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Analysis of Episodes of Care in Medicare Beneficiaries Newly Diagnosed with Alzheimer's Disease

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OBJECTIVES: To study transitions between healthcare settings and quantify the cost burdens associated with different combinations of transitions during a 6-month period before initial Alzheimer's disease (AD) diagnosis so as to investigate how using an episode-of-care approach to payment for specific disease states might apply in AD.

DESIGN: A retrospective observational cohort study.

SETTING: United States.

PARTICIPANTS: A random sample of 8,995 individuals aged 65 to 100 with a diagnosis of AD (*International Classification of Diseases, Ninth Revision, Clinical Modification* code 331.0) were identified from the Medicare database between January 1, 2011, and June 30, 2014. This analysis identified individuals with AD diagnosed in inpatient (18%), skilled nursing facility (SNF) (1%), hospice (4%), and home and outpatient (77%) settings and analyzed episodes that began in the index setting (defined as the care setting in which the individual was first diagnosed with AD).

MEASUREMENTS: Study outcomes included number of transitions between settings, primary discharge diagnoses, and total all-cause healthcare costs during the 6 months after the AD diagnosis.

RESULTS: The average numbers of transitions between care settings were 2.8 originating from an inpatient setting, 2.4 from a SNF, 0.3 from a hospice setting and 0.7 from a home or outpatient setting during 6 months post-AD diagnosis. The overall cost burden during the 6 months after AD diagnosis (including costs incurred at the index setting) was high for individuals diagnosed in a nonambulatory setting (mean $41,468). Individuals diagnosed in an ambulatory setting incurred only $12,597 in costs during the same period.

CONCLUSION: Episodes of care can be defined and studied in individuals with AD. An episode-of-care approach to payment could encourage providers to use the continuum of care needed for quality medical management in AD more efficiently. **J Am Geriatr Soc 66:864–870, 2018.**

Key words: Alzheimer's disease; health economics; episodes of care

In the current U.S. healthcare environment, policymakers are searching for alternative payment models to improve quality of care, promote efficiency, and reduce healthcare spending.[1,2] Episode-based payment, also known as bundled payments, are payment models designed to pay a single price for all services that a person needs during an entire episode of care. The goal is to provide incentives to healthcare providers to reduce unnecessary services within each episode of care by providing better care at lower costs.[3] To our knowledge, no studies have evaluated episode-based payment methods associated with Alzheimer's disease (AD). An estimated 5.4 million individuals in the United States are currently diagnosed with AD, with approximately 5 million of them being aged 65 and older.[4] More than 15 million family members and other unpaid caregivers provided an estimated 18 billion hours of care to people with AD and other dementias, a contribution valued at more than $217 billion in 2014. In 2016, total healthcare costs, including long-term care and hospice, for people with dementia were estimated to be approximately $236 billion, with a steady increase from 2013 to 2016.[5–8] One way to understand and analyze the longitudinal healthcare cost of AD is to categorize these costs into distinct episodes of care. An episode of care can be defined as a series of temporally contiguous

healthcare services related to the treatment of a disease through interactions between individuals with the disease and providers.[9,10]

This study analyzed episodes of care for Medicare beneficiaries newly diagnosed with AD. The purpose was to describe transitions between healthcare settings and to examine and quantify the cost associated with different combinations of transitions during the 6 months after initial AD diagnosis. An objective of this study was to explore, using an episode-of-care approach, whether novel methods of payment for dementia care might be possible as a way to promote better quality of care.

METHODS

Data Source

A retrospective analysis was performed of individuals newly diagnosed with AD using the Medicare 5% national sample administrative database from January 2010 through December 2014. Medicare claims data files used in this study included inpatient and outpatient, Medicare carrier, Part D drug events, skilled nursing facility (SNF), home health agency (HHA), hospice, durable medical equipment (DME), and Medicare denominator file, which contains demographic and enrollment information of Medicare beneficiaries.

