Effects of Home-Based Primary Care on Medicare Costs in High-Risk Elders

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[Editorial comments by Peter A. Boling and Bruce Leff]

OBJECTIVES: To determine the effect of home-based primary care (HBPC) on Medicare costs and mortality in frail elders.

DESIGN: Case–control concurrent study using Medicare administrative data.

SETTING: HBPC practice in Washington, District of Columbia.

PARTICIPANTS: HBPC cases (n = 722) and controls (n = 2,161) matched for sex, age bands, race, Medicare buy-in status (whether Medicaid covers Part B premiums), long-term nursing home status, cognitive impairment, and frailty. Cases were eligible if enrolled in MedStar Washington Hospital Center's HBPC program during 2004 to 2008. Controls were selected from Washington, District of Columbia, and urban counties in Virginia, Maryland, and Pennsylvania.

INTERVENTION: HBPC clinical service.

MEASUREMENTS: Medicare costs, utilization events, mortality.

RESULTS: Mean age was 83.7 for cases and 82.0 for controls ($P < .001$). A majority of both groups was female (77%) and African American (90%). During a mean 2-year follow-up, in univariate analysis, cases had lower Medicare ($44,455 vs $50,977, $P = .01$), hospital ($17,805 vs $22,096, $P = .003$), and skilled nursing facility care ($4,821 vs $6,098, $P = .001$) costs, and higher home health ($6,579 vs $4,169; $P < .001$) and hospice ($3,144 vs. $1,505; $P = .005$) costs. Cases had 23% fewer subspecialist visits ($P = .001$) and 105% more generalist visits ($P < .001$). In a multivariate model, cases had 17% lower Medicare costs, averaging $8,477 less per beneficiary ($P = .003$) over 2 years of follow-up. There was no difference between cases and controls in mortality (40% vs 36%, hazard ratio = 1.06, $P = .44$) or in average time to death (16.2 vs 16.8 months, $P = .30$).

CONCLUSION: HBPC reduces Medicare costs for ill elders, with similar survival outcomes in cases and controls. **J Am Geriatr Soc 2014.**

Key words: home-based primary care; frail elders; Medicare costs; survival

The most costly 5% of Medicare beneficiaries account for approximately half of Medicare expenditures.[1–4] These high-cost beneficiaries tend to be older and disabled and are more likely to have multiple chronic conditions and to enter a hospital or a skilled nursing facility (SNF).[1] They have serious illnesses such as dementia, congestive heart failure (CHF), atherosclerotic disease, stroke, psychiatric disease, and cancer and have high symptom burden and functional impairment.[5,6] These traits predict greater mortality and higher medical costs.[5,7] Individuals with two or more chronic conditions are at greater risk of emergency department (ED) visits, hospitalization, and use of postacute care services.[8,9] Since 2000, such elders have experienced greater rates of hospitalizations in the last 90 days of life.[10] Much current care for these elders is fragmented, ineffective, and expensive.[11–14] Given the implementation of the 2010 Affordable Care Act, which emphasizes value-based care, health providers need to create care models that produce good clinical results and prevent high-cost events.[15]

Home-based primary care (HBPC) is a mobile care innovation that focuses on the most-ill subset of elders. Interprofessional HBPC teams deliver medical and social services to elders with severe and disabling chronic illnesses who find it difficult to get to a doctor's office.[16] The Department of Veterans Affairs (VA) operates more than 150 HBPC sites, which are associated with a reduction in

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hospital and nursing home usage.[17] Observational VA studies demonstrate that their HBPC model is associated with 24% lower total VA costs and 11% lower Medicare costs.[18] A current Medicare demonstration program, Independence at Home, is examining the effects of such HBPC on quality and costs.[19]

To the knowledge of the authors of the current study, no well-controlled studies have tested the effect of an HBPC model on costs and survival in the Medicare fee-for-service (FFS) arena. This study examined the effects of a HBPC program on costs and survival in a population of high-risk elders in Washington, District of Columbia, using a robust case–control methodology and comprehensive Medicare claims data.

