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Three Essays on Medicare's Home Health Care

By

Kun Zhang

Doctor of Philosophy

Health Services Research and Health Policy

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Three Essays on Medicare's Home Health Care

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M.S., Central University of Finance and Economics, 2009

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An abstract of
A dissertation submitted to the Faculty of the
James T. Laney School of Graduate Studies of Emory University
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in Health Services Research and Health Policy

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Abstract

Three Essays on Medicare's Home Health Care

By Kun Zhang

Medicare home health care (HHC) is a critically important component of Medicare services for the seniors. It is important to help the growing population of seniors remain in the community as independently as possible and prevent unnecessary hospitalization and nursing home placement. Despite its importance for patients care, escalating Medicare HHC spending has become a major concern among policymakers over the last several years. One of the strategies employed by policymakers to curb the rising spending has been to reduce the reimbursement rates for HHC. This dissertation is comprised of two articles investigating the potential effects of reimbursement rates reduction on HHC utilization and Medicare expenditures on HHC as well as other Medicare covered services, and one article investigating the likelihood of using and quality of care for one particular group of patients, those with Alzheimer's disease and related dementia (ADRD).

The first chapter investigated the potential effects by analyzing the impact of Medicare HHC's moving into an interim payment system (IPS) in 1997 under the Balanced Budget Act and eventually a prospective payment system (PPS) in 2000, arguably the most significant reimbursement change since the benefit's creation. I investigated effects by Medicare beneficiary's entry path into the program: post-acute or community referral. The results show strong evidence that HHC use by referral source is predicted by different beneficiary characteristics and is differentially affected by reimbursement rates reduction. I also find evidence of cost shifting within Medicare as Medicare spending on HHC for both user groups falls significantly with lower reimbursement rates; while total Medicare spending is unchanged.

The second chapter investigated 1) the likelihood of using any home health care by ADRD patients compared with non-ADRD patients; 2) conditional on using home health care, the likelihood, frequency, and timing of being transferred to a hospital for ADRD patients compared with non-ADRD patients; and 3) the impact on Medicare expenditures. The results show strong evidence that patients with ADRD are not only more likely to be transferred to a hospital during a home health care stay but are also to be transferred to a hospital sooner and with greater frequency upon home health admission compared with non-ADRD patients. I do not find evidence that the higher likelihood of ADRD patients being transferred to a hospital translates into higher Medicare expenditures by them.

The third chapter investigated whether or not hospice care serves as substitute for HHC when the reimbursement rates for HHC are reduced, and how individual-level Medicare expenditures in beneficiaries' last year of life are associated with different choices of these two types of community-based services. The results show strong evidence that beneficiaries substituted hospice care for HHC in their last year of life after the Medicare reimbursement rates for HHC was reduced in 1997 under the Balanced Budget Act. Additionally, I find that hospice care is less costly than HHC with regard to providing community-based services near the end-of-life.

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CHAPTER 1

Implications of Medicare's Home Health Reimbursement Policy:
Does Source of Referral Matter?

Abstract

As part of its effort to control health care expenditures, Medicare continues to cut reimbursement rates for home health care services (HHC) and has proposed cost-sharing for HHC users referred from the community. We explore the potential effects of continued cuts in Medicare reimbursement rates on HHC utilization and Medicare spending by analyzing the impact of HHC's moving into an interim payment system (IPS) in 1997 and eventually a prospective payment system (PPS) in 2000, arguably the most significant reimbursement change since the benefit's creation. We also investigate effects by beneficiary's entry path into the program: post-acute or community referral. Specifically, using the Medicare Current Beneficiaries Survey Cost and Use file from 1992 to 2005, we estimate by user group: 1) the impact of IPS on the likelihood of receiving HHC services, and conditional on use, the intensity of service use and HHC spending through a difference-in-differences approach; 2) the effect of IPS on HHC and Medicare spending from changes in users at the extensive margin. We find strong evidence that HHC use by referral source is predicted by different beneficiary characteristics and is differentially affected by reimbursement reductions. We also find evidence of cost shifting within Medicare as Medicare spending on home health for both user groups falls significantly with lower reimbursement rates; while total Medicare spending is unchanged.

I. Introduction

Medicare Home Health Care (HHC) is a critically important component of Medicare services for the seniors. As an indispensable part of the healthcare continuum for elderly, HHC provides skilled nursing, physical therapy, occupational therapy, speech therapy, aide services, and medical social work to beneficiaries in their homes (Shaughnessy et al. 1997). In 2010, Medicare provided HHC services to 3.4 million beneficiaries and spent around $19.5 billion (CMS 2011). Under the current law, there are two major categories of HHC patients based on the source of referral. One includes beneficiaries discharged from a hospital, and are referred as post-acute setting users; the other contains beneficiaries referred from the community setting directly (hereafter, community users). For post-acute setting users, access to HHC is essential to the recovery from an episode of acute illness and to prevent unnecessary hospital readmission, while for community users, access to HHC is critical to help beneficiaries remain in the community as independently as possible and prevent unnecessary hospitalization and nursing home placement (Buhler-Wilkerson 2007).

Despite its importance for patients care, escalating Medicare HHC spending has become a major concern among policymakers over the last several years; between 2001 and 2010, spending increased more than two fold, from $8.5 billion in 2001 to $19.5 billion (CMS 2011). One of the strategies employed by policymakers to curb this rising spending has been to reduce the reimbursement rate for HHC. The most recent policy change related to Medicare HHC reimbursement is the Affordable Care Act (ACA). ACA proposed to lower the Medicare reimbursement rate for home health agencies (HHAs) by 3.8 percent in 2011 and more in the following years until 2017. Moreover, the White House's 2013 budget plan proposed a $100 per-episode copayment for community users starting in 2017[1]. The policy of adding a copayment has not been used for the past three decades. According to a recent MedPAC report, the recommendation to add the per-episode copay is based on the fact that the HHC utilization rate among the community users is increasing at a higher rate than post-acute setting users in recent years, suggesting that inappropriate and/or overuse might be prevalent among community users (MedPAC 2011).

These proposed HHC reimbursement changes in ACA have stirred up policy debates. The proponents argue that such change will improve efficiency and reduce spending by promoting more appropriate use of HHC and cutting waste (MedPAC 2012). According to the Congressional Budget Office (CBO), the reduction of Medicare HHC reimbursement rate as proposed in ACA is expected to reduce Medicare spending on HHC by $4.2 billion for fiscal years of 2010 -2014, and over $39 billion through 2019 (CBO 2010). The White House's budget estimates that the copay would reduce Medicare spending by $730 million through 2023. The opponents, however, argue that the cost-sharing and reduced Medicare payment rates in general will have unintended consequences to beneficiaries such as adverse health outcomes and higher Medicare spending later based on existing studies (DeJong et al. 2002; Trivedi, Moloo, and Mor 2010; Wu and Shen 2011). Without access to good quality HHC, beneficiaries could end up in much more costly care settings such as hospital, emergency room, and assisted living-based treatment (National Association for Home Care & Hospice 2013).

Such debates often serve to facilitate better policy making in the future. However, one critical point missing in the current Medicare HHC discussion is whether the HHC reimbursement reductions will have a homogeneous impact across the two types of users or,

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[1] President Obama announced his 2013 budget that proposes a $100 copayment for per episode Medicare home health care services that do not follow a hospital stay, set to begin in 2017.

instead, will affect them differentially. The existing literature tends to treat HHC patients as a whole and ignores the fact that the two types of users are not only different regarding the source of referral but also in other aspects, including the purposes of using HHC. Also, HHAs might have different informal admission and discharge policies for the two types of users. Thus, in order to better inform the ACA HHC reimbursement debate, we investigate the impact of past reduced HHC reimbursement rates on HHC utilization and total Medicare spending, and whether post-acute setting users and community users were affected differentially. We also investigate whether IPS changed the likelihood of who gets services as this effect (the extensive margin) as this dimension has not been addressed in the literature to date. Our basic approach is to investigate the impact of previous major Medicare HHC reimbursement reductions on utilization and expenditures, then use these results to draw inferences about reimbursement policies unfolding under ACA.

