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Systems delivery innovation for Alzheimer's disease

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Abstract

Objectives: We describe a comprehensive care model for Alzheimer's disease (AD) that improves value within 1–3 years after implementation by leveraging targeted outpatient chronic care management, cognitively protective acute care, and timely caregiver support.

Design/Setting/Participants: Using current best evidence, expert opinion, and macro-economic modeling, we designed a comprehensive care model for AD that improves the quality of care while reducing total per-capita healthcare spending by more than 15%.

Measurements: Cost savings were measured as reduced spending by payers. Cost estimates were derived from medical literature and national databases including both public and private US payers. All estimates reflect the value in 2015 dollars using a consumer price index (CPI) inflation calculator. Outcome estimates were determined at year 2, accounting for implementation and steady-state intervention costs.

Results: After accounting for implementation and recurring operating costs of approximately \$9.5 billion, estimated net cost savings of between \$13–41 billion can be accomplished concurrently with improvements in quality and experience of coordinated chronic care (\$.01–6.8 billion), cognitively protective acute care (\$8.7–26.6 billion), timely caregiver support (\$4.3–7.5 billion), and enhanced caregiver efficiency (\$4.1–7.2 billion).

Conclusions: A high-value care model for AD may improve the experience of patients with AD while significantly lowering costs.

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Keywords

care design; care delivery; Alzheimer's disease; healthcare policy; high-value care

INTRODUCTION

Dementia is the sixth leading cause of death in the United States, and ranks fifth among individuals 65 years of age and older (1). Despite encouraging evidence of a decline in dementia point prevalence over the 12 years from 2000–2012 (2), adults aged 65 years and older are expected to represent 20% of the U.S. population by 2030 (3). Alzheimer's disease (AD), the most common form of dementia in the U.S., results in an estimated \$236 billion in direct health care and long-term care costs (3). Given that age is the greatest risk factor for dementia, the point prevalence of AD cases in the U.S. is projected to increase to 8.4 million in 2030 (3). Despite evidence for the efficacy and cost-savings of interventions that modify risk factors associated with AD, the most significant costs associated with AD are long-term residential and nursing care, inpatient medical care, and outpatient medical care (3). Healthcare spending in the U.S. continues to rise (4), and the cost of care for these patients is expected to reach \$1 trillion by 2050, adding measurably to the existing national spending crisis (3). Healthcare value—defined as improvement in population health and patient experience at lower per-capita cost—is thus a national imperative.

The primary payment model for health care in the United States remains fee-for-service (FFS), in which individual providers are paid for individual components of care. Fragmentation and poor coordination of care are common within the FFS model, and these deficits are magnified among individuals with AD, who often require complex care management over longer periods of time (5). Individuals with AD have high rates of outpatient medical care, emergency department use and inpatient hospitalization, which contribute to the significant financial burden associated with costs of care in this population. Moreover, medical intervention is uniquely risky for those with AD, who frequently have multiple chronic medical conditions (6)(7). Addressing the costly and low quality aspects of medical care for individuals with AD will provide higher value patient-centered health care delivery.

In January 2017, CMS initiated a new reimbursement mechanism designed for care planning of people with cognitive impairment, individuals with dementia and related conditions. The current procedural terminology (CPT) code 99483 incorporates a multidomain assessment that serves as the basis for a documented care plan, which is developed and shared with the patient and family/caregiver. While this mechanism differs from bundled payment mechanisms for total joint replacement and other discrete episodes of care, the mechanism supports a dementia independent practice unit (IPU), allowing Medicare-enrolled providers (physicians, advanced practice nurses, physician assistants, etc.) to establish an ongoing plan for the care of individuals with dementia, including advanced care planning (8). In addition, the Quality Payments Program (QPP), part of the larger Merit-based Incentive Payment System (MIPS), has instituted 6 quality measures for dementia care including: caregiver education and support, cognitive assessment, counseling regarding safety concerns,

functional status assessment, neuropsychiatric symptom assessment and management of neuropsychiatric symptoms. Costs associated with inpatient utilization among individuals with AD are another source of significant medical spending, and alternative payment models (APM) can incentivize high value evidencebased, coordinated care across outpatient and inpatient settings for individuals with AD and their caregivers.