METHODS

Design Overview

Medicare claims data were used to identify a case cohort of FFS Medicare beneficiaries who enrolled in the HBPC program from 2004 to 2008. A 3:1 direct matching methodology was used to create a control cohort. Inclusion criteria were aged 65 and older and without health maintenance organization coverage during the month of enrollment and for 3 months before. The data received included Medicare Parts A and B claims. Using the Residential History File, total costs and patterns of use during the study period were determined for cases and controls, and the two groups were compared using univariate analysis and multivariate linear regression models. The follow-up period began in the month after the index month and continued until death, last month of FFS eligibility, long-term nursing home placement, or end of study period in December 2008.

Setting and Participants

An urban HBPC practice in Washington, District of Columbia, was examined. Outcomes for 722 incident HBPC cases and 2,161 well-matched external controls during 2004 to 2008 were examined.

Participant Selection

Cases included individuals newly enrolled in the HBPC program during 2004 to 2008. The month of program enrollment was the index month. Nine hundred nine incident HPBC beneficiaries were identified in this time period; 197 were excluded because they lacked Medicare FFS eligibility, resided in a nursing home, or died during the index month. Controls were excluded for the same reasons. Subjects were eligible if they had a Medicare SNF stay but were not eligible if they were in a nursing home for long-term care. Controls were selected from a large pool of beneficiaries in Washington, District of Columbia, and urban counties of Virginia, Maryland, and Pennsylvania. The total control pool from which 2,161 matched controls were drawn consisted of 1,765,972 Medicare beneficiaries.

Cases and controls were matched at the index month for sex; age bands; race and ethnicity; Medicare buy-in status; long-term nursing home placement status; death in index month; diagnosis of Alzheimer's disease (*International Classification of Diseases, Ninth Revision*, (ICD-9) code 331.0) or a chronic mental illness (CMI) such as schizophrenia, depression, psychosis, or alcohol abuse (ICD-9 codes 201, 292, 295–98, 300, 303–4, 311); FFS eligibility; and frailty index. There is a close relationship in frail elders between reporting of dementia and behavioral diagnoses. Because the effect of CMI and dementia on care management is intertwined and not easily distinguishable, a combined Alzheimer's disease and CMI category was used. Three controls were available for 718 of 722 cases, and one or two controls were available for the other four cases, for a total of 2,161 controls. The first three matches achieved through random selection were used.

Frailty was measured using an index score developed by JEN Associates. A linear relationship between the JEN Frailty Index (JFI) and the probability of health service usage and future nursing home entry has been found in high-risk populations, including but not limited to homebound persons.[20] The JFI sums the presence (score = 1) or absence (score = 0) of 13 categories of illness linked to need for long-term supportive services.[21–23] The 13 categories are minor or major ambulatory impairment, mental health diagnosis, mental retardation, dementia, impairment in sensory function or self-care, presence of general symptoms, diagnosis of cancer, presence of major chronic diseases, pneumonia, renal disease, or other medical risks. Summed JFI scores create ranking groups (0–3 low, 4–6 medium, ≥7 high). Major ambulatory impairment was defined according to the presence of certain diagnoses, such as hip fracture, stroke, and falls, which served in this analysis as a claims data proxy for functional impairment.

Baseline characteristics were determined using claims data for diagnoses and use patterns during the 4-month baseline period. Comorbidity flags were yes-or-no indicators of the presence of major selected chronic diseases as primary or secondary diagnoses in the index year.

Intervention

The HBPC program has served ill elders in Washington, District of Columbia, since 1999 under the auspices of the Geriatrics Division of MedStar Washington Hospital Center (MWHC). The HBPC program is similar to VA HBPC in its use of an interprofessional team of physicians, nurse practitioners (NPs), and mental health staff with an elderly, chronically ill population. The MWHC program differs from some house call programs around the United States because the team physicians follow individuals in the hospital and at home, and the core team has a strong social work component.