In the late 1990s, as part of the effort by Congress to contain Medicare spending as mandated by the Balanced Budget Act (BBA) of 1997, Medicare HHC experienced significant reduction in its reimbursement rates as HHC moved towards a prospective payment system. Such changes included both annual per-user reimbursement caps and reductions in per-visit reimbursement rates. Specifically, using data from the Medicare Current Beneficiary Survey (MCBS) from 1992 to 2000, we conduct regression analysis and counter-factual simulation to examine the impact of HHC reimbursement changes enacted by the BBA on HHC utilization and Medicare expenditures by HHC referral sources (post-acute vs. community). The results will shed light to the current policy debate of ACA HHC reimbursement changes.

II. Background

Home health care was initially included as a post-acute care benefit in the Medicare legislation in 1965, which made publicly funded home care available for the first time. At the outset, about 2,000 agencies, mainly not-for-profit, were certified to participate in the Medicare program; and Medicare's HHC outlay was $46 million, roughly 1 percent of the program's total expenditures (Ryder, Stitt, and Elkin 1969). By the 1990s, Medicare had become the largest payer of home care services, and remains so today. In 2010, Medicare's HHC outlay was around $20 billion and almost half of the nation's total home care expenditures, and Medicare-certified home health agencies reached nearly 12,000 (National Association for Home Care and Hospice 2010).

Currently, Medicare uses a prospective payment system for HHC, with eligibility based primarily on the enrollee's demonstrated need for skilled care in a home care (homebound) setting. Over the past several decades, Medicare HHC has experienced several major changes to its eligibility criteria and reimbursement method; see Figure 1. Some of the changes were aimed at liberalizing the Medicare HHC benefit such as eliminating the prior hospitalization requirement in 1980, while others aimed at controlling expenditures. Since elimination of the prior inpatient stay requirement, HHC users now comprise two major types of beneficiaries based on their source of referral.

As shown in Figure 1, major changes to the reimbursement method of Medicare HHC took place after the enactment of the BBA in 1997. The reimbursement method first transitioned from a fee-for-services (FFS) scheme to an Interim Payment System (IPS) in 1997, then from IPS to a Prospective Payment System (PPS) in 2000. This provides a great opportunity to conduct an in-depth investigation of the effect of previous Medicare HHC reimbursement rates changes to inform current and future policy debate. The focus of this study is the transition from FFS to IPS as it significantly reduced the reimbursement rate.

Nature of the reimbursement changes in the BBA of 1997

The BBA first mandated the IPS in 1997 that brought two changes to the reimbursement method for Medicare HHC while the PPS was still under development. First, a first-time per-user reimbursement cap was added. The cap was calculated by blending 75% of a home health agency's historical per-user reimbursement in 1994 with 25% of the median reimbursement of all agencies in the same census region. For agencies certified by Medicare after 1994, the per-user cap was set at the national median reimbursement of existing agencies before 1994. Second, the per-visit reimbursement limit was reduced from 112% of the mean of national per-visit reimbursement to 105% of the national median. These limits were only applied to agency reimbursement at the annual aggregate level, meaning that an agency did not necessarily need to keep the cost of every patient below the limit. The intention of the IPS was to create an incentive for agencies to provide care more efficiently both at the per-visit and the per-user level. As a result, Medicare spending on HHC would be contained.

After three years of development, Medicare home health PPS was implemented in October 2000. Under the home health PPS, HHAs were paid a fixed amount for all items and services furnished during each 60-day episode of care. An episode with four or fewer home health visits is reimbursed under the Low Utilization Payment Adjustment on a per-visit basis. Patients receiving 5 or more visits per episode are assigned to 1 of the original 80, which was expanded to 153 in 2008, home health resource groups (HHRGs) based on beneficiaries' clinical and functional status and service use. Home health PPS was intended to control per-episode expenditures while taking into account differences in beneficiary's care needs and expected resource use. Compared with IPS, the PPS increased average reimbursement to home health agencies, but actually reduced marginal reimbursement for an episode of care (Huckfeldt et al. 2012).

Implications for Medicare beneficiaries: the literature

Prior work focused on the impact of reimbursement method transitions – from FFS to IPS and from IPS to PPS – on utilization of HHC by Medicare beneficiaries and on Medicare HHC spending in general. Numerous other studies investigated the impacts of the transition from FFS to IPS on health outcomes among Medicare HHC users in the post-BBA period, i.e., after the implementation of the IPS.

These studies investigating the effect of the transition from FFS to IPS on the utilization of Medicare HHC services consistently found that in the post-BBA period both the proportion of beneficiaries using HHC, i.e. the extensive margin, and the visits per HHC user, i.e. the intensive margin, were reduced significantly (McCall et al. 2001, 2003; Komisar 2002; Zhu 2004; Spector et al. 2004; McKnight 2006). McCall (2001) reported that beneficiaries using HHC and the visits per HHC user dropped by 22 percent and 39 percent, respectively, in the first two years after the implementation of the IPS. In more detailed investigations, Komisar (2002), McCall (2003), and McKnight (2006) reported that the reduction of HHC utilization was greater for beneficiaries with low-income, dual-eligibles, and those aged 85 and older. HHAs were most likely to report that beneficiaries they no longer admitted or else discharged sooner included long-term users and/or patients with multiple chronic conditions (Abt Associates 1999). Regarding the effect of the IPS on Medicare HHC expenditures, McCall (2001) and Komisar (2002) showed that Medicare

HHC total spending and per-user reimbursement fell about 50 percent and 30 percent, respectively, from 1997 to 1999. Consistent with findings on reduced HHC utilization, Zhu (2004) and McKnight (2006) showed that the reductions in HHC expenditures were also concentrated among low-income, unhealthy, and older beneficiaries.

Few studies have investigated the impact of the reimbursement transition from IPS to PPS on HHC utilization and health outcomes of Medicare beneficiaries. Schlenker et al. (2005) showed total HHC visits per episode declined 16.6 percent, although skilled therapy visits increased by 8.4 percent compared to the period before the PPS was implemented. However, under PPS, changes in HHC users' health outcomes were mixed with only modest improvement for functioning. Huckfeldt et al. (2012) investigated the effect of HHC reimbursement method changes on HHC expenditures and health outcomes by contrasting the two transitions in a single unified framework. Their findings about IPS were consistent with prior work; nevertheless, they found that the transition from IPS to PPS increased Medicare HHC expenditures modestly.

Despite significant effects of the IPS on HHC utilization and expenditures, prior work showed that the IPS had a minimal negative impact on health outcomes measured by either functional status or hospital readmissions (Hadley et al. 2000; Chen 2002; McCall et al. 2002; McCall et al. 2003; McKnight 2006). McKnight (2006) argued that the reason might be that IPS led HHAs to reduce precisely those HHC visits that had the lowest marginal medical value. However, the conclusion of no impact on health outcomes has one major limitation. These studies compared the health outcomes of Medicare HHC users from the pre-BBA period and post-BBA period. This comparison could generate misleading results because it only captures the impact of reduced intensity of care for those who received services before and after BBA. It does not account for possible changes at the extensive margin as certain beneficiaries may have been less likely to receive services with changes in reimbursement and themselves experienced cost-shifting. To understand fully the effects of BBA on Medicare expenditures, this dimension warrants examination.