Participant Identification

Beneficiaries aged 65 to 100 and diagnosed with 1 primary or 2 or more secondary diagnoses for AD (International Classification of Diseases, Ninth Edition, Clinical Modification (ICD-9-CM) code 331.0) during the identification period (January 1, 2011–June 30, 2014) were included in the study. The first AD diagnosis date was designated as the index date. Participants were also required to have continuous health plan enrollment with medical and pharmacy benefits for at least 12 months before (baseline period) and 6 months after (follow-up period) the index date. Individuals with pharmacy claims for an antidementia drug (donepezil, rivastigmine, galantamine, memantine) or claims of AD or AD-related dementia (ICD-9-CM codes 290.xx, 294.xx, 331.1, 331.2, 331.7, 331.82, 331.89, 331.9, 797) during the baseline period were excluded. This analysis identified individuals diagnosed in inpatient, SNF, hospice, and home or outpatient settings. Home and outpatient settings included outpatient, DME, HHA, and Medicare Carrier outpatient settings.

Episode-of-Care Measurement

This retrospective study was two faceted. The first facet was to examine transitions between settings and overall cost burden during the 6 months after AD diagnosis in individuals newly diagnosed with AD in inpatient, SNF, hospice, and home and outpatient settings. The second facet was to examine and quantify cost burden associated with common combinations and to evaluate admitting diagnoses. We analyzed episodes that began in the setting where AD was first diagnosed and then studied participant

pathways and transitions of care between settings for up to 3 transitions during the 6 months after the AD diagnosis. All transitions between settings for each participant were then collated into one "combination". This analysis focused on the 4 most commonly observed combinations in our study sample.

Outcomes Variables

Study outcomes included the number of transitions between settings, total all-cause healthcare costs, and costs for the first 3 transitions during the 6 months after AD diagnosis. Total costs were censored at 6 months. For the 4 most frequent combinations of transition, we analyzed length of stay (LOS), primary diagnoses, and healthcare costs of the first 3 settings in the combination. The discharge diagnoses coded on inpatient, SNF, and hospice claims were captured. The principal diagnosis coded on an outpatient claim was used as the primary diagnosis in an outpatient setting.

Baseline Variables

Baseline characteristics from 12 months before an AD diagnosis (age, race, sex, U.S. geographical region, individual comorbid conditions) were evaluated.

Statistical Analysis

All study variables were examined descriptively. Numbers and percentages were determined for dichotomous and polychotomous variables. Means and standard deviations were determined for continuous variables.

RESULTS

Participant Characteristics

After applying the study selection criteria, 8,995 individuals newly diagnosed with AD aged 65 to 100 were selected for analysis: 18% in inpatient settings, 77% in home and outpatient settings, 1% in SNFs, and 4% in hospice (Supplementary Figure S1).

The overall mean age was 84, 82% of participants were white, 77% were female, 37% resided in the South at the time of diagnosis. The most common comorbidities were hypertension (55%), diabetes (26%), chronic pulmonary disease (19%), cerebrovascular disease (18%), and mood disorder (16%) (Supplementary Table S1).