HBPC recipients have multiple chronic illnesses such as dementia, CHF, diabetes mellitus, chronic obstructive pulmonary disease (COPD), stroke, and severe arthritis. The HBPC program delivers detailed care coordination at home with a team of geriatricians, NPs, social workers, licensed practical nurses, and office coordinators. The physicians perform an initial visit, visit beneficiaries every 3 to 4 months, provide 24-hour-a-day, 7-day-a week on-call telephone coverage, and perform hospital attending duties. The NPs make frequent visits, ranging from every 8 weeks to several times a week, depending on medical necessity. The social workers provide case management for

psychosocial and supportive services. Team members occasionally make joint visits to resolve conflicts in care plan, address staff safety concerns, or resolve ethical questions. Weekly team meetings allow discussion of individuals with unstable conditions and direct communication with home health, mental health, and pharmacy colleagues. The team uses a wireless electronic health record with live access to inpatient and outpatient records and applies home-based diagnostic technology.

Outcomes and Follow-Up

Primary outcomes were total Medicare costs, mortality, and pattern of use such as hospital admissions, SNF care, ED visits, skilled home health episodes, hospice, and subspecialist or generalist visits. Generalist visits included all home and office visits by NPs or primary care physicians, including internal medicine, family medicine, and geriatrics. All participants were included in follow-up analysis with Medicare claims data; death, long-term nursing home placement, entry into a Medicare Advantage program, or end of study period truncated their follow-up. The team did not provide direct care but coordinated discharge planning for beneficiaries admitted to a Medicare SNF bed.

Statistical Analysis

Medicare FFS claims data were analyzed for all cases and controls during 2004 to 2008. CMS granted the use of Medicare Standard Analytic Files, including claims from all covered services except Part D records. The data release met privacy requirements of the federal government and was approved by the institutional review board of MWHC. Individual-level longitudinal records were constructed, including summaries of payments, patterns of use, and flags for selected diagnoses. Dates of death came from Social Security Administration benefit records.

Univariate analysis was performed using analysis of variance, chi-square tests, and *t*-tests. Descriptive statistics were used to calculate prevalence of selected major chronic diseases, demographic characteristics, costs, and use patterns for baseline and follow-up periods. Multiple linear regression models were used to measure differences in Medicare costs, mortality, hospital admissions, hospital days, SNF days, ED visits, and specialist and generalist encounters. Covariates' estimated effect on expenditures was derived from a linear regression model, based on stepwise selection of major selected chronic diseases and baseline period use, with separate variables for home health, hospitalization, and SNF care. The premodel matching of participant characteristics, streamlining of factors in the stepwise selection, and the use of score-based complexity covariates allowed for control of interactions.

Presence of selected major chronic diseases, including osteoarthritis, coronary heart disease, CHF, COPD, cerebrovascular disease, and diabetes mellitus (ICD-9 codes 7145, 410–11, 413–14, 427–28, 491–93, 496, 430–438, 250) was controlled for.[2] Covariates were chosen based on external clinical judgment and on evidence from the literature of what affects use.[2] A Cox proportional hazards model was used to assess differences in mortality during follow-up, which ensured that effects of end-of-life events and unequal follow-up time were equally distributed. The Cox model controlled for information censoring in the baseline matching and covariate selection. Death was a proportional risk over time for the aging population.

Log + 1 transformation was applied to improve usage modeling. The parameter estimates with log + 1 transformation can be interpreted as a percentage difference in the model's outcome variable when comparing those with and without predictor variables. All analyses were performed using SAS version 9.1 (SAS Institute, Inc., Cary, NC). The study's funding source played no role in data collection or statistical analysis.