Additionally, to date there has been little research addressing whether HHC reimbursement rate and method changes had differential impacts on HHC users from the two different settings. Specifically, at least three factors underscore the significance of investigating the potential differential effects.

First, although all HHC users from both the post acute setting and the community are required to meet the two primary eligibility criteria: being homebound and needing skilled services, there are some systematic differences between the two types of users. For instance, the post-acute setting users are more likely to have an orthopedic or cerebrovascular disease diagnosis/procedure code, whereas community users are more likely to have multiple chronic conditions (Murtaugh et al. 2008). In addition, reasons for using HHC by these two types of users could be different. While post-acute setting users typically are recovering from a prior episode of acute illness, community users are more likely to use HHC to support or maintain their health/functional status in order to stay in their homes and minimize the risk of being institutionalized. Also, different types of physicians make referral decisions, and eligibility requirements provide limited guidance about referrals (MedPAC 2011). Given these factors, the admission into HHC could be a function of referral source as well as patient characteristics and Medicare reimbursement rate. Therefore, we investigate whether changes at the extensive and intensive margins affect admission to HHC from the acute setting and the community differently.

Second, for post-acute setting users, there are other Medicare covered post-acute care options, e.g. skilled nursing facility (SNF) care and inpatient rehabilitation facility care

(IRF), which might serve as substitutes for HHC. For instance, Gage (1999) concluded that changes in the reimbursement policies for post-acute care could change utilization patterns for Medicare patients discharged from acute inpatient settings. Buntin (2009) showed that stroke and joint replacement patients discharged from a hospital were more likely to use SNF care compared with HHC after the implementation of home health IPS. However, community users would not be eligible for other post-acute care options because of the prior hospitalization requirement. Therefore, again, these two types of users might end up in different situations when reimbursement rate and/or method changes.

Third, the number of community users increased at a higher rate compared to post-acute setting users in the past decade (MedPAC 2010). In 2009, around two-thirds of total HHC episodes were provided to beneficiaries referred from the community setting (MedPAC 2010). On the one hand, this might indicate inappropriate use and that overuse of HHC is more common among community users (MedPAC 2011); in fact, a per-episode copayment is now proposed for community users. On the other hand, this might reflect that the increase in demand for HHC from the community setting exceeds the increase from the post-acute setting. Either way, it highlights the importance of differentiating between the two types of users when evaluating any HHC related policy change.

Given the potentially differential impacts of HHC reimbursement rates/method changes for the two types of users, the omission of this approach from prior work may yield misleading policy implications. With the proposed per-episode HHC copayment for community users and the on-going HHC reimbursement rate cuts, we need a better understanding about whether the impacts differ or not. Thus, this study adds to the literature by conducting systematic and in-depth investigations on how the HHC reimbursement transition from FFS to IPS differentially affected the two types of users with regard to HHC utilization and expenditures, as well as utilization of other types of care and annual total Medicare expenditures.

III. Hypotheses

Our overarching hypothesis is that the reimbursement transition from FFS to IPS reduced both the volume and intensity of Medicare HHC use, i.e. the number of beneficiaries who got admitted and the amount of services provided to those admitted. For example, aggregate data from CMS (1985-2001) in Figure 2 shows that after the implementation of the IPS, the number of HHC users per 1,000 beneficiaries declined significantly, from 105 in 1997 to 83 in 1999. In addition, we use the MCBS sample from 1992 to 2005 to show the unadjusted trends for HHC use in Figure 3 and Medicare HHC spending in Figure 4 by separating the two types of users. The vertical axis in Figure 3 stands for the percentage of beneficiaries using HHC in the MCBS sample. The overall trend is consistent with the CMS aggregate data. Based on Figure 3, after the implementation of the IPS, the percentage for community users declined from 7.5% in 1997 to 5.4% in 1999, while the reduction for post-acute setting users from 1997 to 1999 was only 3.7% to 3.1%. The vertical axis in Figure 4 stands for Medicare HHC reimbursement per-user in the MCBS sample. After the implementation of the IPS, HHC reimbursement per post-acute setting user declined at a higher rate than it for a community user.

Therefore, our study hypotheses are that:

1. The community setting population was less likely to be admitted to HHC due to the reimbursement reduction from FFS to IPS;
2. Post-acute setting users experienced a greater reduction in Medicare HHC reimbursement conditional on being admitted to HHC in the post-BBA period.

Correspondingly, there was a greater reduction in HHC visits among post-acute setting users;

3. The reduction in Medicare HHC spending led to a decline in annual total Medicare spending among HHC users.

IV. Data and Methods

Data

The 1992-2005 Medicare Current Beneficiaries Survey (MCBS) Cost and Use files are the sources of data for the study. MCBS is a longitudinal and multipurpose survey of a nationally representative sample of the Medicare population funded by CMS. The Survey began in fall of 1991, and the sample frame includes those eligible for Medicare on January 1st of the survey year. Survey participants were initially followed for an indefinite period via longitudinal survey. Starting in 1994, the MCBS shifted to a rotating panel design with each beneficiary surveyed for no more than four years. Thus, each year new participants are strategically selected to help make the panel more representative and account for those who have died, dropped out of the survey, or completed their four-year survey (ResDAC 2013). The survey is conducted through several interviews with beneficiaries (or proxies for beneficiaries who cannot participate in an interview) over the course of a year.

The advantages of MCBS for this analysis are that it contains information on demographics, beneficiary income, health status, family structure, and many other beneficiary characteristics. Particularly, it includes detailed information on functional status and chronic conditions – information necessary for predicting HHC use. Additionally, it is also linked to the administrative Medicare enrollment and claims files. Thus, it provides virtually complete and consistently defined data on beneficiaries' health care use and expenditures including inpatient, outpatient, physician, prescription drug, short- and long-term institutional care, hospice care, and home health care. ICD-9 diagnosis codes are also available for inpatient, outpatient, physician, and short- and long-term institutional care.

Home health care use

Home health care use in the MCBS is captured by three variables in the survey component: "one or more home health visits in the calendar year", "total home health visits in the calendar year", and "total home health care reimbursement in the calendar year". HHC use is also captured by variables in the claims component, such as "total payments for home health", "Medicare payments for home health", "Medicaid payments for home health", "individual purchased insurance payments for home health", and "out-of-pocket payments for home health". In some instances, a beneficiary is identified as HHC user in a calendar year but has no payments shown in the claims data, or vice versa. Nevertheless, the accordance rate between survey data and claims data for identifying HHC use from 1992 to 2000 is about 93%[2]. Those HHC users who are not identified by both survey and claims data are excluded from the analysis.

Referral source of home health care use: post-acute vs. community

Hospitalizations in MCBS are captured by variables obtained from the survey part such as "one or more inpatient discharges in the calendar year" and "total inpatient stays in the calendar year". More detailed information on beneficiaries' hospitalizations, if there is any, could also be obtained from the claims data. Detailed information includes but is not limited to admission date, discharge date, discharge destination, diagnosis codes, and

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[2] For example, if 1,000 beneficiaries are identified as HHC users in 2000, 930 of them are identified by both the survey data and the claims data.

procedure codes. Post-acute skilled nursing facility stay and inpatient rehab facility stay are captured in the similar way.

If a beneficiary had both inpatient and HHC use, and the discharge destination of the inpatient stay was HHC, this beneficiary would be categorized as post-acute care setting users. Moreover, if a beneficiary first used SNF or IRF care following a hospitalization, then was discharged from SNF or IRF to HHC, the beneficiary would be also categorized as a post-acute setting user. Two scenarios of HHC use are categorized as from the community setting: one is if the beneficiary only had HHC use but no inpatient stay in the calendar year; the other is if the beneficiary had both HHC use and an inpatient stay in the calendar year, but the discharge destination of the inpatient stay was not home health care.