Using a method incorporating current best medical evidence, in-depth site and practice observation, expert opinion and macro-economic modeling, we designed a comprehensive care model that targets the major cost drivers for individuals with AD and improves healthcare value within 1–3 years after implementation. We used macroeconomic quantitative analysis to estimate the net economic impact of the resulting care model on Medicare and Long Terms Services and Support (LTSS) spending if scaled nationally. We describe a comprehensive care model for individuals with AD that improves the quality of care while reducing total per-capita expenditure.

METHOD

Model Development

Stanford's Clinical Excellence Research Center uses an established healthcare delivery redesign method that has promoted high quality, cost saving care delivery strategies across a number of populations and medical conditions (9)(10)(11)(12). The method includes 1) literature review; 2) Qualitative observations of organizations that take population health financial risk to observe how patients and processes are managed cost-effectively while meeting ethical norms and achieving high Centers for Medicare & Medicaid Services (CMS) star ratings. These site observations of care delivery are conducted using field-based ethnographic tools (13) and interviews using design methods from Stanford's Design School and Biodesign Programs to help identify problematic aspects of current care delivery and opportunities to improve the experience of care and total per-capita healthcare spending (14); and 3) Expert knowledge from executives at healthcare systems and key opinion leaders.

We refined and combined these diverse elements into an overall care delivery model with iterative input from clinicians, social scientists, health services researchers, and business leaders. Potential savings were estimated from the total costs of care for individuals with AD (3) deducting implementation and operating costs of new care delivery strategies. We estimated the potential national impact of the dementia centered care model on Medicare and LTSS annual spending using established methods of budget impact analysis (15). Sensitivity analyses evaluating the efficacy of individual subcomponents for each model component yielded low and high gross and net estimated savings utilizing 95% confidence intervals. This study was exempted from review by the Stanford Institutional Review Board.

Model Components

The high-value care model is comprised of the following components: 1) coordinated outpatient chronic care management, 2) provision of cognitively-protective acute medical care through delivery of acute medical care at home when feasible, and use of delirium

prevention interventions for inpatients, and 3) improvement in the efficiency and resiliency of caregivers.

Tailored outpatient chronic care management

Complex care management programs (CCM) have been successfully employed to improve care coordination and reduce healthcare utilization for high-cost individuals with multiple chronic conditions (16), including individuals with dementia (17)(18). Typical dementia care, however, is fragmented and rarely meets the unique needs of patients and caregivers (19). Healthcare providers struggle to manage this disease given the lack of effective disease-modifying agents or a cure. Frequently, dementia is ignored during routine care, despite evidence that the disorder is an important driver of healthcare utilization, caregiver burnout, and total healthcare cost (3). Emerging clinical research has demonstrated the efficacy and cost-effectiveness of outpatient care management for individuals with dementia (20)(21)(22). The coordinated outpatient chronic care component includes evidence-based guidelines for primary care providers and care coordination for individuals with dementia delivered through a multidisciplinary dementia care team.

This component emphasizes harm-reduction with a focus on reducing polypharmacy (23) and improving quality of life. Recommendations include rethinking the necessity of routine cancer screening (24)(24), avoiding placement of percutaneous feeding tubes (26), scheduling advanced care planning discussions, especially at mild dementia stages when patients can express their wishes, and reducing the intensity of disease management for chronic conditions to avoid treatment-induced complications. A goal for glycated hemoglobin (hemoglobin A1c) of 89%, for example, is considered sufficient for patients with diabetes and limited life expectancy (26). Similar harm-reduction approaches can be taken for individuals with AD in the continuing management of other asymptomatic chronic conditions such as hypertension and hypercholesterolemia.

A dementia Integrated Patient Care Unit (IPU) plays a critical part within the CCM program. An IPU is a means to support integrated care that is organized around the patient, providing the full cycle of care for a medical condition (e.g., patient education, engagement and follow-up). IPU providers include psychologists, social workers, nurses, pharmacists, physical/occupational therapists and medical assistants. This team, overseen by a geriatric nurse practitioner or physician, works closely with the patient's primary care doctor over the full patient care cycle (27)(17)(18).