RESULTS

Table 1 shows baseline characteristics of cases (n = 722) and controls (n = 2,161). Large majorities in both groups were female (76.7%) and African American (90.2%). Both

Table 1. Baseline Case and Control Characteristics

Characteristic	Cases, n = 722	Controls, n = 2,161
Demographic		
Female, %[a]	76.7	76.7
Age, %[a]		
<65	2.4	2.4
65–74	12.9	12.9
75–84	36.3	36.3
≥85	48.5	48.5
Race, %[a]		
African American	90.2	90.3
Caucasian	7.1	7.1
Other	2.8	2.6
Medicare buy-in status, %[a,b]	36.3	36.3
Alzheimer's disease or chronic mental illness, %[a]	57.5	57.4
JEN Frailty Index, %[a,c]		
0–3 (low)	19.7	19.7
4–6 (medium)	43.4	43.5
≥7 (high)	37.0	36.9
Baseline period service use, %		
Medicare skilled home health[d]	63.4	39.6
Inpatient hospitalization[d]	43.4	33.4
Skilled nursing facility[e]	12.9	14.5
Nursing home	5.0	4.8
Selected major chronic conditions, %		
Coronary heart disease[d]	40.6	52.7
Cerebrovascular disease	40.4	37.1
Congestive heart failure[d]	38.4	32.4
Diabetes mellitus[d]	35.6	42.6
Chronic obstructive pulmonary disease[d]	21.6	26.8
Arthritis	39.8	36.3
Number of major chronic diseases, average	2.16	2.28

[a] Case–control matching characteristics.

[b] State payment of Medicare Part B premiums, indicating low socioeconomic status.

[c] The JEN Frailty Index sums the presence (score = 1) or absence (score = 0) of 13 categories of illness linked to need for long-term care services, including institutionalization and healthcare costs.

[d] Significant difference at $P < .05$.

[e] Any use of Medicare skilled nursing facility in the 3 months before index was used for direct matching. Long-term care status is based on an individual being in a nursing home beyond the skilled nursing facility stay.

cohorts were matched for age bands, with 36.3% each aged 75 to 84 and 48.5% each aged 85 and older. The mean age of cases (83.7) was slightly higher than that of controls (82.0, $P < .001$). Thirty-seven percent of cases and controls qualified for the highest JFI subcategory. The average number of selected major chronic diseases was similar for cases (2.16) and controls (2.28, $P = .08$). Both groups had similar rates of Alzheimer's disease and CMI, which includes other neurocognitive disorders.

Baseline Medicare Costs and Usage

During a 4-month baseline period, there was no difference between cases ($12,464) and controls ($11,209) in mean total Medicare costs ($P = .13$). Cases had a higher rate of skilled home health use (63.4% vs 39.6%, $P < .001$) and hospitalization (43.4% vs 33.4%, $P < .001$) during the baseline period.

Medicare Costs and Outcomes in Follow-Up Period

Table 2 depicts primary findings of Medicare costs during the average 2-year follow-up period (cases, 23.3 months; controls, 24.2 months; $P = .18$). The average follow-up period was less than the time span of the database (2004–2008) because of death, long-term nursing home placement, loss of FFS eligibility, and the continuous enrollment of cases over the study period.

Total Medicare costs during the 2-year mean follow-up were lower for cases ($44,455) than controls ($50,977) ($P = .01$). The cases had lower costs for hospital care, physician fees, and SNF care and higher costs for skilled home health and hospice services. Cases had 9% fewer hospitalizations ($P = .001$), 10% fewer ED visits ($P = .001$), 27% fewer SNF days ($P = .001$), 23% fewer specialist visits ($P = .001$), and 105% more generalist visits ($P < .001$). Generalists include NPs and primary care physicians in internal medicine, family medicine, and geriatrics. The Medicare costs of the HBPC services were included in the total costs of care for the cases.