Transitions of Care Between Settings

Inpatient

During the 6 months after AD diagnosis, the average number of transitions was 2.8 for 1,637 individuals with AD diagnosed in the inpatient setting (18%). Approximately half of the individuals diagnosed in inpatient settings transitioned to a SNF and 49% to home and outpatient settings. Of those who transitioned to a SNF, approximately 14% were readmitted to the hospital, and 78% were
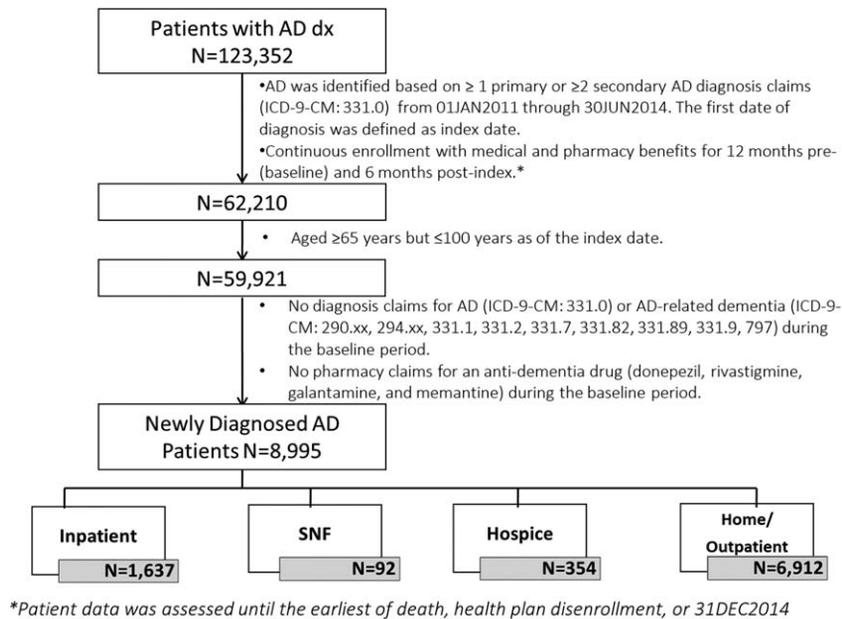
Figure 1. Flow chart for participant selection criteria.

discharged home. Of those who were discharged to home or an outpatient setting, 58% did not have a second transition, and almost 37% were re-hospitalized. The 30-day hospital readmission rate after index hospitalization discharge was 22%. Participants who remained in the home or outpatient setting and did not have a second transition had almost $30,000 lower costs than those who were readmitted to the hospital (Figure 2a).

Home and outpatient

Most individuals newly diagnosed with AD were diagnosed in the home or outpatient setting (n=6,912) and had an average of 0.7 transitions between care settings during the 6 months after AD diagnosis. Of participants diagnosed in home and outpatient settings, 76.5% remained in the original setting and did not transition to another care setting, and 19.6% were later admitted to the hospital during the 6 months after AD diagnosis. The cost of care was $46,941 more for participants who had a second transition from inpatient to SNF than for those who remained in the home or outpatient setting and $24,308 more for those who had a second transition from inpatient to home or outpatient (Figure 2b).

Skilled Nursing Facility

Participants who were initially diagnosed in a SNF (n=92) had an average of 2.4 transitions between care settings over the 6 months after AD diagnosis. Seventy-seven percent of participants diagnosed in a SNF were discharged to a home or outpatient setting, and 18.5% were admitted to the hospital (Figure 3a).

Hospice

The mean number of transitions between care settings was 0.3 for participants originally diagnosed with AD in a

hospice setting (n=354). More than three-quarters of these participants remained in hospice and did not transition to another setting during the 6 months after AD diagnosis. Total Medicare expenditures were $30,169 for those who did not transition to another setting during the 6 months after AD diagnosis and $46,223 for those who had their first transition to an inpatient setting and then to a SNF (Figure 3b).

Primary Discharge Diagnoses Associated with Commonly Observed Combinations of Transitions

Four commonly observed combinations of transitions were further evaluated.

Home or Outpatient Setting →Inpatient Setting→ Home or Outpatient Setting

The first combinations included 765 participants who transitioned from home or outpatient to inpatient and back to home or outpatient setting. The primary diagnoses were AD for index home or outpatient, malaise or fatigue for inpatient setting, and diabetes for second home or outpatient settings (Supplementary Figure S1).