Dependent variables

To investigate the hypotheses outlined in last section, two groups of dependent variables are created. Key dependent variables in the first group are HHC use-related variables. A dichotomous variable is created to indicate any HHC use in the calendar year. Other HHC use dependent variables are total number of HHC visits and Medicare HHC reimbursement in the calendar year. Key dependent variables in the second group are total Medicare expenditures at the person-year level, as well as Medicare expenditures for other types of care including inpatient, outpatient, and SNF care.

Independent variables

The transition from FFS to IPS or from IPS to PPS, represented by a dummy variable, is the key policy variable of interest. The IPS was implemented on October 1, 1997, and data from the last 3 months of 1997 are technically part of the post-policy period.

However, because the data is annual based on the calendar year, these three months are regarded as pre-policy in the analysis. If anything, this would bias the results toward finding no effect of the IPS. One concern with the dummy variable approach is that outcomes may have evolved over time under IPS. For example, in the early part of the IPS period, agencies may have been slow to adjust behavior, and in the latter part of the period, agencies may have adjusted behavior in anticipation of the PPS. Prior work has proved the robustness of this dummy variable approach (McKnight 2006; Grabowski et al. 2006).

Demographics include age, gender, race/ethnicity, and marital status. Race/ethnicity is reported in the survey as five mutually exclusive categories: white, black, Hispanic/Latino, Asian, and others. Due to the small sample sizes for Asian and others, they will be combined into one category in the study, i.e. "others". Socioeconomic status (SES) is measured by the educational and income level of the beneficiary. Income includes earnings from any employment, social security, pension benefits, and income from assets, and is measured continuously. Education is measured by years of education obtained and is categorized into two groups for the analysis: more than high school, high school and less than high school.

Health status is assessed with three groups of measures. First, general health status is measured by self-reported health and includes five categories: excellent, very good, good, fair, or poor. Second, functional limitations are assessed by whether or not beneficiaries have difficulties with activities of daily living (ADLs). Third, chronic conditions are examined based on chronic diseases reported in the survey that are leading causes of disability and death among the older population. Leading causes include cardiovascular diseases (heart diseases, stroke, and hypertension), respiratory system diseases, cancer, and dementia (Ferrucci and Guralnik 1997). Additional chronic conditions are also included such as diabetes, arthritis, mental disorder, and partial paralysis. We also include whether or not the beneficiary ever had broken hip.

Other covariates include a beneficiary's other types of insurance coverage such as Medicaid and private insurance, number of children of the beneficiary, number of helpers at home for the beneficiary, and the beneficiary's living arrangement. It is well documented that living arrangement has an important role in predicting use of HHC and/or other types of post-acute care. Living arrangement has three categories: living alone, living with spouse or with child, and living with others. In the analyses, we group living arrangement as two levels: living alone and living with someone.

Empirical approach

The analysis is based on a standard economic model in which utilization of health care services is a function of individual demographic, SES, individual health status, and economic conditions (Newhouse et al. 1993), and exploits the panel nature of the MCBS data to examine the implications of reimbursement transition from FFS to IPS. Covariates included in the empirical analyses have been strong predictors of HHC use in previous studies (Liu et al. 1998; Hadley et al. 2000; Langa et al. 2001).

First, I separately model any home health care use in the pre-BBA period for beneficiaries with prior inpatient stay and beneficiaries without any prior inpatient stay in the calendar year. Any HHC use is modeled as a function of demographic, SES, health status, health care utilization, and supply side factors described in the data section above. For beneficiaries with prior inpatient stay, the dependent variable is whether a beneficiary was discharged to HHC from a prior hospital stay or from a prior SNF stay. For beneficiaries without inpatient stay, the dependent variable is whether the beneficiary used HHC in the calendar year or not. Given the dichotomous nature of outcome variables here, the models take the general binary logistic form shown in (1) below, where logit represents the log of the odds ratio for the underlying response variable of interest, *Any HHC Use*. On the right-hand side, X_{is} contains all the independent variables introduced in prior section, and i stands for beneficiary, and s indicates the beneficiary's state of residence. Coefficients obtained from these regressions are used to predict counterfactual use of HHC in the post-BBA period assuming the reimbursement rate changes did not occur.

$$\text{logit}(Any\ HHC\ Use_{is}) = \beta_0 + \beta_1 \mathrm{X}_{is} + \beta_2 Supply\ Side_{is} + \sum_{s=1}^{S} \beta_{3s} State_s + \mu_{is} \qquad (1)$$

Second, I adopt the two-part model approach to analyze whether impacts of IPS on HHC utilization differed between beneficiaries from the post-acute setting and beneficiaries from the community setting. In the first part, I model any HHC using logit regression and data from both pre- and post-BBA periods in (2):

$$\begin{aligned}\text{logit}(Any\ HHC\ Use_{is}) = \beta_0 + \beta_1 IPS_{is} + \beta_2 Community_{is} + \beta_3 IPS_{is} * Community_{is} + \\ \beta_4 \mathrm{X}_{is} + \beta_5 Supply\ Side_{is} + \sum_{s=1}^{S} \beta_{6s} State_s + \mu_{is} \qquad (2)\end{aligned}$$

The coefficient (β_3) for the interaction term involving the IPS indicator and the community setting indicator is of prime interest in this "difference-in-differences" model, Basically, I compare the pre-BBA and post-BBA difference in HHC use likelihood for community beneficiaries relative to the pre- and post- difference for post-acute care beneficiaries.

In the second part, conditional on any HHC use, I further estimate if there are differential impacts of IPS on quantity of HHC use measured, respectively, by the number of home health visits and the amount of Medicare HHC reimbursement at the person-year level, as well as impacts on total Medicare expenditures at the person-year level. Ordinary least square (OLS) regression with the same model specification in (2) is used:

$$HHC\ Visits_{is} \,/\, HHC\ Spending_{is} = \beta_0 + \beta_1 IPS_{is} + \beta_2 Community_{is} + \beta_3 IPS_{is} * Community_{is} + \beta_4 \mathrm{X}_{is} + \beta_5 Supply\ Side_{is} + \sum_{s=1}^{S} \beta_{6s} State_s + \mu_{is}$$

Third, because IPS reduced the overall number of HHC users per 1,000 beneficiaries, by using the coefficients obtained in (1) and data from the post-BBA period, i.e. 1998 to 2000, counter-factual simulations are conducted to examine health care use and annual total Medicare spending among those who are predicted to use HHC but did not use in the post-BBA period. Specifically, I first apply the coefficients obtained in (1) to predict any HHC use between 1998 and 2000. Then I conduct regression analyses to compare health care use and annual total Medicare spending between these counter-factual users and actual users in the post-BBA period.

V. Results

Summary statistics using data from both pre- and post-BBA periods are provided in Table 1. The first column contains the variables that are used in the empirical analyses. The second column shows statistics for the sample of non-HHC users. The third column provides statistics for post-acute setting users, while the fourth column shows statistics for community users. As expected, HHC users in general are more likely to be female, older, living alone, Medicaid eligible, having more functional limitations and/or chronic conditions. Nevertheless, compared with post-acute setting users, community users are more likely to be Medicaid eligible. Although prior work shows that community users are more likely to have multiple chronic conditions (Murtaugh et al. 2008), we find that having more than four chronic conditions is more common among post-acute setting users. In contrast, community users have more limitations with ADLs.

