressing, and other daily tasks. The presence of an informal caregiver while receiving home health has been associated with lower 30-day readmission risk for older adults with and without ADRD.<sup>9,10</sup>

More than 75% of adults aged 50 and older indicate that they want to live at home in a community setting as they age.<sup>11</sup> Successful discharge to the community is an important goal of post-acute care. Home health agencies are required by the Centers for Medicare and Medicaid Services to report the percentage of home health recipients who were not readmitted to the hospital or died within 30 days of being discharged from home health.<sup>12</sup> Home health recipients with ADRD have lower rates of successful community discharge than recipients without ADRD even after adjusting for differences in mobility, independence in self-care tasks, and caregiver support.<sup>9</sup> This makes it important to identify characteristics associated with successful community discharge that are specific to older adults with ADRD compared to those without ADRD. The primary objective of this study was to identify home health utilization factors associated with successful community discharge after receiving home health care for Medicare fee-for-service beneficiaries with and without ADRD. We focused on utilization factors that may be most impacted by the PDGM, such as the types of therapy visits (e.g., occupational therapy, physical therapy, etc.), the number of days in home health, and the number of home health visits. We were especially interested in identifying utilization factors that are differentially associated with successful discharge to community according to ADRD status.

## 2 | METHODS

### 2.1 | Data sources

Data were obtained from five Medicare 100% clinical assessment and billing data files between October 1, 2016, through September 31, 2017. These files included the Home Health Base file (cohort, start

and end dates of care), the Outcome Assessment Information Set (mobility, self-care, caregiver support), the MedPAR file (International Classification of Diseases, Clinical Modification Codes, Tenth Revision [ICD-10] code for dementia, readmissions), and the Beneficiary Summary file (verification of Medicare Fee-for-Service enrollment, sociodemographic information). This study was approved by our university's institutional review board (#13-0549). A Data Use Agreement was reviewed and approved by the Centers for Medicare and Medicaid Services.

## 2.2 | Patient cohort

Criteria from the Home Health Quality Reporting Program specification models<sup>13,14</sup> were modified to identify our cohort from 2,781,878 Medicare beneficiaries admitted to home health during the study period (Figure 1). The cohort was limited to those individuals who had an index hospitalization prior to home health admission. Consistent with the Home Health Quality Reporting Program specification models, we excluded individuals for the following reasons: (1) admitted to home health more than 30 days after discharge from an acute or psychiatric hospitalization; (2) under the age of 66 years; (3) transferred between home health agencies; (4) non-continuous Medicare Fee-for-Service coverage for 12 months prior to the index hospitalization and 31 days after the hospital discharge; (5) discharged from the acute care hospitalization against medical advice; (6) missing items of interest in the Outcome Assessment Information Set; (7) having a discharge status that the Centers for Medicare and Medicaid Services excludes from the specification model (hospice, federal hospitals, law enforcement, etc.); and (8) hospital stay was for non-surgical treatment of cancer.

Three additional exclusion criteria were applied consistent with the aims of this study. First, patients who were not assigned at least two therapy visits were excluded from the study to examine the association between number of therapy visits and the outcome of interest. Second, in addition to those patients with a discharge status excluded by the Centers for Medicare and Medicaid Services, we also excluded patients who were admitted to hospitals, rehabilitation facilities, nursing home facilities, and those whose discharge status were unknown. This limited the patient cohort to those patients who were discharged to the community (with or without formal assistive services). This is the most significant deviation from the Home Health Quality Reporting Program specification model. This exclusion criterion was included as we were interested in examining the association between the care provided during completed home health episodes and outcomes after discharge to the community. Last, patients who had records that included a number of visits that were greater than the patient receiving a visit every other day for the length of the care were excluded out of concern that these reflected errors in the data files.<sup>15,16</sup>

## 2.3 | Dementia diagnosis

Beneficiaries with dementia were identified using 19 ICD-10 codes included in the Chronic Conditions Data Warehouse algorithm for