Multivariate analysis showed that participation in the HBPC program was associated with 17% lower total Medicare costs, or an average of $8,477 per person over the follow-up period (95% confidence interval (CI) = $2,980–$13,971, $P = .003$). Figure 1 is a visual representation of the observed cumulative Medicare spending

Table 2. Medicare Costs During Follow-Up

Outcome Variable	Cases, n = 722	Controls, n = 2,161	*P*-Value
Medicare-eligible months (95% CI)	23.3 (22.1–24.5)	24.2 (23.6–24.9)	.18
Medicare cost categories, $ (95% CI)			
Hospice	3,144 (2,287–4,001)	1,505 (1,178–1,833)	<.001
Home health	6,579 (5,923–7,236)	4,170 (3,827–4,512)	<.001
Physician	4,143 (3,691–4,596)	5,718 (5,416–6,019)	<.001
Skilled nursing facility	4,821 (4,070–5,571)	6,098 (5,570–6,626)	.006
Other[a]	7,962 (6,723–9,202)	11,392 (10,265–12,519)	<.001
Hospitalization	17,805 (15,438–20,173)	22,096 (20,533–23,659)	.003
Total Medicare costs	44,455 (40,376–48,533)	50,978 (48,059–53,896)	.01

The follow-up period began in the month after the index month and extended until the month of death, last month of fee-for-service eligibility, or end of the study period in December 2008.

CI = confidence interval.

[a] Including diagnostic testing, transportation, Medicare Part B drugs, nonphysician practitioners, durable medical equipment, and outpatient facility use.

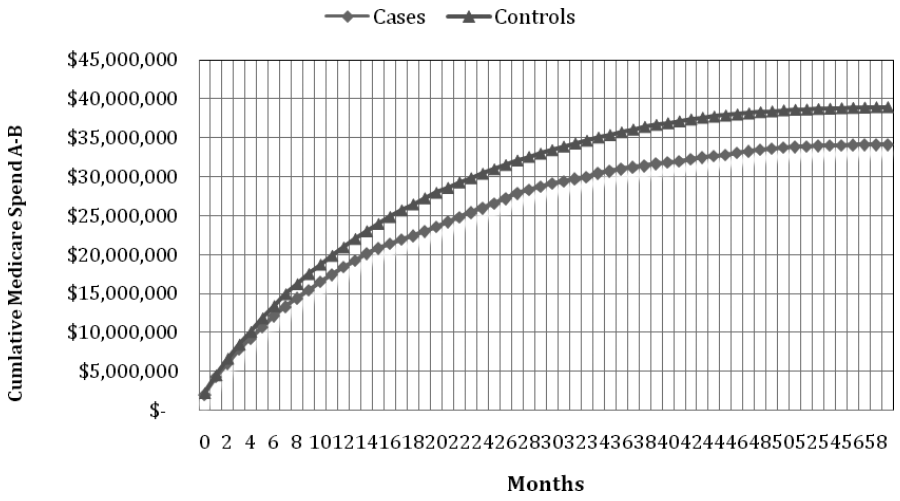

Figure 1. Total cumulative Medicare spending for home-based primary care cases averaged cumulative spending of matched controls from index month until the end of the 2004–2008 study time period.

for cases and controls from index month to the end of the study. Based on the multivariate model's estimated savings of $8,477 per person, this translates into $6.1 million in overall savings for the 722 cases during the 2-year follow-up.

In Table 3, a subgroup analysis found that overall cost differences were significant only in participants in the highest frailty category ($56,589 vs $76,840, $P < .001$) and not in the medium ($42,223 vs $43,353, $P = .37$) or low ($22,611 vs $19,146 $P = .73$) frailty groups. Differential mortality can confound the analysis of follow-up expenditures. Mortality did not affect the amount of follow-up time measured and observed for cases and controls. Overall mortality during follow-up was high and was similar for cases (40%) and controls (36%, hazard ratio = 1.06, $P = .44$). There was no difference in survival over time between cases and controls who died during the study. Average time to death was 16.2 months for cases and 16.8 months for controls. A two-sample *t*-test showed a nonsignificant difference of 0.60 months (95% CI = −2.41–1.20, $P = .30$).