Table 2 displays the results for the logit regression models predicting the use of HHC in the pre-BBA period among beneficiaries with inpatient stay(s) in the calendar year, i.e. post-acute setting, and beneficiaries without inpatient stay in the calendar year, i.e. community setting. Because these results are intermediary to the counterfactual analyses reported later, only coefficients from the logit regression models are presented. Although coefficients of logit regression do not have intuitively useful interpretations, the marginal effects will have the same sign and significant level as the coefficients. According to the results, post-acute setting users and community users are predicted by different beneficiary characteristics. For instance, race, Medicaid eligibility, living alone, general health status, functional limitations, partial paralysis, and diabetes are strong predictors of HHC use by beneficiaries from the community setting while not for beneficiaries from the post-acute setting. In addition, the supply side factor, measured by number of HHAs per 10,000 Medicare beneficiaries at state level, is strongly associated with HHC use from the community setting but has no association with post-acute setting HHC use. This is consistent with the literature that number of HHC users per 1,000 beneficiaries varies significantly among states, and is positively associated with number of HHAs in a state. However, results here further indicate that this relationship only holds for HHC use from the community setting. These coefficients of the logit models are finally applied for counter-factual simulation using data from the post-BBA period to examine impacts of IPS on beneficiaries' health care utilization and annual total Medicare expenditure.

Effect on home health care utilization

Table 3 presents the coefficient results from regression models with difference-in-differences (DD) estimators. The DD estimator allows us to examine if there are differential effects of IPS on HHC utilization among post-acute setting users and community users. The coefficients of prime interest are those of Post-BBA (IPS), Community, and the interaction term between Post-BBA (IPS) and Community.

First of all, the results for any HHC use confirm the evidence in the literature and aggregate data: the implementation of the IPS reduced the likelihood of using HHC in the post-BBA period significantly. Specifically, the DD estimator implies that there is a significant differential effect of IPS on any HHC use between the two types of users, and as a matter of fact, the reduction effect only holds for community users. In order to obtain meaningful interpretations of estimates for logit regression models, we also calculate the marginal effects for coefficients of interests. The marginal effect of IPS on the probability of using HHC for post-acute users is insignificant, while the IPS significantly reduces the probability of using HHC for community users by 1.2 percentage points ($p<0.01$). This finding is consistent with our hypothesis that beneficiaries from the community setting experienced a greater reduction in the probability of using HHC after IPS. Most of the remaining covariate estimates in Table 2 are significant and in the expected direction; for example, controlling for other factors, age, living alone, functional limitations, certain chronic conditions, and HHC availability are strong predictors of any HHC use.

The results for number of HHC visits, i.e. the intensity of care, conditional on any HHC use also are consistent with evidence in the literature: the implementation of IPS reduced per-user HHC visits. Specifically, our results show that HHC visits decreased by 9 ($p<0.05$) on average for post-acute setting users in the post-BBA period, controlling for other patient-level covariates and the supply side factor; expectedly, the DD estimator implies that HHC visits reduce only by 4 (*p*<0.1) on average for community users in post-BBA period, about 5 (*p*<0.1) visits less reduction compared to post-acute setting users. Although the differential effect of IPS on the intensity of care exists, it is not as significant as the effect on any HHC use. This indicates that the IPS mainly reduced the probability of being admitted to HHC among community setting population; however, conditional upon the admission, post-acute setting users experienced a greater reduction in services provided. Estimates of other covariates included in the model are in the expected direction; for instance, HHC users with more functional limitations have more visits. With regard to chronic conditions, only diabetes is significantly associated with more HHC visits.

The results for Medicare HHC reimbursement conditional on any HHC use confirm the evidence from the literature, as well: the implementation of the IPS significantly reduced Medicare spending on HHC, one of the major goals for adopting the IPS. Specifically, our results show that in the post-BBA period, per-user Medicare HHC spending reduced by $1,236 (*p*<0.01) on average for post-acute setting users while controlling for other covariates. The reduction is $895 (*p*<0.01) for community users, about $341 less reduction according to the DD estimator. This is consistent with the findings about reduction in HHC visits, as well as the raw data showed in figure 3.

Effect on annual total Medicare spending

Results for annual total per person-year Medicare spending conditional on HHC use are shown in the first and second column of Table 4. The results indicate that there are no significant effects of IPS on total Medicare spending for both post-acute setting users and community users, although IPS significantly reduces Medicare spending on HHC for both types of users. For instance, the difference between total Medicare spending for post-acute setting users in post-BBA period and spending for those in pre-BBA period is $195.4 while controlling for other covariates, but insignificant. Therefore, I further examine the effects of IPS on different components of total Medicare spending such as inpatient care, outpatient care, and SNF care. Results are shown in the first and second column of Table 4. Strikingly, among post-acute setting users, Medicare expenditures on inpatient and SNF care increase by $1,262.3 ($p<0.01$) and $475.5 ($p<0.01$), respectively, after the implementation of IPS, while they do not change among community users. With regard to Medicare outpatient care spending, there is a $290.2 increase ($p<0.05$) among community users and no change for post-acute setting users. This implies potential cost-shifting effect within Medicare after Medicare reimbursement rates are reduced for certain services (Trivedi, Moloo, and Mor 2010; Wu and Shen 2011), and in this case, home health care. It should partially explain the finding that although the IPS reduced Medicare HHC spending, annual total Medicare spending did not decline correspondingly among HHC users. Given these observed changes and the absence of identifiable competing factors that can account for our findings, we believe these results suggest an IPS effect.

Counter-factual simulation

Major results from counter-factual simulation are shown in the third column of table 4. As our results in one of prior sections show that the reduction in probability of using HHC in post-BBA mainly exists among community setting population, we apply coefficients obtained from logit regression model predicting HHC use among community setting population in pre-BBA period (Table 2) to conduct the counter-factual simulation. The simulation predicts 1,525 HHC users in the post-BBA period. Among these simulated users, 686 (45%) are actual community users in post-BBA period. Thus, the remaining 839 are referred as counter-factual users. In the following step, regression analyses show that with regard to annual total Medicare expenditure, counter-factual users spend $546.2 less than the actual community users in the post-BBA period while controlling for other covariates; however, the difference is insignificant ($p=0.24$). This is contrary to the hypothesis that a decline in Medicare HHC spending would reduce annual total Medicare spending correspondingly. Therefore, we further examine Medicare spending for other three types of care: inpatient, SNFs, and outpatient. Results are also presented in the third column of Table 4. Although these counter-factual users did not use HHC in the post-BBA period due to the implementation of IPS, they used more other types of care instead based on their other Medicare expenditures. This provides evidence on substitution between HHC and other types of care. For instance, counter-factual users cost Medicare $2,077.4 more ($p<0.01$) on inpatient care and $223 more ($p<0.01$) on SNF care compared with actual community users. However, counter-factual users cost Medicare $201 less ($p=0.05$) on outpatient care.

VI. Discussion

Prior work examining the home health reimbursement transition from FFS to IPS focused solely on HHC users in general without considering the source of referral. With regard to the effects of IPS, they mainly focused on HHC use and spending itself instead of considering Medicare as a whole. This study is the first to consider the implications of the IPS for beneficiaries with different sources of referral. Our results are informative regarding the differential effects of the IPS between post-acute setting users and community users.

To add to the prior literature which concluded that the IPS significantly reduced the likelihood of using any HHC, our results indicate that IPS mainly affects community users.

This finding has two implications. First, although the two primary eligibility criteria should equally apply to beneficiaries from both settings, they might be used flexibly by HHAs to admit patients, particularly when it comes to patients referred from the community setting. The need for skilled care is relatively more difficult to justify for community users compared with post-acute setting users, which could be amplified by the reduced reimbursement rates in post-BBA. Second, although post-acute setting users have other potential substitutes such as SNF care, these options are heavily constrained by their availability. SNFs do not always have available Medicare beds. Therefore, we do not observe a significantly reduced likelihood of using HHC among beneficiaries from the post-acute setting.