Inpatient Setting →SNF Setting→ Home or Outpatient Setting

The second combination included 646 participants who went from inpatient to SNF then home or outpatient setting. The first primary discharge diagnosis in the index inpatient setting was malaise or fatigue. AD was not recorded in the top 9 primary discharge diagnoses in the inpatient setting. AD was the principal discharge diagnosis in the SNF setting, and hypertension was the primary diagnosis for participants in the home or outpatient setting (Supplementary Figure S2).
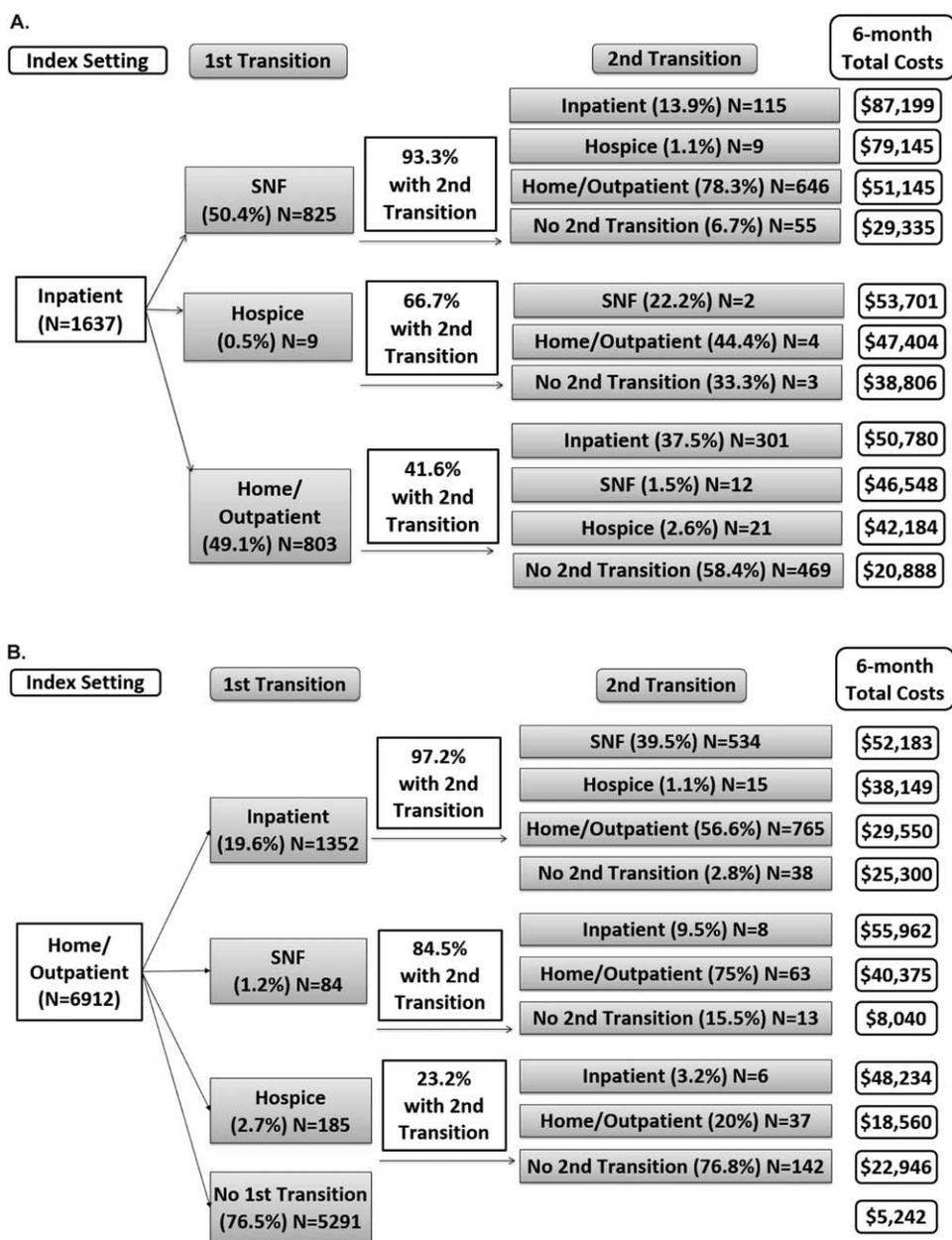
Figure 2. Transition from (A) inpatient, (B) home or outpatient.