### RESEARCH-IN-CONTEXT

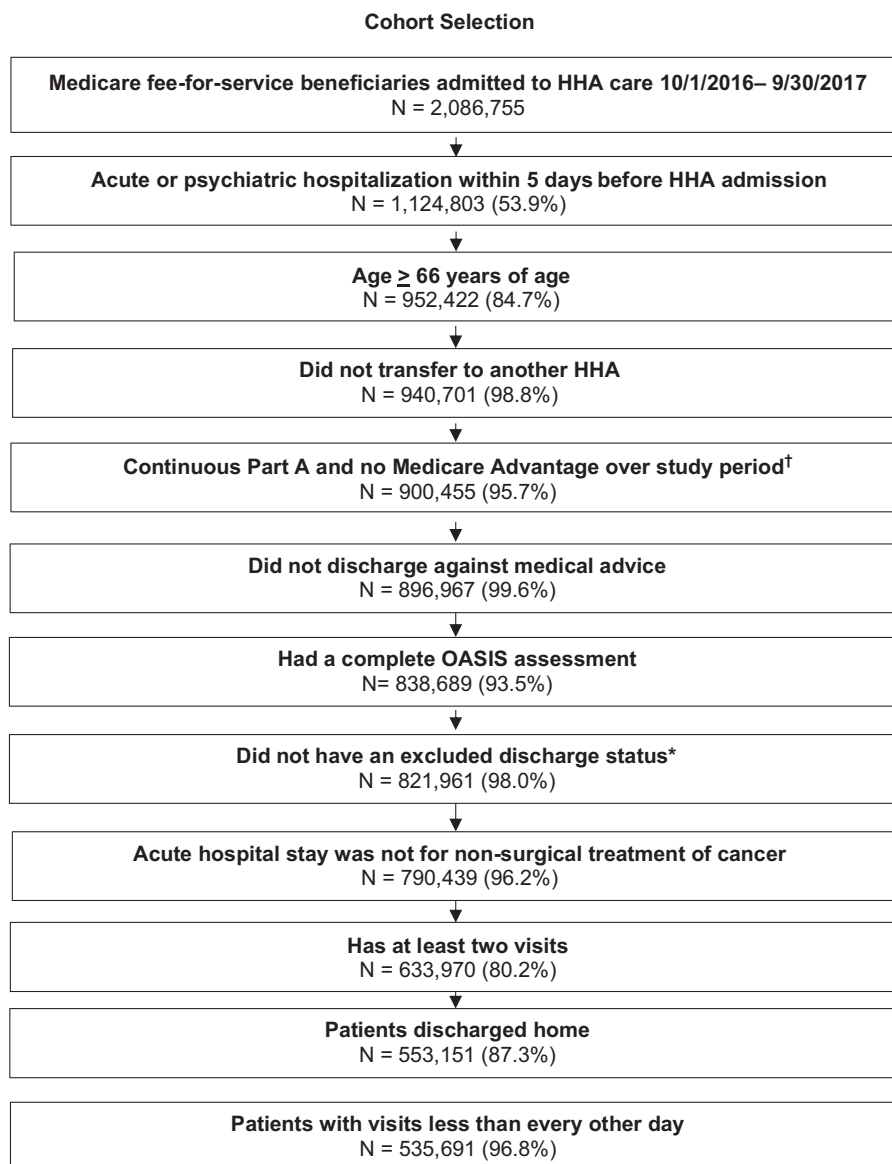
- **Systematic Review:** The authors reviewed literature using traditional sources and meeting proceedings. The relationship between home health services and modified successful discharge to community for people with Alzheimer's disease and related dementias (ADRD) has not been described in the literature. However, factors associated with successful discharge to community have been described in the literature and are cited appropriately.
- **Interpretation:** We identified that longer home health episodes are associated with an increased likelihood of remaining in the community after home health discharge for people with ADRD. This is consistent with prior research that identified that people with ADRD have improved outcomes with longer episodes of care.
- **Future Directions:** Future studies should explore (1) if the provision of speech therapy, skilled nursing, and home health aide services serve as a proxy indicator of patient complexity; (2) if greater community resources are needed after home health discharge; (3) the relationship between early discharge and ADRD severity; and (4) the impact of the Patient-Driven Groupings Model on home health utilization characteristics.

Alzheimer's disease, related disorders, or senile dementia (Table S1 in supporting information).<sup>17,18</sup> Beneficiaries with one or more of these ICD-10 codes for dementia in Medicare Part A, home health, skilled nursing, or inpatient rehabilitation claims in the year prior to hospitalization were classified as having ADRD.