Cognitively protective acute care

Relocation of care to home when feasible—Hospital at Home (HaH), a well-validated means of delivering acute medical care for nearly one third of patients who would otherwise require inpatient admission is another component. Individuals with AD have a higher frequency of hospitalization largely due to exacerbations of chronic disease that could be effectively managed at home (28). Hospitalizing demented patients is particularly problematic, given that upwards of 56% of all acute hospitalizations for individuals with dementia are complicated by delirium (29). When delirium is superimposed on dementia the risk of death increases, cognitive decline accelerates and, cognitive and functional losses are

often permanent (29,30). Considering that 66% of all community dwelling individuals with AD are hospitalized once a year, nearly one in three have permanent cognitive and functional losses attributed to delirium during a hospitalization (31). Notably, iatrogenic injury avoidance through decision support permeates health systems for multiple other disorders, with alerts that avoid ordering contrast agents in renal failure and hepatotoxic medications in liver failure. Yet for patients with AD, no such systematic prevention measures exist. Demonstrable benefits of HaH include a 19% (32) reduction in mortality, 75% reduction in delirium (33), and higher patient satisfaction scores (34).

Mitigation of inpatient delirium—Movement toward age-friendly health systems and calls for redesigning acute care for the cognitively impaired are gaining increasing support from organizations such as the Hartford Foundation and the Institute for Healthcare Improvement (35). Effective interventions exist to mitigate the risk of delirium in individuals with dementia for both elective and non-elective hospitalizations (32)(36). If hospitalization is anticipated, whether for elective or emergent reasons, electronic clinical decision support can alert providers of the risks associated with delirium and default to protective interventions. For those patients who cannot receive HaH due to unsatisfactory home conditions, medical urgency, necessity for hospital equipment, or geographic limitations, multi-domain interventions such as the Hospital Elder Life Program (HELP) can be employed to combat delirium in hospitalized cognitively impaired patients, and reduce the risk of accelerated decline and death (32).

Improved efficiency and resiliency of caregivers

The model also attends to caregivers. More than 15 million individuals provide unpaid care for individuals with AD (3). These caregivers – primarily daughters and spouses – spend some 18 billion hours of unpaid care per year at an invisible cost of more than \$220 billion dollars (3). The sometimes harsh and usually relentless nature of care for individuals with AD takes a toll on caregivers, and as the burden to these individuals increases, individuals with AD often end up in the emergency department, re-hospitalized, and ultimately placed into long-term care (37)(38)(39). Improving caregiving efficiency early in the caregiving trajectory holds considerable potential for reducing the number of unpaid caregiving hours required and the toll it takes on caregivers' health, financial status, and wellbeing. Women provide nearly two-thirds of all elder care and are notably disproportionately at risk of early or complete workplace exit at the start of a high-intensity caregiving role, with downstream implications for workplace gender equality (40)(41). Well-timed caregiver support using home-based interventions led by occupational therapists can stabilize functional abilities in care recipients and reduce the number of hours of caregiving required (42). Similarly, psychosocial interventions aimed at reducing caregiver burden can remediate depressive symptoms in caregivers, delay long-term placement, and reduce health care utilization of both caregivers and care recipients (43)(44)(45). Many interventions have focused on increasing the efficiency of caregiving (46), but regrettably few data exist on cost savings associated with these interventions (47)(48).

Cost Analysis

We estimated low and high direct and indirect cost savings from the US health system perspective based on outpatient CCM, inpatient acute care interventions, and caregiver support interventions. Relevant population demographic parameters were utilized for each intervention (Table 2). Intervention-specific modeling assumptions were derived from published sources to generate confidence interval based efficacy ranges included in cost modeling analyses (Table 3). In cases where data were not available we contacted the manuscript authors to collect the relevant data required to calculate confidence intervals. Cost modeling was conducted at year 2 of the comprehensive care model, adjusted for the increase in AD cases based on current incidence rates of diagnosis and death. Average total costs of care for individuals with AD were calculated based on severity of dementia and the proportion of the U.S. population at each stage of dementia severity. The measure of cost savings is reduced spending by payers. Cost estimates were derived from medical literature and national databases including both public and private US payers. Discounting was not applied. All estimates reflect the value in 2015 dollars using a consumer price index (CPI) inflation calculator. For strategies requiring new healthcare job roles (e.g., chronic care management team), we offset savings by estimated implementation and steady-state intervention costs, which we expect to be ongoing on an annual basis. These costs were estimated from published costs of related interventions.