DISCUSSION

Using comprehensive claims data, this study found that a HBPC model led to 17% lower total Medicare costs over a mean 2 years of follow-up, with similar mortality in both groups. To the knowledge of the authors, this is the first well-designed, case–control study of HBPC for frail elders in the Medicare FFS arena. Potential confounders present in previous before-and-after comparison studies were adjusted for by providing a methodologically robust external control group.[17,24,25] The large Medicare database and covariate adjustments addressed statistical challenges of selection bias and regression-to-the mean effects common in population-based studies. This methodology supports an accurate estimate of the model's effects on Medicare costs and mortality, apart from other factors.

Ethical barriers to randomized controlled studies and difficulty identifying an adequate control group has limited research on HBPC programs. Prior observational research found that, over a 4-year period, a posthospital house call program had aggregate costs that were 38% lower than for the 6 months before enrollment.[24] Another study showed that individuals in an HBPC program were less likely to enter a hospital and had lower rates of ED and specialty care visits.[25] In 2002, VA before-and-after analysis of their HBPC model found a 62% reduction in hospital bed days of care, an 88% reduction in nursing home bed days, and a 264% increase in home care visits. Mean total VA costs of care fell 24% in this analysis.[17,26] Some limitations of these prior studies were the lack of well-matched external control groups or multivariate modeling.

The current study found that a HPBC model lowered total Medicare costs by shifting usage from inpatient and specialty care to community-based and generalist care. Cases had 105% greater use of generalists and 23% fewer specialist visits. Despite the higher rate of generalist visits, overall physician fees were lower because there were fewer of the more-expensive specialist visits. In this model, the geriatricians serve as primary care physicians, so their services were considered "generalist" visits. An HBPC program shifts the pattern of providers, with greater use of skilled home health, palliative, and hospice services, yet still achieves overall lower cost and similar mortality outcomes.

The main HBPC program goals are to provide or coordinate all needed primary care and arrange specialty care that is compatible with beneficiaries' values and preferences. This avoids the phenomenon of discordant care that can result when multiple specialists care for an individual with complex needs without coordination by a primary care team. Critical elements of the care model are detailed care coordination by an interprofessional team, use of portable diagnostic technology, continuity of care across all settings, elicitation of beneficiaries' values and preferences, and creation of a long-term and trusting relationship with beneficiaries and their family caregivers. Enrollment in the HBPC program can shift the pattern of providers used to achieve the goal of well-coordinated care in the community. This includes increased use of skilled home health and hospice services.

The use of same-day urgent house calls allows clinicians to intervene early in exacerbations of chronic illness and preempt avoidable ED visits and hospitalizations. Physicians also directly manage care in the hospital to ensure continuity of goals and advance care plans. More than 85% of case admissions occurred at MWHC, which facilitated better control of care and costs. The NPs perform house calls within 48 hours after hospital discharge to ensure clinical stability. This all helps to improve safety and overall quality of care.[27] The HBPC social workers coordinate an array of supportive services, such as home health aides, and provide crisis management to stabilize the home situation. A mobile electronic health record enhances the team's access to clinical data across settings

Table 3. Medicare Costs According to Frailty Category

Frailty Category	Cases, n = 722	Controls, n = 2,161	*P*-Value
Medicare-eligible months (95% CI)	23.3 (22.1–24.5)	24.2 (23.6–24.9)	.18
JEN Frailty Index, $ (95% CI)[a]			
0–3 (low)	22,611 (15,667–29,554)	19,146 (16,076–22,217)	.37
4–6 (medium)	42,223 (36,670–47,775)	43,383 (39,781–46,985)	.73
≥7 (high)	58,689 (50,946–66,432)	76,827 (70,840–82,814)	<.001

The follow-up period began in the month after the index month and extended until the month of death, last month of fee-for-service eligibility, or end of the study period in December 2008.