## 2.4 | Outcome

The Home Health Quality Reporting Program<sup>14</sup> defines successful discharge to the community as being discharged to home/self-care with or without services, without readmission or death within 30 days of discharge from home health. This measure includes all individuals who were discharged from home health, regardless of their discharge location, and includes readmissions and death in the same model.<sup>14,18</sup>

With the focus of this study being on home health utilization factors, we modified the successful discharge to community measure to only examine the outcomes of those patients who were discharged to the community with or without formal services (please see the Patient Cohort section for details). For this article, we will refer to this outcome as modified successful discharge to community (M-SDC). We used the patient discharge status code variable in the Home Health Fee-for-Service claims file to identify discharge status. To remain consistent with the Center for Medicare and Medicaid Services successful discharge to community measure, we kept readmission and death in the same model. During the 31-day period after discharge from home



**FIGURE 1** Cohort selection. Flow chart depicting cohort selection at each step as exclusion criteria were applied. Percentages represent percent remaining from the previous step. \* Excluded discharge status included hospice, federal hospital, law enforcement. † “Study period” refers to the 1 year prior to the index hospitalization through the 32 days post-discharge for each hospitalization. HHA, home health agency; OASIS, Outcomes Assessment Information Set

health, readmissions were identified using the Home Health Quality Reporting Program’s specification model<sup>19</sup> and death was identified based on beneficiary date of death from Medicare Beneficiary Summary File.

## 2.5 | Primary predictors

Our primary predictors included the amount of (1) physical therapy (PT), (2) speech therapy (ST), (3) occupational therapy (OT), (4) skilled nursing (SN), and (5) home health aide (HHA) services received during the home health episode. The (6) length of home health episodes (in days) and (7) the total number of visits received were also included

as primary predictors. The eighth and final primary predictor was a measure of early discharge from therapy services. Early discharge from therapy services was defined as missing more than two of the planned number of therapy visits identified on the start of care the Outcome Assessment Information Set.

## 2.6 | Covariates

Sociodemographic characteristics included age, sex, race/ethnicity, Medicare original entitlement, and Medicare–Medicaid dual eligibility status. Health care utilization characteristics included length of index hospitalization, days in the intensive care unit/critical care unit,

primary diagnosis and procedure categories from index hospitalization (based on the Centers for Medicare and Medicaid Services multilevel clinical classification software), receipt of dialysis during the index hospitalization, and the number of hospitalizations in the previous year. Patient functional status as measured by summary scores for mobility, self-care, and caregiver support were also included as control variables. A detailed description of the Outcome Assessment Information Set items used to derive these summary scores has been published.<sup>20</sup> The mobility summary score was calculated using three items: (1) transferring to/from a toilet, (2) transfer to/from bed to chair, and (3) ambulation. The self-care summary score was based on seven items: (1) grooming, (2) upper body dressing, (3) lower body dressing, (4) toileting hygiene, (5) bathing, (6) eating, and (7) plan and cook a light meal. These items were used to calculate summary scores for mobility and self-care that ranged from 0 (independent) to 100 (dependent), which were then converted into quartiles. The variable for caregiver support was based on items for needing assistance in the following areas: (1) activities of daily living, (2) instrumental activities of daily living, (3) taking medications, (4) managing medical procedures, (5) managing medical equipment, (6) needing supervision for safety reasons, and (7) receiving medical care (e.g., being driven to a medical appointment). Each item is rated as no assistance needed (0 points), non-agency caregiver gives assistance (1 point), non-agency caregiver needs training to give assistance (2 points), non-agency caregiver is unlikely to give assistance (3 points), and patient needs assistance but a non-agency caregiver is not available (4 points). A summary score was then calculated (range 0–28) with higher scores reflecting greater unmet caregiver needs. This total score was dichotomized to indicate if the patient had their caregiving needs met (score  $\leq 12$ ) or not met (score  $\geq 13$ ).