Home or Outpatient Setting →Inpatient Setting→ SNF Setting

Participants who transitioned from home or outpatient to inpatient and then SNF setting were captured in the third most commonly observed combination of transitions and included 534 individuals with AD. The primary diagnoses were AD in the index home or outpatient setting, pneumonia in the inpatient setting, and hypertension in the SNF (Supplementary Figure S3).

Inpatient Setting →Home or Outpatient Setting →Inpatient Setting

The fourth combination included 301 participants who transitioned from an inpatient to a home or outpatient and back to an inpatient setting. The primary discharge diagnosis in the index inpatient setting was syncope and

collapse, diabetes mellitus in the home or outpatient setting, and chest pain in the second inpatient setting (Supplementary Figure S4).

Cost Associated with Commonly Observed Combinations of Transitions

Home or Outpatient Setting →Inpatient Setting→ Home/ Outpatient Setting

The average total Medicare expenditures of the first combination was $29,550 over 6 months. The average LOS was 74 days in the first home or outpatient setting, which accounted for 14.6% ($4,322) of the average total cost. The next transition was to an inpatient setting, where participants remained an average of 6 days, accounting for 31.3% ($9,250) of the total cost. The average length of
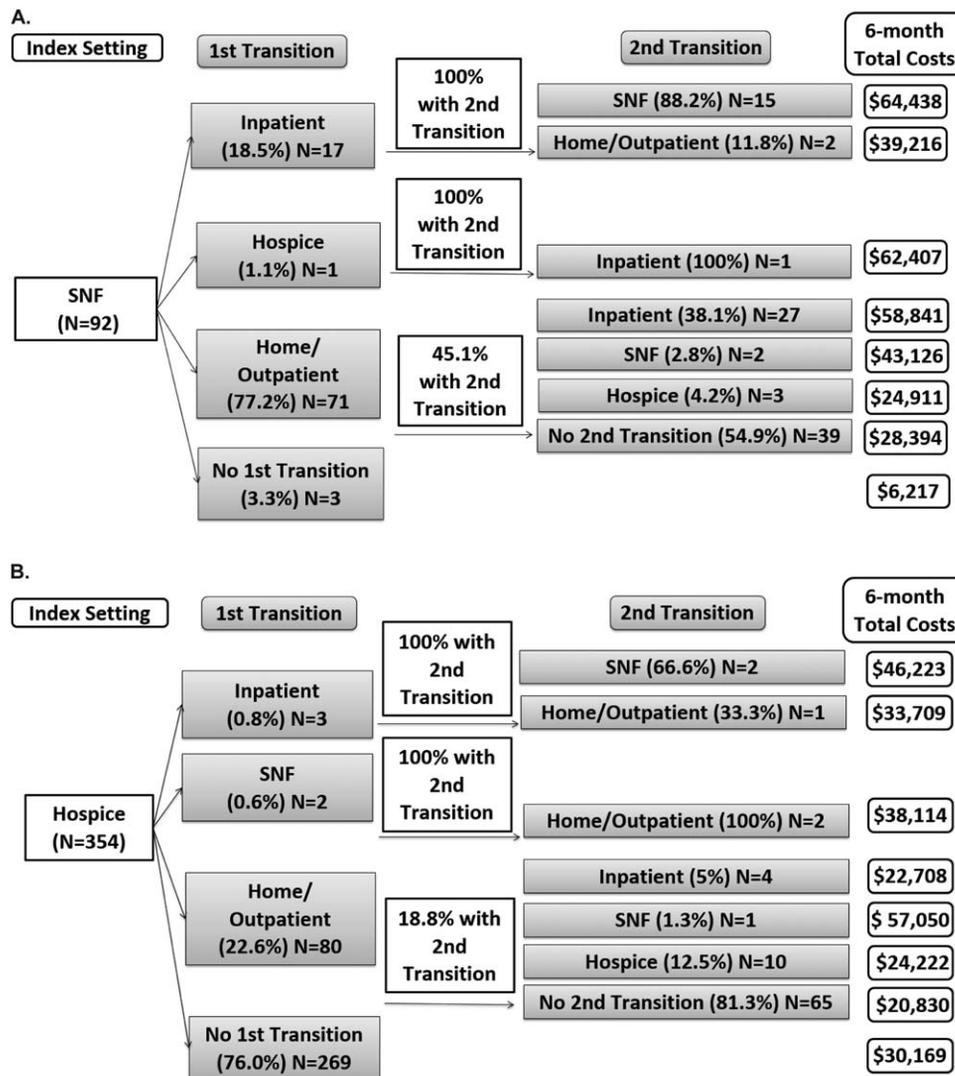
Figure 3. Transition from (A) skilled nursing facility, (B) hospice setting.