RESULTS

Annual and PMPM gross savings across Medicare, LTSS and out of pocket (OOP) associated with the three approaches at year 2 are shown in Table 4. Low and high annual savings rates for the outpatient CCM components were derived from published CCM program outcomes across inpatient utilization, medical provider costs, skilled nursing facility costs and prescription drug costs. Low and high PMPY savings rates were multiplied by the number of persons with moderate/severe dementia (assumes full enrollment of persons with moderate/severe dementia). Estimated implementation costs of \$270 million in year 1 were calculated assuming an individual patient panel size of 1000 patients (49). Estimated total operating costs of \$6.5 billion for year 2 were calculated as the annual cost of dementia team care (\$1540 PMPY) multiplied by the estimated point prevalence of individuals with AD. If nationally implemented, we estimate high net annual savings for our tailored CCM component to be \$6.8 billion for the estimated 4 million persons in the US with moderate to severe dementia in year 2. Net annual savings of approximately \$10 million are estimated with more limited reduction in costs for inpatient utilization (7.5%), medical providers (4%), skilled nursing facilities (7.5%), and prescriptions (5%).

Cost modeling for the HaH Medicare component estimated gross savings at year 2 for community-dwelling individuals with AD with home care assistance available accounting for population specific inpatient care costs and percentage of eligible patients using ambulatory care sensitive conditions. Low and high annual savings rates were modeled using published data on inpatient cost savings utilizing HaH (50). The HELP Medicare component of cognitively protective acute care estimated gross savings at year 2 for community-dwelling individuals with AD not treatable by HaH hospitalized at least once a year. Savings

are calculated from decreased lengths of stay in both those with delirium prevented and those who became delirious but had shorter lengths of stay associated with HELP intervention. Costs are modeled as the fraction they would contribute to total inpatient Medicare costs for the year based on lengths of stay. Low and high annual savings rates were modeled using published data on percentage reduction of inpatient delirium and the fraction of inpatient days reduced when delirium does occur.

HaH LTSS savings was calculated as the difference in care setting (home vs. assisted living for CDR1 and assisted living vs. nursing home for CDR2) for all those persons who had delirium prevented by receiving medical care at home, adjusting for the percentage of people who would be eligible for HaH based on medical severity. Our model further assumes that mitigation of delirium avoids subsequent cognitive decline at a more rapid rate (51). Low and high annual savings rates were modeled using published data on odds reduction of inpatient delirium for HaH compared to inpatient hospitalization (33). HELP LTSS savings was estimated as the difference in care setting (home vs. assisted living for CDR1 and assisted living vs. nursing home for CDR2) for all those persons who had delirium prevented by receiving HELP during their hospitalization. This analysis assumes that avoiding delirium avoids subsequent cognitive decline at an increased rate (51).

Low and high net savings were estimated utilizing 95% confidence intervals of the reported cost savings from HaH and HELP on total inpatient costs, delirium reduction and length of stay reductions (see Table 3). Steady-state intervention costs for HaH were derived from third party vendors of HaH systems and estimated at \$2.24 billion. Implementation costs of \$80 million and steady-state intervention costs of \$40 million were derived from published data on costs associated with implementation and operation of HELP programs (52). Net annual savings from the cognitively protective acute care component are estimated at \$8.7–26.7 billion in year 2.

Gross savings at year 2 for the timely caregiver support component were calculated as the difference in care setting cost (community vs. assisted living or long-term care) PMPY for all community dwelling individuals with AD with CDR2 severity living with a spouse. Costs were modeled adjusting for the increase in AD cases without a concomitant rise in available caregivers, and excluding the percentage of caregivers that would have received the intervention at year 1 assuming a 50% year 1 adoption rate. Low and high annual savings rates were modeled using published data on the median number of days delayed before long-term care placement associated with caregiver support (44). Implementation and steady-state intervention costs were derived from published data on the costs of caregiver support interventions.

Estimated PMPY gross savings at year 2 from reductions in unpaid caregiving hours associated with caregiver efficiency training were calculated as the difference in unpaid caregiving hours valued at \$9.14 per hour for all spousal caregivers of individuals with AD with CDR2 severity who received the caregiver intervention. The estimated savings were adjusted for the increase in AD cases without a concomitant rise in available caregivers, and excluding the percentage of caregivers that received the intervention at year 1, assuming a 50% year 1 adoption rate.

Lower and higher estimated net annual long-term care savings for caregiver support were estimated utilizing published data on median days delayed before long-term care placement (45)(44). Implementation costs at year 1 were approximately \$250 million and at year 2 were approximately \$140 million. Ongoing input costs associated with caregiver support interventions are principally salaries for the interventionists, which can include therapists, nurses, and social workers. Estimated net annual long-term care savings from increased caregiver support are between \$4.3–7.5 billion.