We find that conditional on the admission to HHC, the effect of IPS on intensity of care is stronger among post-acute setting users, which is consistent with the fact that post-acute setting users had more visits on average than community users in pre-BBA period, and therefore, became the target of the per-user reimbursement cap implemented by the IPS. Our results in Table 3 also indicate that the marginal effect of IPS on Medicare HHC reimbursement is more than the monetary value of the marginal effect of IPS on HHC visits for both types of users. This highlights the potential effect of IPS on improving the efficiency of providing HHC services.

More importantly, our results show that although the IPS successfully reduced HHC utilization and contained Medicare spending on HHC, it did not reduce total Medicare spending for neither type of HHC users. This suggests potential cost-shifting within Medicare in the post-BBA period. Specifically, post-acute setting users spend more on inpatient and SNF care, which suggests the possibility of more hospital readmissions. Readmission could happen because of reduced HHC visits or because quality of care is compromised by the reduced per-visit reimbursement rate. Community users, instead, spend more on outpatient care. The finding is further confirmed by our counter-factual simulation. No significant difference is observed between our counter-factual users and actual users in the post-BBA period. Although counter-factual users did not use HHC in the post-BBA period, they ended up costing Medicare more on inpatient and SNF care. As we mentioned at the beginning of the paper, access to HHC is critical to prevent unnecessary hospitalization for community users. Thus, the increased spending on inpatient care is suggestive of increased hospitalization due to the implementation of IPS.

Considering the ongoing reduction in Medicare home health reimbursement rate and the proposed per-episode copay for community users, our results highlight the importance of evaluating the potential impact of these changes with a focus on community users. First of all, the reduction in reimbursement rate could have a disproportionate impact on community users based on prior experience. In addition, there has not been any empirical evidence on how much the per-episode copayment would affect access to HHC for beneficiaries from the community setting. Our descriptive statistics show that the average community user is poorer than post-acute setting users and non-users, and is more likely to be Medicaid eligible. The affordability of the copay among community users is not guaranteed. Furthermore, the ACA of 2010 mandated a physician face-to-face encounter requirement starting from April 2011 when HHC is prescribed. Post-acute setting users should have better access to physicians when inpatient discharge planning takes place; however, this is not necessarily the case for community users, and the face-to-face encounter requirement could be an obstacle to access. To sum up, if the impact of these changes on access to care for community users adds up, it could be more intense than policymakers would expect. Our results suggest that in this scenario, cost savings to Medicare will not be guaranteed. Estimates suggest that there will be about 72.1 million older persons by 2030, more than twice their number in 2000. People older than 65 represented 12.4% of the U.S. population in the year 2000 but are expected to grow to be 19% of the population by 2030 (Administration on Aging 2012). That said, the demand for home health care by the elderly will not decline in the foreseeable future, particularly for beneficiaries from the community setting.

From a policy perspective, our results suggest that any spending containment measure which targets at certain specific Medicare benefit does not necessarily lead to reduction in total Medicare spending because of potential cost-shifting within different Medicare benefits. To contain total Medicare spending, more integrated measure should be adopted. For example, the ACA proposed integration of HHC into a bundled payment scheme under Accountable Care Organizations (ACOs) could be a promising solution. Establishing ACOs is one focus of Medicare reform under section 3502 of ACA. Specifically, a Medicare ACO agrees to be responsible for all the care needs, including HHC, of its patients and to receive a bundled payment based on those patients' health outcomes, satisfaction, and costs. The hospitals, physicians, and HHC agencies, therefore, could work together to find creative solutions to provide the most efficient care “package” that patients with different care demand, and thus avoid cost-shifting within Medicare.

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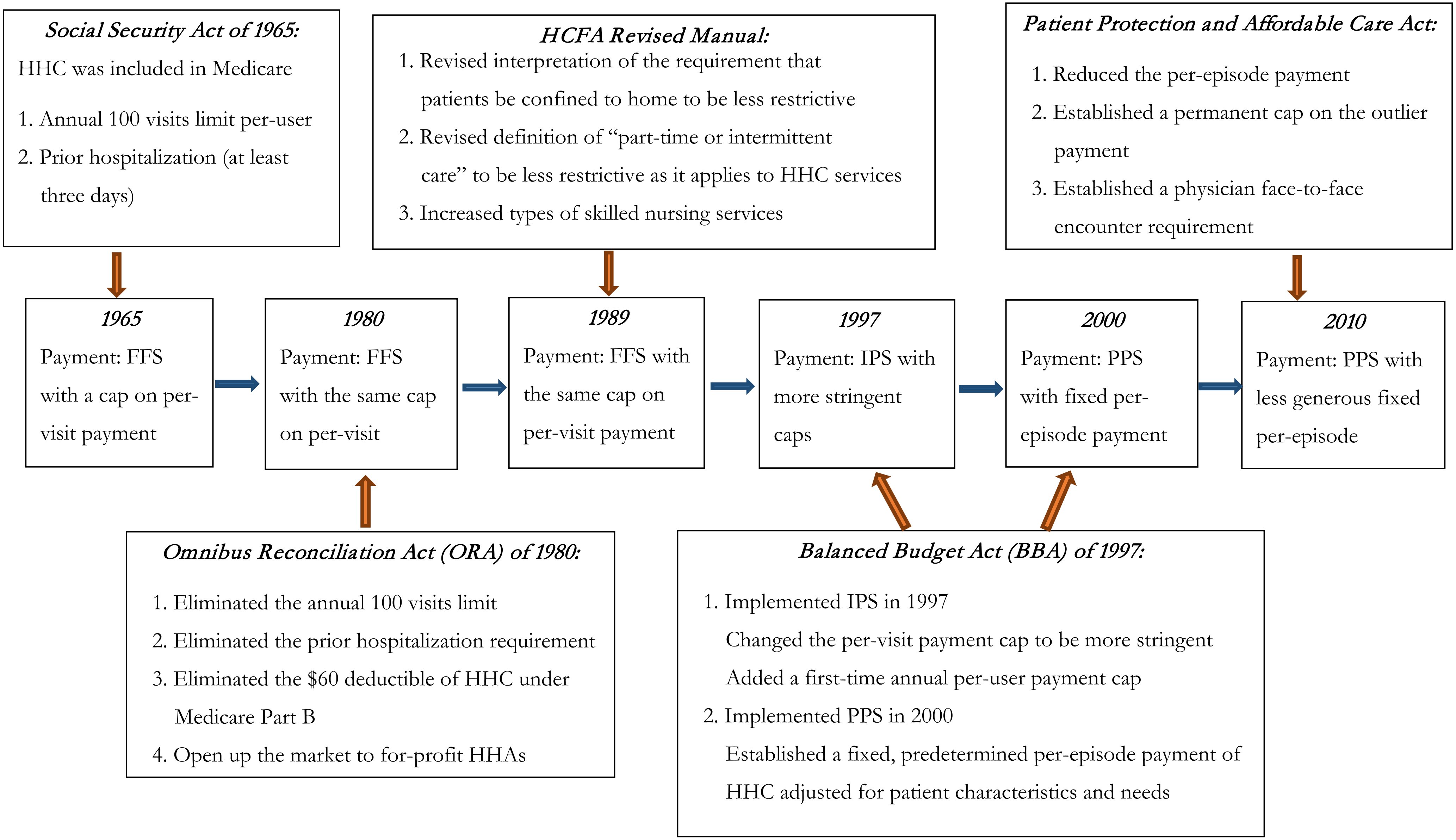
Figure 1: Flow chart of major changes in reimbursement method and eligibility criteria of Medicare HHC