### 3 | DATA ANALYSIS

For each patient characteristic, we calculated M-SDC rates, with associated 95% confidence intervals (CIs). We used multilevel logistic regression to study the relationship of home health utilization characteristics, including types of visits (PT, OT, ST, SN, HHA), length of episode, number of therapy visits, and early discharges, with M-SDC after home health, adjusting for patient demographics, patient comorbidities (using the Centers for Medicare and Medicaid Services Hierarchical Condition Categories based on diagnoses from the past year of acute care stays and the non-primary diagnoses from the index hospitalization), clinical characteristics, and patient function. Risk ratios were calculated by adjusting the odds ratios as described by Zhang et al.<sup>21</sup> A second level random effect was used to account for the clustering of patients within home health agencies. Significant interactions were identified using backward selection, an iterative procedure in which we first used a model with the interactions of each domain and ADRD. Then, the interaction with the highest *P*-value greater than 0.05 is removed from the model. This process is repeated until all *P*-values are less than 0.05. Once the interactions were selected, the associations between those domains were examined in a model stratified by ADRD. This was done both with and without controlling for mobility,

independence with self-care tasks, and caregiver assistance. All data analyses were performed using SAS software version 9.4.<sup>22</sup>

## 4 | RESULTS

The final cohort consisted of 535,691 Medicare beneficiaries, 94,497 (18.0%) of whom had ADRD. Within the sample, 42% were 81 years of age or older, 62% were female, and 85% were White (Table 1). The overall M-SDC rate was 92.1% (95% CI 91.0–91.3). M-SDC rates decreased as the following characteristics increased: age, index hospital length of stay, intensive care unit/critical care unit days, and number of acute care stays in the past year. M-SDC rates were lower for individuals whose Medicare entitlement was based on disability/end stage renal disease (82.4%; 95% CI 80.0–84.7), who were Black (89.6%; 95% CI 89.3–89.9), who were receiving dialysis (74.7%, 95% CI 69.1–80.2), and who had an ADRD diagnosis (88.5%; 95% CI 88.3–88.7).

M-SDC rates were lower when ST (89.7%; 95% CI 89.3–89.9), SN (91.4%; 95% CI 91.1–91.5), and HHA (89.0%; 95% CI 88.7–89.2) services were provided (Table 2). Conversely, M-SDC rates were higher when PT services were provided (92.3%; 95% CI 92.2–92.4). M-SDC rates decreased when home health episodes were greater than 61 days (89.3%; 95% CI 89.0–89.6) and the number of visits were greater than 25 (90.0%; 95% CI 89.8–90.2). M-SDC rates were decreased for individuals who experienced early discharge from therapy services (87.7%; 95% CI 87.4–88.0).

The likelihood of M-SDC after discharge from home health was increased when PT services were provided (1.019, 95% CI 1.012–1.025), when episodes of care were longer than 15 days ([16–30 days; 1.025, 1.023–1.027], [31–60 days; 1.016, 1.013–1.018], [61+ days; 1.013, 1.009–1.017]), and when the total number of therapy visits was greater than 10 (1.012, 95% CI 1.008–1.015; Table 3). The likelihood of M-SDC after discharge from home health was decreased when ST (0.994, 95% CI 0.991–0.997), SN (0.987, 95% CI 0.985–0.990), and HHA (0.997, 95% CI .974–.980) services were provided and when patients were discharged early (0.952, 95% CI 0.948–0.956).

Four home health characteristics significantly interacted with ADRD: ST, OT, HHA services, and length of home health episode (Table 4). For people with ADRD, the negative relationship between M-SDC and the delivery of ST and HHA services was stronger than for people without ADRD. While people without ADRD had a decreased likelihood of M-SDC when OT services were provided, the likelihood of M-SDC increased when people with ADRD received OT services. The likelihood of M-SDC had a stronger positive association with longer home health episodes for people with ADRD.

When controlling for mobility, independence with activities of daily living and caregiver support, length of home health episode was the only home health utilization characteristic that showed a significant interaction with ADRD on relative risk of M-SDC (Table 4). Home health episodes greater than 15 days had a stronger association with the likelihood of M-SDC after discharge from home health for patients with ADRD (1.09, 95% CI 1.08–1.10) than for those patients without ADRD (1.02, 95% CI 1.01–1.02).