stay for the second time in the home or outpatient setting to the end of the 6 months after the AD diagnosis or next transition (if any) was 78 days, and participants incurred an average of $4,472 (15.1%) of the average total cost during the 6-month postdiagnosis period (Supplementary Figure S1).

Inpatient Setting →SNF Setting→ Home or Outpatient Setting

Average total healthcare expenditures were $51,145 during the 6 months after AD diagnosis for participants in the second combination of transitions. These participants were hospitalized for an average of 8 days and incurred 24.8% ($12,699) of the average total cost. Participants remained for an average of 43 days during their SNF stay, accounting for 39.9% ($20,417) of the average total cost. The mean LOS for the home or outpatient setting to the end of the 6 months after AD diagnosis or next transition (if any) was 102 days, and participants incurred 9.7% ($4,985) of the average total cost (Supplementary Figure S2).

Home or Outpatient Setting →Inpatient Setting→ SNF Setting

The average total Medicare expenditure of the third combination was $52,183 over 6 months after AD diagnosis. The mean LOS in the index home or outpatient setting was 65 days, which accounted for 6.3% ($3,296) of the average total cost before being admitted to the hospital. The average hospital stay was 8 days, which cost 25% ($13,263) of the average total cost. These individuals were later discharged to a SNF, where they remained for an average of 60 days, incurring an average of 32.9% ($17,185) of the average total cost in the 6-month period (Supplementary Figure S3).

Inpatient Setting →Home or Outpatient Setting →Inpatient Setting

Individuals in the fourth combination incurred an average $50,780 of costs during the 6 months after AD diagnosis. These individuals were hospitalized for an average of 8 days, resulting in an average cost of $11,283 (22.2% of the average total cost). Participants remained for an

average of 65 days in the home or outpatient setting before being re-admitted to the hospital, where they remained for an average of 6 days. The mean cost in the home or outpatient setting was $4,043, which was approximately 8% of the average total cost; the average cost of the second inpatient setting was $11,124 (21.1% of the average total cost) (Supplementary Figure S4).

DISCUSSION

A significant portion of individuals received their first AD diagnosis in a nonambulatory setting—particularly inpatient settings. Participants diagnosed in nonambulatory settings went through more transitions of care during the 6-month postdiagnosis period than those who were diagnosed in a home or outpatient settings. Overall economic burden was substantial for participants diagnosed in nonambulatory settings—an average of $41,468 (results not shown) during the 6 months after AD diagnosis—whereas participants diagnosed in an ambulatory setting incurred an average of only $12,597 during the same period.

The 30-day readmission rate after index hospitalization discharge was 22% in this analysis. In addition, the current study results indicate that, once an AD diagnosis is made, especially if a diagnosis is made in an inpatient setting, subsequent care is necessary. It is possible that these individuals were not adequately managed or were not given an adequate management postdischarge plan, which might have resulted in a high readmission rate. Furthermore, individuals with AD with other comorbidities need to be properly managed and treated for all of their conditions to prevent some of the extensive additional care. The cost of comorbid conditions in individuals with AD could explain some of the cost differences between index settings and transitions between settings. We did not evaluate the effect of the costs of comorbidities in the current analysis because it was beyond of the scope of the study.