We also estimated additional savings from reductions in unpaid caregiving hours associated with caregiver efficiency training. While these savings are not currently captured by specific payers or providers, they represent a valuable improvement in the experience of caregivers. High and low net annual unpaid caregiving savings from increased caregiver efficiency were estimated using 95% confidence intervals of per day cost savings (42). Net savings ranged from \$4.1–7.3 billion.

Table 5 summarizes the net savings from each of the three model components. Overall, our proposed high value dementia care model could lower the cost of healthcare for individuals with AD in the United States between \$13–41 billion within two years after implementation, including the costs of implementation and operation, representing total per member per year (PMPY) savings of between 6–17%. Additional estimated savings of between \$4–7 billion (23%) could be realized from reduction of unpaid caregiving hours required by caregivers. Some caregiver support interventions have reported reductions in patient-specific health expenditures (43). As a result, we also calculated total estimated savings accounting for the costs without savings derived from the CCM component. In this scenario, total savings are reduced to between 6.17 billion and 27.37 billion within two years after implementation, representing total PMPY savings between 3–12%.

DISCUSSION

We propose a care model to improve healthcare value for individuals with AD and their caregivers. The model consists of care delivery strategies focused on the cost of outpatient and inpatient medical care and long-term care. The model employs strategies that incorporate patient-centered CCM, cognitively protective inpatient care, and caregiver support.

We estimate that the costs of implementation and operation of the model would be approximately \$8.9 billion. After subtracting the implementation costs, our analysis suggests the model could lower the cost of AD healthcare in the United States between \$13–41 billion within two years of implementation. This estimate includes estimated savings across Medicare, out of pocket and long-term services and support costs, the total societal impact is likely to be even greater. Unpaid caregiving costs, for example, are now valued at approximately \$220 billion yearly, a figure that rivals the total costs of care currently captured in the AD population (3). For the majority of the US population, these cost savings would accrue to the individual with AD and their family and delay the process of ‘spend-down’ to Medicaid eligibility. However, federal and state governments would also realize savings through postponement of Medicaid enrollment among individuals with AD.

A significant challenge for value-based care model design is ensuring that lowering the cost of clinical care does not come at the expense of lowering the quality of care, ultimately resulting in poor clinical outcomes. CERC defines healthcare value using the triple aim: improvement in population health and patient experience at lower per-capita cost (53). For this reason, integrated healthcare systems and risk-bearing systems such as Medicare advantage plans are typically the early adopters of high value models. Increasingly, however, policy changes represent a lever that can incentivize less risk-bearing systems to implement higher value care delivery.

In the case of a chronic and degenerative disease such as AD, declines in cognitive functioning almost always require care across multiple clinical settings, with increasing involvement of caregivers and family members. This reality underscores the importance of communication and coordination between providers and with patients and their family and caregivers. It is not uncommon for care of patients with AD to include PCPs, neurologists, psychiatrists, geriatricians, emergency physicians, psychologists, nurses, rehabilitation professionals, and social workers. Ideally, care delivery should be aligned to support providers' communication about all aspects of care, whether diagnostic, outpatient management, emergent conditions, inpatient care and long term care planning. Amjad and colleagues (2016) have reported that among FFS Medicare beneficiaries, low continuity of care is associated with higher rates of hospitalization, ED visits, testing, and global healthcare spending (5). Similarly, Mondor and colleagues (2017) reported higher rates of hospitalization and ED visits among individuals with dementia enrolled in home healthcare delivery in Ontario receiving low continuity of care (54). These data provide evidence for improvements in patient experience, quality of care, and reductions in overall cost associated with improved continuity of care across both outpatient and inpatient settings. CMS has recently implemented a new Medicare billing code – CPT code 99483 (initially G0505) – designed to incentivize providers to develop greater continuity of care for individuals with cognitive impairment. Billing for this visit requires assessments of safety, physical functioning, cognition, neuropsychiatric and behavioral symptoms, and caregiver needs. Additionally, the visit requires a complete medication review, an advanced care planning discussion, and the creation and documentation of an ongoing care plan. While CPT code 99483 has limitations (8), it is an important policy advance that lowers current barriers toward implementation of higher-value care in this population. For health care systems that have effectively utilized CCM models in other populations, increased reimbursement for chronic care management will further aid in implementation and dissemination.