**TABLE 1** Unadjusted cohort characteristics and observed rates of modified successful discharge to community

	Overall sample N, (%)	Observed rate of M-SDC (95% CI)
<b>Total cohort</b>	535,691	92.1% (92.0, 92.1)
<b>Sex</b>		
Male	204,989 (38.3%)	91.1% (91.0, 91.3)
Female	330,702 (61.7%)	92.6% (92.5, 92.7)
<b>Age (years)</b>		
66–70	101,629 (19.0%)	93.9% (93.7, 94.0)
71–75	106,281 (19.8%)	93.1% (93.0, 93.3)
76–80	104,129 (19.4%)	92.4% (92.2, 92.6)
81+	223,652 (41.8%)	90.5% (90.4, 90.7)
<b>Race/ethnicity</b>		
White	454,919 (84.9%)	92.3% (92.2, 92.4)
Black	40,078 (7.5%)	89.6% (89.3, 89.9)
Hispanic	22,296 (4.2%)	91.0% (90.7, 91.4)
Other	18,398 (3.4%)	92.7% (92.3, 93.1)
<b>Medicare original entitlement *</b>		
Age	467,941 (87.4%)	92.4% (92.3, 92.4)
Disability	65,749 (12.3%)	90.1% (89.8, 90.3)
ESRD	985 (0.2%)	82.6% (80.3, 85.0)
ESRD and disability	1016 (0.2%)	82.4% (80.0, 84.7)
<b>Dialysis during index hospitalization</b>		
No	535,454 (100.0%)	92.1% (92.0, 92.1)
Yes	237 (0.0%)	74.7% (69.1, 80.2)
<b>Index hospitalization length of stay (days)</b>		
1–2	148,045 (27.6%)	95.0% (94.9, 95.1)
3	124,455 (23.2%)	93.6% (93.5, 93.8)
4	72,116 (13.5%)	91.6% (91.4, 91.8)
5	49,932 (9.3%)	90.3% (90.0, 90.6)
6–7	62,953 (11.8%)	89.3% (89.1, 89.6)
8+	78,190 (14.6%)	87.7% (87.4, 87.9)
<b>Index hospitalization ICU/CCU utilization (days)</b>		
0	358,437 (66.9%)	93.2% (93.1, 93.3)
1–2	59,150 (11.0%)	90.9% (90.7, 91.2)
3–4	52,649 (9.8%)	89.9% (89.7, 90.2)
5+	65,455 (12.2%)	88.6% (88.3, 88.8)
<b>Acute stays over prior year (count)</b>		
0	347,471 (64.9%)	94.6% (94.5, 94.7)
1	115,982 (21.7%)	90.4% (90.3, 90.6)
2	41,284 (7.7%)	86.1% (85.7, 86.4)
3	16,795 (3.1%)	81.0% (80.4, 81.6)
4+	14,159 (2.6%)	74.2% (73.4, 74.9)
<b>ADRD</b>		
No	441,194 (82.4%)	92.8% (92.7, 92.9)
Yes	94,497 (17.6%)	88.5% (88.3, 88.7)

\*Original reason for Medicare enrollment.

Abbreviations: ADRD, Alzheimer's disease and related dementias; CI, confidence interval; ESRD, end stage renal disease; ICU/CCU, intensive care unit/critical care unit; M-SDC, modified successful discharge to community.

**TABLE 2** Unadjusted home health utilization characteristics and observed rates of modified successful discharge to community

	Overall sample N, (%)	Observed rate of M-SDC (95% CI)
<b>Total cohort</b>	535,691	92.1% (92.0, 92.1)
<b>Physical therapy</b>		
No	18,378 (3.4%)	85.6% (85.1, 86.1)
Yes	517,313 (96.6%)	92.3% (92.2, 92.4)
<b>Speech therapy</b>		
No	499,471 (93.2%)	92.2% (92.2, 92.3)
Yes	36,220 (6.8%)	89.7% (89.3, 90.0)
<b>Occupational therapy</b>		
No	287,038 (53.6%)	92.7% (92.6, 92.8)
Yes	248,653 (46.4%)	91.3% (91.2, 91.4)
<b>Skilled nursing</b>		
No	81,621 (15.2%)	95.5% (95.3, 95.6)
Yes	454,070 (84.8%)	91.4% (91.4, 91.5)
<b>Home health aide</b>		
No	472,523 (88.2%)	92.5% (92.4, 92.5)
Yes	63,168 (11.8%)	89.0% (88.7, 89.2)
<b>Length of home health episode (days)</b>		
1–15	94,882 (17.7%)	92.6% (92.4, 92.8)
16–30	180,739 (33.7%)	94.0% (93.8, 94.1)
31–60	211,999 (39.6%)	90.8% (90.7, 90.9)
61+	48,071 (9.0%)	89.3% (89.0, 89.6)
<b>Number of therapy visits</b>		
0–10	170,535 (31.8%)	92.2% (92.0, 92.3)
11–15	124,118 (23.2%)	93.5% (93.4, 93.7)
16–25	142,564 (26.6%)	92.0% (91.9, 92.2)
26+	98,474 (18.4%)	90.0% (89.8, 90.2)
<b>Early discharge</b>		
No	480,091 (89.6%)	92.6% (92.5, 92.6)
Yes	55,600 (10.4%)	87.7% (87.4, 88.0)

M-SDC, Abbreviations: CI, confidence interval; M-SDC, modified successful discharge to community.