[a] The JEN Frailty Index sums the presence (score = 1) or absence (score = 0) of 13 categories of illness linked to need for long-term care services, including institutionalization and healthcare costs.

to lessen error risk and repetitive testing.[28] An ongoing Independence at Home Medicare demonstration project is studying the effect of this approach to home-based medical care.[29]

The fact that the lower costs occurred primarily in the subgroup with the greatest frailty (Table 3) suggests that the most-ill individuals offer the greatest opportunity for savings. The high mortality seen in cases and controls reflects the high severity of illness and frailty in both groups. Clinical judgment in referral to HBPC programs can involve factors that matching variables do not capture. This can result in the higher baseline usage event rates seen in the study cases and reduce the observed magnitude of subsequent cost savings. Cases and controls were matched according to 5-year age bands but differed in mean age because cases had more participants in the higher range of the age bands. The slightly higher mean age and higher prevalence of dementia in the cases suggest that the study results may have underestimated the actual cost savings. HPBC teams appear to have the most influence on the highest risk subset of elders. This result can guide health systems and accountable care organizations to focus home-based medical services on the most-ill populations who are most likely to benefit.[30]

Strengths of this study are the use of population-based Medicare claims data not subject to recall bias. These data are longitudinal from time of Medicare coverage until death.[31] The study also included a well-matched external control group that was not enrolled in HBPC for whom comprehensive claims data were available. The direct matching methodology addressed selection bias and provided statistical power to attribute outcome differences to the care model. The study also focused on an older, female, minority, and disabled population that is not the usual target of research.

This study has some limitations. Subjects were not randomized, but the use of direct matching and multivariate analysis helped address differences between the two groups. Because of the nature of the study cohorts, the results are generalizable mainly to Medicare FFS beneficiaries. Also, the administrative Medicare data do not reflect disease severity or individual preferences for care and lacks Part D drug costs data. One other limitation is the focus on a single program and demographic that is not representative of the entire nation's frail elderly population.

The results of this study are consistent with those of other studies that suggest that a house call model can reduce costs and produce solid clinical outcomes for high-risk elders. Given the move toward more value-based payments, providers will need to create such innovative models that provide better-quality, lower-cost care to elders with severe chronic illness. This study highlights the need for further research to examine individual and caregiver satisfaction and quality of life in the HBPC model.

Implications

An HBPC model reduced total Medicare costs by 17% in an ill population and produced survival outcomes similar to those in a control population. The observed cost savings could make HBPC teams more financially viable if payers were to share savings, offer global budgeting to qualified providers, or simply pay more for HBPC for this ill subgroup of individuals. Such value-based payments could encourage scalability of this care model, promote the health and dignity of elders, and help stabilize Medicare's financial future.

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REFERENCES

1. Holtz-Eakin D. High-Cost Medicare Beneficiaries, 2005 [on-line]. Available at http://www.cbo.gov/publication/16487 Accessed March 1, 2013.
2. The Medicare Modernization Act and Chronic Care Improvement. Report to the Congress. New Approaches in Medicare. MEDPAC Report, 2004.
3. Liu K, Wall S, Wissoker D. Disability and Medicare costs of elderly persons. Milbank Q 1997;75:461–493.
4. Manton KG, Stallard E. Analysis of underwriting factors for AAPCC (adjusted average per capita cost). Health Care Financ Rev 1992;14:117–132.
5. Fried LP, Kronmal RA, Newman AB et al. Risk factors for 5-year mortality in older adults: The Cardiovascular Health Study. JAMA 1998;279:585–592.
6. Wajnberg A, Ornstein K, Zhang M et al. Symptom burden in chronically ill homebound individuals. J Am Geriatr Soc 2013;61:126–131.
7. Stuck AE, Iliffe S. Comprehensive geriatric assessment for older adults. BMJ 2011;343:d6799.
8. Bindman AB, Blum JD, Kronick R. Medicare payment for chronic care delivered in a patient-centered medical home. JAMA 2013;310:1125–1126.
9. Services CfMM. Chronic Conditions among Medicare Beneficiaries: Chartbook 2012 Edition [on-line]. Available at http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/Chronic-Conditions/Downloads/2012Chartbook.pdf Accessed June 24, 2014.
10. Teno JM, Gozalo PL, Bynum JP et al. Change in end-of-life care for Medicare beneficiaries: Site of death, place of care, and health care transitions in 2000, 2005, and 2009. JAMA 2013;309:470–477.
11. Foundations and Healthcare Reform Policy Brief. Waltham, MA: Brandeis University, 2010.
12. Jencks SF, Williams MV, Coleman EA. Rehospitalizations among patients in the Medicare fee-for-service program. N Engl J Med 2009;360:1418–1428.