Importantly, CPT code 99483 bill also addresses the assessment of caregiver needs. Identification of caregiver needs is integral to patient care for individuals with AD, and can no longer be regarded as optional. While a caregiver needs assessment does not ensure intervention or follow-up it recognizes the fundamental role that caregivers play in AD. Maust and colleagues recently reported that caregiver distress is associated with healthcare utilization and costs in a nationally representative sample of individuals with dementia (55). In addition to potential cost savings through reduced healthcare utilization, timely and effective caregiver support can achieve reductions in cost for individuals with AD through delayed long-term care placement and decreased unpaid caregiving hours, both of which are mediated by caregiver factors (44)(42).

Additional specific inpatient care interventions can further improve the quality and experience of care for individuals with AD. Given that almost every individual with dementia in the US is at risk of experiencing at least one episode of delirium (31), interventions aimed at reduction and prevention of inpatient delirium could potentially improve both current life expectancy and reduce the risk of an irreversible acceleration in the decline of cognitive functioning (51), resulting in down-stream decreases in the cost of long-term care. Total costs of care for inpatient hospitalization can be reduced through incorporation of HaH. Third party vendors such as Medically Home have reduced total cost for a medical episode by up to 50% (56). Published sources suggest a 19% reduction in episodic costs in older adults with diverse multiple chronic conditions (34). Reducing total hospitalization costs annually for patients with dementia can save this margin for total inpatient costs, which are upwards of \$11,000 per person per year (3). The Physician-Focused Payment Model Technical Advisor Committee (PTAC) has recently recommended full implementation of two alternative payment models (APM) for HaH. Adoption of an APM would establish dedicated Medicare billing codes, allowing for broad uptake and dissemination of HaH across the U.S. (57). Such a policy lever would significantly aid implementation of this model component. Nevertheless, system implementation of HaH is challenging for most health systems. Successful adoption can be accomplished through partnerships with third-party vendors. For example, Marshfield Health System in Wisconsin has partnered with Contessa Health to advance HaH implementation.

This healthcare delivery redesign study has several limitations. Our method for identifying high value medical evidence necessarily includes multiple sources of varying methodological rigor. Though the components of our care model were reviewed by clinicians and researchers with expertise in geriatrics and neurodegenerative disease, in some cases we necessarily relied upon evidence from interventions in closely related frail elderly populations. Our model includes implementation costs for acute care and ongoing operating costs for chronic care, caregiver support, and acute care, but it was not readily susceptible to multifactorial sensitivity analysis. The dissemination and adoption of this model will be limited by specific systemic and organizational factors. In addition, we assumed cost savings between the three components to be additive. While each component of the model addresses a distinct aspect of cost and care, in practice, these components may have synergistic effects on cost. For this reason, we also reported net savings if costs for the outpatient CCM and caregiver support components were included, without additional savings accrued from the CCM component. On the other hand, the care model may also have synergistic effects that result in unanticipated effects of cost savings.

Conclusion

In 2002 the American Board of Internal Medicine released the Medical Professionalism in the New Millennium: A Physician Charter (58). Notably, the charter requires physicians to provide care based upon the “cost-effective management of limited clinical resources” and to “develop guidelines for cost-effective care.” As the US population continues to age, physicians and health systems must increase their awareness regarding the costs of chronic care conditions such as dementia on family’s pocketbooks and systemic health care spending. Our care model employs diverse sources of information to design a composite

strategy to improve overall healthcare value for individuals with AD and their caregivers. Cost savings can be accomplished concurrently with improvements in quality and experience of care such as more efficient and continuous outpatient management, decreased iatrogenic delirium and better supported caregivers. “Usual care” for individuals with AD fails to address factors of care continuity, caregiver support and inpatient risk mitigation. As a result, the standard of care for these patients is disjointed and expensive. It is time for a new approach.

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What is the primary question addressed by this study?

Health care policies for episodic and chronic care for older adults are increasingly focused on lowering costs of care. This study addressed the question of whether a comprehensive care model for individuals with Alzheimer's disease and their caregivers can reduce costs of care, while improving aspects of medical care and patient experience.

What is the main finding of this study?

A high-value care model for individuals with Alzheimer's disease and their caregivers may improve the quality of medical care and the experience of patients with Alzheimer's disease and their caregivers while significantly lowering costs. Cost savings are realized across outpatient and inpatient settings.