Social Security Act of 1965:

HHC was included in Medicare

1. Annual 100 visits limit per-user
2. Prior hospitalization (at least three days)

HCFA Revised Manual:

1. Revised interpretation of the requirement that patients be confined to home to be less restrictive
2. Revised definition of "part-time or intermittent care" to be less restrictive as it applies to HHC services
3. Increased types of skilled nursing services

Patient Protection and Affordable Care Act:

1. Reduced the per-episode payment
2. Established a permanent cap on the outlier payment
3. Established a physician face-to-face encounter requirement

1965

Payment: FFS with a cap on per-visit payment

1980

Payment: FFS with the same cap on per-visit

1989

Payment: FFS with the same cap on per-visit payment

1997

Payment: IPS with more stringent caps

2000

Payment: PPS with fixed per-episode payment

2010

Payment: PPS with less generous fixed per-episode

Omnibus Reconciliation Act (ORA) of 1980:

1. Eliminated the annual 100 visits limit
2. Eliminated the prior hospitalization requirement
3. Eliminated the $60 deductible of HHC under Medicare Part B
4. Open up the market to for-profit HHAs

Balanced Budget Act (BBA) of 1997:

1. Implemented IPS in 1997
   Changed the per-visit payment cap to be more stringent
   Added a first-time annual per-user payment cap
2. Implemented PPS in 2000
   Established a fixed, predetermined per-episode payment of HHC adjusted for patient characteristics and needs

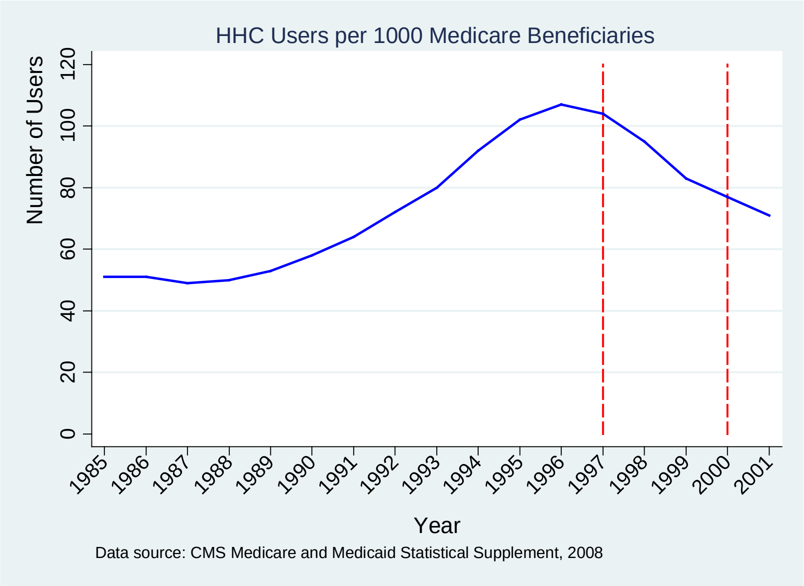


Figure 2: HHC users per 1000 Medicare beneficiaries from 1985 to 2001

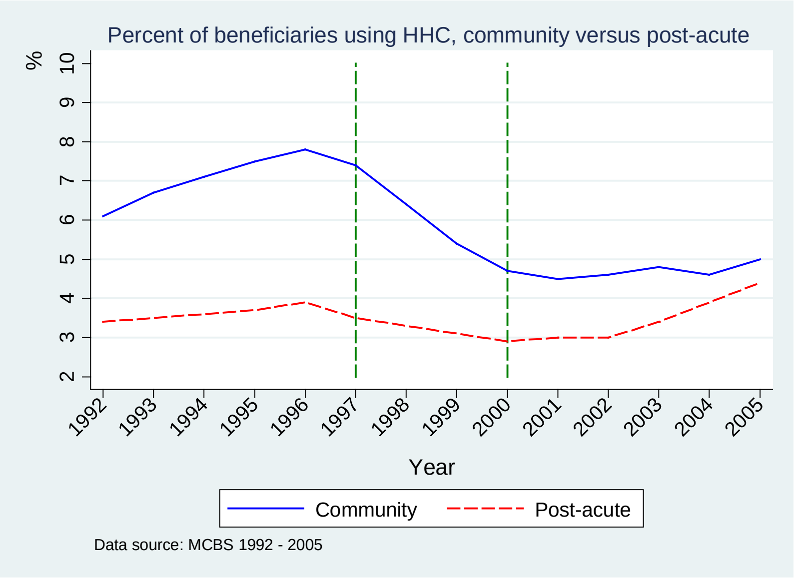


Figure 3: Percent of beneficiaries using HHC, community vs. post-acute from 1992 to 2005

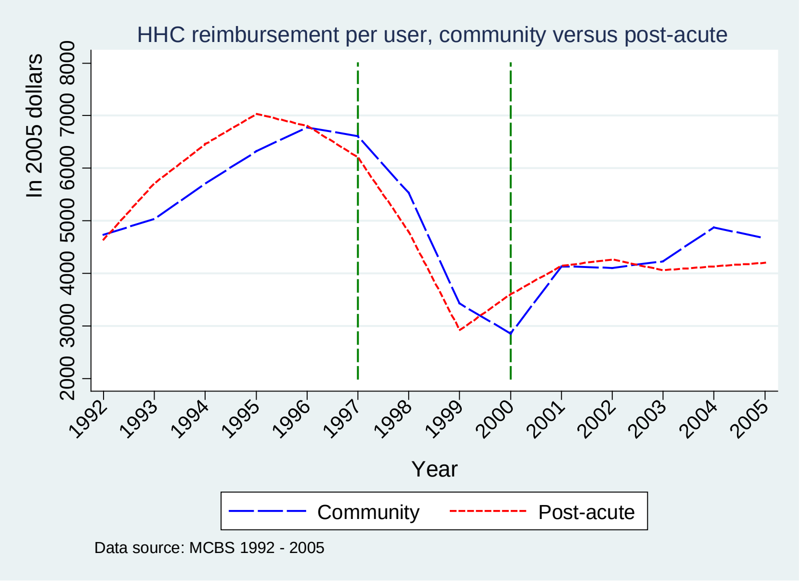


Figure 4: HHC reimbursement per user, community vs. post-acute from 1992 to 2005

Table 1: Summary statistics (means) using data of both pre- and post-BBA periods

	Non-users (N=121,782)	Post-acute users (N=5,262)	Community users (N=8,767)
Female	0.54	0.63	0.65
Age	71.3	78.2	78.5
White	0.85	0.85	0.82
Black	0.11	0.12	0.14
Hispanic	0.02	0.01	0.02
More than high school	0.33	0.25	0.25
Married†	0.52	0.40	0.34
Number of children	2.8	2.8	2.5
Live alone	0.30	0.34	0.39
Number of helpers at home	0.5	1.1	1.3
Medicaid eligibility	0.16	0.25	0.31
Income	25433	21600	18650
General health status*	2.7	3.6	3.5
Having difficulty with any ADLs			
Bath	0.10	0.45	0.51
Out of bed/chair	0.12	0.40	0.45
Dress	0.06	0.32	0.37
Eat	0.03	0.12	0.13
Use toilet	0.05	0.26	0.30
Walk	0.23	0.61	0.61
Difficulty with 3+ ADLs	0.06	0.30	0.36
Chronic conditions			
Hypertension	0.55	0.69	0.64
Myocardial infraction	0.14	0.27	0.22
Coronary HD	0.13	0.25	0.20
Stroke	0.10	0.26	0.24
Cancer	0.18	0.24	0.23
Diabetes	0.16	0.31	0.25
Arthritis	0.59	0.72	0.69
Respiratory disease	0.15	0.24	0.20
Have 4+ chronic conditions	0.18	0.40	0.35
Other conditions			
Mental disorder	0.14	0.13	0.13
Partial paralysis	0.05	0.12	0.15
Had broken hip	0.03	0.12	0.12

Health care use			
Any hospitalization	0.13	1	0.40
Any SNF stay	0.01	0.24	0.11
Any hospital outpatient visit	0.52	0.87	0.77
Number of physician visits	4	9	7
Health care expenditure			
HHC	N/A	4050	3740
Total annual Medicare expense	2762	28960	16088

* General health status is self-reported and measured in a scale from 1 to 5. "1" means excellent.