13. Jenq G, Tinetti ME. The journey across the health care (dis)continuum for vulnerable patients: Policies, pitfalls, and possibilities. JAMA 2012;307:2157–2158.
14. DeJonge KE, Taler G, Boling PA. Independence at home: Community-based care for older adults with severe chronic illness. Clin Geriatr Med 2009;25:155–169.
15. Richard Kronic RP. Growth in Medicare Spending Per Beneficiary Continues to Hit Historic Lows [on-line]. Available at http://aspe.hhs.gov/health/reports/2013/medicarespendinggrowth/ib.pdf Accessed December 13, 2013.
16. Meyer GS, Gibbons RV. House calls to the elderly—a vanishing practice among physicians. N Engl J Med 1997;337:1815–1820.
17. Beales JL, Edes T. Veteran's Affairs home based primary care. Clin Geriatr Med 2009;25:149x–154x.
18. Edes T, Kinosian B, Davis D et al. Financial savings of home based primary care for frail veterans with chronic disabling disease. Abstract Presentation, American Geriatrics Society Annual Scientific Meeting, 2010.
19. Independence at Home Demonstration, Section 3024 of the Affordable Care Act [on-line]. Available at https://www.cms.gov/Medicare/Demonstration-Projects/DemoProjectsEvalRpts/Medicare-Demonstrations-Items/CMS1240082.html Accessed May 21, 2013.
20. Programmatic Applications for Predictive Modeling of Nursing Home Entry. Cambridge, MA: JEN Associates, 2008.
21. Bratesman S, Saucier P. Applying Managed Fee-for-Service Delivery Models to Improve Care for Dually Eligible Beneficiaries: University of Maryland Center on Aging. Robert Wood Johnson Foundation Medicare/Medicaid Integration Program. Portland, ME: Muskie School of Public Service, 2002.
22. Rae S, Kubisiak J, Gilden D. Cost of illness associated with metastatic breast cancer. Breast Cancer Res Treat 2004;83:25–32.
23. Gilden DM, Kubisiak J, Zbrozek AS. The economic burden of Medicare-eligible patients by multiple sclerosis type. Value Health 2011;14:61–69.
24. Boling PA, Chandekar RV, Hungate B et al. Improving outcomes and lowering costs by applying advanced models of in-home care. Cleve Clin J Med 2013;80(Electronic Suppl 1):eS7–eS14.
25. Beck RA, Arizmendi A, Purnell C et al. House calls for seniors: Building and sustaining a model of care for homebound seniors. J Am Geriatr Soc 2009;57:1103–1109.
26. Percy A, Goldberg MS. The Health Care System for Veterans: An Interim Report, 2007 [on-line]. Available at http://www.cbo.gov/ftpdocs/88xx/doc8892/ 12–21-VA_healthcare.pdf Accessed December 13, 2013.
27. Singh H, Graber M. Reducing diagnostic error through medical home-based primary care reform. JAMA 2010;304:463–464.
28. Schiff GD, Bates DW. Can electronic clinical documentation help prevent diagnostic errors? N Engl J Med 2010;362:1066–1069.
29. Independence at Home Demonstration, 2012, Details for Demonstration Project [on-line]. Available at http://www.cms.gov/Medicare/Demonstration-Projects/DemoProjectsEvalRpts/Medicare-Demonstrations-Items/CMS1240082.html Accessed December 13, 2013.
30. Boling PA. The value of targeted case management during transitional care. JAMA 1999;281:656–657.
31. Using SEER-Medicare Data for Cancer Survivorship Research. Bethesda, MD: U.S. Department of Health and Human Services, 2012.