What is the meaning of the finding?

Designing high-value care models for specific older adult populations can work synergistically to improve the quality of care and patient experience. High-value care for individuals with Alzheimer's disease and their caregivers is a national priority and can be achieved.

Figure 1.
Dementia Centered Care Model for High Value Care of Individuals with Alzheimer's Disease

Figure 2.
Dementia Independent Practice Unit for Tailored Chronic Care Management

Table 1:**Complex Care Management Programs and Healthcare Utilization**

Program Name	Target Population	Staff Ratio	Inpatient Hospital	Medical Provider	Other
Aetna Medicare Case Management	High utilization, depression	1 CM: 1000 pts	31% reduction in hospital days	24% reduction in ED visits	34% reduction in rehab days
BWH Care Management	High utilization	1 RN: 200 pts	20% reduction in hospital days	13% reduction in ED visits	
Sutter Care Coordination	High utilization, multiple chronic conditions	RN/LCSW: 60–80 pts	27% reduction in admissions	37% reduction in ED visits	1.5 yr delay in entrance in LTC
Senior Whole Health	Older adults	1 RN: 150 pts	10–20% reduction in admissions	10–20% reduction in ED visits	
UCLA Alzheimer's and Dementia Care	Individuals with dementia and caregivers	1 NP: 1082 pts	Significant reduction in ACS admissions and 30-day readmissions		\$605 average total cost of care savings; reduced risk of nursing home placement
CERC Dementia Centered Care	Individuals with AD and caregivers	1 Clinical Navigator: 1000 pts	7.5–15% reduction in hospital costs	4–8% reduction in ED visits	7.5–15% lower SNF costs 5–10% lower medication costs

Existing CCM programs targeting older adults and individuals with dementia, staffing patterns and ratios, and reported utilization outcomes. CERC Dementia Centered Care target population, staffing patterns and ratio, and modeled utilization outcomes. Data adapted from (59).

Table 2:

Population Assumptions for Dementia Centered Care Components

Population Assumption variable	Frequency / %	Source
Prevalence 2015	5.4 million	(3)
Incidence 2016	476,000	(3)
Estimated prevalence at Year 2	5.78 million	(3)
Percentage of community dwelling AD patients	58%	(3)
Percentage of community dwelling AD patients living with a spouse or caregiver	75%	(3)
AD patients in clinical dementia rating (CDR) stage 1 or 2	60%	(60)
Percentage of AD patients in Clinical Dementia Rating (CDR) stage 2	30%	(60)
AD patients in clinical dementia rating (CDR) stage 2 or 3	73%	(53)
Community modifier to inpatient costs	89%	(3)
Percentage of eligible patients based on severity of illness using ambulatory case sensitive conditions	27.65%	(28)
Percentage of community dwelling AD patients that have any form of home assistance available (including transient)	96.8%	(3)
CDR1 and CDR2 patients who are hospitalized at least once a year	66%	(31)
AD patients who experience delirium during hospitalization	56%	(29)
Eligible patients based on illness severity using ambulatory case sensitive conditions	27.65%	(28)
Not treatable by HaH based on severity of illness	72.4%	(28)
Percentage of community dwelling patients who are hospitalized at least once a year	66%	(31)
Percentage of AD patients who experience delirium during routine hospitalization	56%	(29)
Fraction of inpatient days saved by avoiding delirium	18.7%	(52)

U.S. population estimates for demographic and clinical variables of individuals with AD included in macroeconomic analyses. AD: Alzheimer's disease.