## 5 | DISCUSSION

Home health utilization characteristics were associated with the ability to successfully remain in the community for 30 days after discharge from home health without experiencing an unplanned readmission or death for this national cohort of Medicare beneficiaries. The association of type, frequency, and duration of home health services with post-discharge outcomes is important considering the recent implementation of the PDGM. The PDGM shifts reimbursement focus off the number of therapy visits and onto shorter lengths of care. Patient advocacy groups have voiced concerns that the PDGM disincentivizes home health agencies from admitting patients with chronic and complex conditions, such as ADRD, that required more visits and longer durations of care.<sup>23,24</sup>

In this study we showed that longer episodes of home health care are associated with an increased likelihood of remaining in the community without a readmission or death within 30 days of discharge to the community from home health. This association was stronger for people with ADRD. Prior studies have also shown that longer home health episodes with greater numbers of visits are an effective strategy for helping people with ADRD remain in the community and avoid hospitalization.<sup>25–29</sup> Reimbursement incentives under the PDGM appear to conflict with this need. Lower reimbursement rates for longer episodes of care may decrease home health agencies' willingness to provide care to people with ADRD. As data become available to assess home health utilization under the PDGM, it will be important to assess the impact on the type, frequency, and duration of home health services provided to people with ADRD. Shifts to shorter durations in

**TABLE 3** Relative risk of modified successful discharge to community for home health utilization characteristics

	Relative risk (95% CI)	Relative risk adjusted for MB, ADL, CG (95% CI)
<b>Physical therapy</b>		
No	Reference	Reference
Yes	1.019 (1.013–1.025)	1.019 (1.012–1.025)
<b>Speech therapy</b>		
No	Reference	Reference
Yes	0.991 (0.988–0.994)	0.994 (0.991–0.997)
<b>Occupational therapy</b>		
No	Reference	Reference
Yes	0.999 (0.997–1.000)	1.000 (0.998–1.001)
<b>Skilled nursing</b>		
No	Reference	Reference
Yes	0.986 (0.984–0.988)	0.987 (0.985–0.990)
<b>Home health aide</b>		
No	Reference	Reference
Yes	0.974 (0.971–0.977)	0.977 (0.974–0.980)
<b>Length of home health episode (days)</b>		
1–15	Reference	Reference
16–30	1.025 (1.023–1.027)	1.025 (1.023–1.027)
31–60	1.015 (1.012–1.018)	1.016 (1.013–1.018)
61+	1.012 (1.008–1.016)	1.013 (1.009–1.017)
<b>Number of therapy visits</b>		
0–10	Reference	Reference
11–15	1.007 (1.004–1.010)	1.008 (1.006–1.011)
16–25	1.006 (1.003–1.009)	1.009 (1.006–1.012)
26+	1.007 (1.003–1.010)	1.012 (1.008–1.015)
<b>Early discharge</b>		
No	Reference	Reference
Yes	0.948 (0.944–0.952)	0.952 (0.948–0.956)

Abbreviations: ADL, activities of daily living; CG, caregiver assistance; CI, confidence interval; MB, mobility; M-SDC, modified successful discharge to community.

\*All relative risk ratios have been adjusted for patient demographics and clinical characteristics.

\*\* Patient functional status is comprised of mobility, activities of daily living, and caregiver assistance.

care may have a detrimental effect on the health and rehabilitation of people with ADRD.