Early detection of dementia is helpful in delivering appropriate care and offering direct benefits to individuals with dementia,[11] and studies of hospital data have found that early detection of AD can be cost-saving.[12–14] The observed benefit from the study findings suggests that participants managed in home and outpatient settings who did not have another transition during the 6-month postdiagnosis period, were better managed and cost the healthcare system less. This highlights the need to reevaluate management of AD by preventing frequent hospitalizations with proactive outpatient care[15] because the earlier an individual is managed, the longer he or she can avoid intensive healthcare resource encounters.

We also observed high cost burden for participants who transitioned to institutional care facilities, such as an inpatient setting or SNF, or those who transitioned twice to an inpatient setting. As reported above, AD was not listed as an admitting diagnosis for most of these individuals. Even when transitions from care settings where AD was initially diagnosed were assessed, AD was not observed to be the primary diagnosis for subsequent care settings. Furthermore, AD exacerbates other comorbid conditions, and individuals with AD tend not to adhere to management because

of their cognitive impairment, which can complicate their care.[16,17] Our study was exploratory and descriptive and provides a preliminary examination of how these comorbidities are present among AD patients across different healthcare settings. Dementia, even if it is not the primary reason for an episode of care, can have a profound effect on care delivery and outcomes[18–20]

The health status of an individual seeking care for an acute event such as hip fracture can be updated at the onset of care for the acute episode and during transitions to different care settings. A different approach might be developed for individuals seeking care for a chronic illness such as AD. Being a chronic disease, AD is difficult to study in terms of episodes of care because it is often difficult to define a start and end of an episode for a chronic disease. Even though our health economic approach to episodes might not easily transition into a bundled payment approach, they can help analyze transitions of care between healthcare settings for individuals with AD.

Although claims data are valuable for the effective assessment of real-world health information, there are inherent limitations in this study. The main challenge of existing bundles is their short duration because most cover services up to 90 days after hospital discharge for Medicare beneficiaries.[21] Further studies should evaluate bundled payment using longer follow-up time frames if they are to be useful for chronic diseases. In most institutional settings, AD was not coded as an admitting diagnosis in the current analysis. Undercoding of AD in acute hospital and outpatient care settings could cause this, as previously discussed.[22] Measures such as AD duration, disease severity and progression, stage of disease, cause of death, health behaviors, and caregiver information were lacking in the Medicare data, so study participants may represent individuals across the spectrum of dementia severity and may not reflect results for individuals with new onset of AD. This study was descriptive, so factors such as age, sex, and comorbid conditions that could affect individuals' costs and transitions of care were not adjusted in a multivariate model. Methodologically, a multivariate analysis of a sequence of acute events as part of an overall episode is not straightforward because the pattern of such care will vary according to the individual. This study included fee-for-service beneficiaries enrolled in Medicare Parts A and B, which may limit generalizability of the study results to individuals enrolled in Medicare Part C. Studies are needed to determine the significance of the episode-of-care approach to analysis of the health economics and quality of care in Medicare Part C settings. At the time of this analysis, ICD-9 code 331.0 was a billable code. It is likely that the switch from ICD-9 to ICD-10 codes for disease classification will improve results and quality of care because ICD-10 codes are more specific to individual disease conditions, allowing for more effective disease management.

This analysis displays how an episode-of-care approach might be implemented using health economic data to identify individuals at risk of hospitalization and analyze care across the continuum of care for individuals with AD. This study highlights the number of transitions, time between each transition, and healthcare expenditures

across different healthcare facilities for individuals newly diagnosed with AD, which could help stakeholders and medical professionals to better manage individuals with AD in different healthcare settings and guide future research.

ACKNOWLEDGMENTS

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SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article.

Table S1. Demographic and Clinical Characteristics of Newly Diagnosed AD patients (By Index Settings)

Table S2. Health Care Utilizations During the 6-month Follow-up Period

Figure S1. Transition Between Home/Outpatient → Inpatient → Home/Outpatient

Figure S2. Transition Between Inpatient → SNF → Home/Outpatient

Figure S3. Transition Between Home/Outpatient → Inpatient → SNF

Figure S4. Transition Between Inpatient → Home/Outpatient → Inpatient

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