Table 3:**Cost Modeling Assumptions for Dementia Centered Care Components**

Assumption variable	Base PMPY Costs / % / Odds (3)	High Annual Savings PMPY / % Change	Low Annual Savings PMPY / % Change	Source
Coordinated Chronic Care Management				
Inpatient utilization	\$11,834	\$1775 / 15%	\$888 / 7.5%	(26)
Medical provider	\$6,440	\$483 / 8%	\$242 / 4%	(26)
Skilled nursing facility	\$4,334	\$650 / 15%	\$325 / 7.5%	(26)
Prescriptions	\$3,037	\$304 / 10 %	\$152 / 5%	(26)
Hospital at Home				
Inpatient payments for one year in community dwelling AD patient	\$11,834			(3)
Mean percent savings of total inpatient costs by HaH	32%	42%	22%	(50)
Odds of delirium for HaH compared to hospital	0.283	0.094	0.868	(33)
Cost difference of home vs. assisted living (modeling for CDR1s)	\$43,200			(3)
Cost difference of assisted living vs. nursing home (modeling for CDR2)	\$42,570			(3)
Hospital Elder Life Program				
Percentage reduction in inpatient delirium with HELP	23%	25%	15%	(52)
Fraction of inpatient days saved when delirium occurs (i.e. when delirium occurs, days in hospital with HELP vs. without HELP)	30.7%	40%	14%	(52)
Inpatient payments for one year in community dwelling AD patient	\$11,834			(3)
Difference in cost of home vs. assisted living (modeling for CDR1s)	\$43,200			(3)
Difference in cost of assisted living vs. nursing home (modeling for CDR2)	\$42,570			(3)
Increased Efficiency and Resiliency of Caregivers				
Per day cost difference between assisted living and community dwelling AD patients	\$118.36			(3)
Median days delayed long-term care placement		557	329	(44)(45)
Per day unpaid caregiving cost savings	\$100.27	\$134.86	\$63.89	(42)
Duration in days of unpaid caregiving cost savings as a function of CDR stage 2 duration	449			(60)

Reported cost and clinical outcomes for CCM, HaH, HELP and caregiver support interventions including 95% confidence intervals. CCM: chronic care management; HaH: hospital at home; HELP: hospital elder life program.

Table 4:

Gross Savings in Billions and Per Member Per Month (PMPM) for Model Components

Intervention & Savings Beneficiary	High gross savings (US billions, 2015)	Low gross savings (US billions, 2015)	High gross PMPM Savings (US dollars, 2015)	Low gross PMPM Savings (US dollars, 2015)
Tailored Chronic Care Medicare	\$13.55	\$6.78	\$268	\$134
Cognitively Protective Acute Care Medicare	\$6.86	\$3.60	\$637	\$334
Hospital at Home Medicare	\$3.97	\$2.08	\$369	\$193
Hospital Elder Life Program Medicare	\$2.89	\$1.52	\$268	\$141
Cognitively Protective Acute Care LTSS	\$22.16	\$7.44	\$3960	\$940
Hospital at Home LTSS	\$12.87	\$1.87	\$3026	\$440
Hospital Elder Life Program LTSS	\$9.29	\$5.57	\$834	\$500
Caregiver Support LTSS	\$7.87	\$4.65	\$2356	\$1392
In-home Caregiver Training OOP	\$8.25	\$5.05	\$3770	\$2308
Total Medicare Savings	\$20.41	\$10.38	\$905	\$468
Total LTSS Savings	\$30.03	\$12.09	\$6316	\$2332
Total OOP Savings	\$8.25	\$5.05	\$3770	\$2308

Gross national and PMPM savings for individual model components. Model component savings are specified as Medicare, LTSS and OOP with total national and PMPM savings calculated by payer. PMPM: per member per month; LTSS: long term services and support; OOP: out of pocket.

Table 5.**Net Savings in Billions from Dementia Centered Care Model**

Intervention (US billions, 2015)	High gross savings	Low gross savings	Implementation Cost year 1	Annual operating cost at year 2	High net savings	Low net savings
Tailored Chronic Care	\$13.55	\$6.78	0.27	\$6.50	\$6.78	\$0.01
Cognitively Protective Acute Care	\$29.02	\$11.04	\$0.08	\$2.28	\$26.66	\$8.68
Hospital at Home	\$16.84	\$3.95	n/a	\$2.24	\$14.60	\$1.71
Hospital Elder Life Program	\$12.18	\$7.09	\$0.08	\$0.04	\$12.06	\$6.97
Caregiver Support	\$7.87	\$4.65	\$0.25	\$0.14	\$7.48	\$4.26
Caregiver Support (Unpaid)	\$8.25	\$5.05	\$0.46	\$0.52	\$7.27	\$4.07
Total Direct Cost Savings	\$50.44	\$22.47	\$0.60	\$8.92	\$40.92	\$12.95
Total Direct and Indirect Cost Savings	\$58.69	\$27.52	\$1.06	\$9.44	\$48.19	\$17.02

Gross and net national direct and indirect savings for model components. Estimated implementation and annual operating costs are subtracted from estimated low and high gross savings to calculate net individual and total direct and indirect savings.