Therapy services are often terminated early for individuals with ADRD because clinicians are unable to effectively engage the patient in care, especially during the later stages of ADRD.<sup>30–34</sup> In this study, early discharge was associated with a decreased likelihood of M-SDC for all home health patients, including those with ADRD. A significant interaction was not found between early discharge and ADRD. However, an interaction may not have been detected due to ADRD being represented by a binary variable. The binary variable of ADRD in this study treats people with ADRD as a homogenous group and thus does not distinguish between people in the early stages of ADRD and those in the later stages of ADRD. Given that clinicians have identified that

it is the later stages of ADRD that present the most difficulty in engaging clients in therapy, future research should explore the relationship between early discharge and ADRD severity.

It is interesting to note the relationships that we found between different types of therapy services and M-SDC. The provision of physical therapy services was associated with an increased likelihood of M-SDC, while the provision of ST, SN, and HHA services were each associated with a small but statistically significant decrease in the likelihood of M-SDC. While the reasons for these differences cannot be fully explained within the scope of this study, it is reasonable to assume that patient complexity and social factors may be contributing to this finding and not that PT services are superior to other services or that other services are contributing negatively to the likelihood of



**TABLE 4** Relative risk of modified successful discharge to community for home health utilization characteristics with ADRD as an interactive term

	ADRD	Non-ADRD
<b>Speech therapy</b>		
No	Reference	Reference
Yes	0.984 (0.976–0.992)	0.996 (0.992–1.000)
<b>Occupational therapy</b>		
No	Reference	Reference
Yes	1.006 (1.000–1.011)	0.999 (0.997–1.000)
<b>Home health aide</b>		
No	Reference	Reference
Yes	0.970 (0.962–0.978)	0.975 (0.971–0.978)
<b>Length of home health episode (days)</b>		
1–15	Reference	Reference
16–30	1.091 (1.081–1.101)	1.020 (1.018–1.022)
31–60	1.085 (1.073–1.096)	1.009 (1.007–1.012)
60+	1.085 (1.070–1.100)	1.006 (1.002–1.010)
<i>Controlling for mobility, independence with self-care, and caregiver support</i>		
<b>Length of home health episode (days)</b>		
1–15	Reference	Reference
16–30	1.090 (1.080–1.100)	1.020 (1.018–1.022)
31–60	1.084 (1.073–1.096)	1.010 (1.007–1.012)
61+	1.086 (1.070–1.100)	1.007 (1.003–1.010)

Abbreviation: ADRD, Alzheimer's disease and related dementias.

\*All relative risk ratios have been adjusted for patient demographics and clinical characteristics.

\*\* Patient functional status is comprised of mobility, activities of daily living, and caregiver assistance.

a successful community discharge. Future studies should explore if (1) the provision of ST, SN, and HHA services serve as a proxy indicator of patient complexity or frailty or if (2) greater community resources are needed after home health discharge for patients receiving SN, ST, and HHA services during home health care.

## 6 | LIMITATIONS

Our study has limitations. First, our method of identifying people with ADRD was based only on an ICD-10 diagnosis, which has been shown to have poor sensitivity for detecting older adults in the early to mild stages of ADRD.<sup>35</sup> Additionally, by categorizing ADRD as a binary variable, we are not able to distinguish across the stages of dementia. Next, our measurements of function, self-care, and caregiver support were based on the patient's status at the start of home health care. Changes in these factors across the episode of care were not considered but may impact the likelihood that a person is able to remain in the community after discharge from home health. Additionally, these measures were based on items on the Outcomes Assessment Information Set and we are not able to account for differences in how the assessment is administered among clinicians and across home health

agencies. While the Centers for Medicare and Medicaid Services publishes a detailed implementation manual describing best practices in the Outcome Assessment Information Set administration, it is likely that there is variability in how items are interpreted and recorded. Finally, there is not a standardized definition of early discharge from therapy services in home health care. So, there is not normative data on which to compare our early discharge findings.

## 7 | CONCLUSION

The results of this study indicate that the provision of PT services, episodes of care between 15 and 61 days long, and a quantity of therapy visits between 0 and 25 is associated with increased likelihood of M-SDC. A decreased likelihood of M-SDC when ST, SN, and HHA services are delivered may be a proxy indicator of patient acuity and disease severity and needs to be further investigated. The PDGM incentivizes shorter duration home health episodes, which may create an additional barrier for people with ADRD who need home health services. An important next step in understanding home health access and outcomes for people with ADRD is to examine the impact of the PDGM on home health utilization characteristics.

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## CONFLICTS OF INTEREST

The authors report no conflicts of interest. Author disclosures are available in the supporting information.

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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