† The reference group of married includes single, widowed, or married-separate.

Table 2: Results from logistic models predicting HHC use in the pre-BBA period

	Any post-acute HHC use (N=12,464)	Any community setting HHC use (N=49,317)
Number of inpatient stays	0.457***	N/A
Any SNF stay	0.379***	N/A
Any hospital outpatient visit	0.362***	0.755***
Number of physician visits	0.024***	0.032***
Female	0.149**	− 0.153**
Age	0.026***	0.030***
More than high school education	− 0.007	− 0.045
White	0.043	− 0.213***
Hispanic	− 0.108	0.161
Other	0.489***	− 0.487***
Married	− 0.013	− 0.276***
Number of children	− 0.024**	− 0.039***
Live alone	− 0.036	0.296***
Number of helpers at home	0.201***	0.355***
Medicaid eligibility	− 0.021	0.491***
Income	− 0.019	− 0.012
General health status	0.009	0.107***
Having difficulty with		
Bath	0.362***	0.833***
Out of bed/chair	− 0.041	− 0.129
Dress	0.017	0.201***
Eat	0.046	0.051
Use toilet	− 0.029	0.554***
Walk	0.107	0.325***
Chronic conditions		
Hypertension	0.046	− 0.041
Myocardial infraction	− 0.107	0.121*
Coronary heart disease	− 0.055	− 0.177**
Stroke	0.138**	0.234***
Cancer	− 0.129*	− 0.022
Diabetes	0.111	0.391***
Arthritis	0.114*	− 0.131**

Respiratory disease	− 0.023	− 0.013
Other conditions		
Mental disorder	− 0.219**	− 0.248**
Partial paralysis	0.151*	0.361***
Broken hip	0.208**	0.142
Principle diagnosis at inpatient		
Diabetes	0.372***	N/A
Heart disease	− 0.122***	N/A
Stroke	0.265***	N/A
Cancer	0.328***	N/A
Respiratory disease	0.299***	N/A
# of HHAs per 10K Medicare population in the State	− 0.021	0.033***

Notes: * *P*<0.1 ** *P*<0.05 *** *P*<0.01
All regressions include state dummies. Standard errors are corrected for clustering at the state level.

Table 3: Results from difference-in-differences models

	Any HHC use	HHC visits among users	Medicare HHC reimbursement
	(Logit) N=94,839	(OLS) N=9,784	(OLS) N=9,784
Post-BBA (IPS)	− 0.006	− 8.54**	− 1236.5***
Community	− 1.903***	− 14.9***	− 242.82***
Community*Post-BBA (IPS)	− 0.262***	4.52*	341.33***
Any hospital outpatient visit	0.866***	17.3***	− 84.4
Number of physician visits	0.028***	0.22*	3.20
Female	0.008	1.97	− 81.5
Age	0.035***	0.22**	− 3.11
More than high school	0.029	− 1.04	− 120.9*
White	− 0.187***	− 23.2***	− 195.4**
Hispanic	− 0.306**	− 36.0***	− 126.8
Other	− 0.247**	− 26.6***	− 176.3
Married	− 0.213***	− 2.28	− 119.7*
Number of children	− 0.031***	− 1.52***	− 15.8
Live alone	0.121***	0.45	13.4
Number of helpers at home	0.390***	12.2***	257.6***
Medicaid eligibility	0.229***	− 0.75	− 22.6
Income	− 0.029***	− 0.08	23.3*
General health status	0.069***	0.70	14.5
Having difficulty with			
Bath	0.592***	16.5***	13.1
Out of bed/chair	− 0.096**	3.0	− 23.7
Dress	0.238***	10.5***	140.1*
Eat	− 0.050	8.92***	49.3
Use toilet	0.467***	15.4***	55.8
Walk	0.252***	− 3.42	87.3
Chronic conditions			
Hypertension	0.019	3.57*	60.7
Myocardial infraction	0.035	− 1.32	− 48.4
Coronary heart disease	− 0.189***	− 1.53	− 82.7
Stroke	0.143***	− 3.46	15.5
Cancer	− 0.038	− 4.33**	48.0
Diabetes	0.314***	8.04***	61.1

Arthritis	− 0.073**	− 2.19	− 87.3
Respiratory disease	0.031	− 2.16	68.4
Other conditions			
Mental disorder	− 0.107**	− 11.3***	− 219.1**
Partial paralysis	0.320***	9.67***	− 37.1
Broken hip	0.313***	2.98	− 27.3
HHC visits	N/A	N/A	48.1***
# of HHAs per 10K Medicare population in the State	0.096***	4.84***	492.8***

Notes: * P<0.1 ** P<0.05 *** P<0.01
All regressions include state dummies. Standard errors are corrected for clustering at the state level.

Table 4: Effect of the IPS on annual total and other Medicare spending †

	Actual HHC users in post-BBA		Counter-factual users in post-BBA
	Post-acute users	Community users	Community users
Medicare HHC spending ‡	− 1236.5***	− 895.3***	− 2916.6***
Total Medicare spending	195.4	− 48.1	− 546.2
Medicare inpatient	1262.3***	224.8	2077.4***
Medicare outpatient	− 32.9	290.2**	− 200.8*
Medicare SNF	475.5***	73.3	222.6***

Notes: * P<0.1 ** P<0.05 *** P<0.01
‡ Based on results in the last column of table 3
† Regression analyses include the same covariates as those in table 3

CHAPTER 2

Transitions between Home Health Care and Hospital for Medicare Beneficiaries with and without Alzheimer's Disease and Related Dementia

Abstract

Caring for people with Alzheimer's disease and related dementia (ADRD) outside institutional settings has become a major challenge for our healthcare system and society. To improve the efficiency and quality of care delivered in the community setting to patients with ADRD is a priority for providers and policy makers. We investigate the transitions between home health care and hospital care for ADRD patients living in the community. Specifically, using the Medicare Current Beneficiaries Survey Cost and Use file and the Outcome and Assessment Information Set from 2002 to 2005, we investigate 1) the likelihood of using any home health care by ADRD patients compared with non-ADRD patients; 2) conditional on using home health care, the likelihood, frequency, and timing of being transferred to a hospital for ADRD patients compared with non-ADRD patients; and 3) the impact on Medicare expenditures. We find strong evidence that patients with ADRD are not only more likely to be transferred to a hospital during a home health care stay but are also to be transferred to a hospital sooner and with greater frequency upon home health admission compared with non-ADRD patients. We do not find evidence that the higher likelihood of ADRD patients being transferred to a hospital translates into higher Medicare expenditures by them.

I. **Introduction**

Alzheimer's disease and related dementias (ADRD) have become a major challenge for our healthcare system and society. Currently, an estimated 5.2 million Americans have Alzheimer's disease and related dementia, and the cost of formal and informal care for ADRD is estimated at more than $180 billion in 2012, with Medicare bearing more than half of the cost (Gajital 2008; Alzheimer's Association 2013). The National Institutes of Health (NIH) and the Alzheimer's Association predict that increased aging of the population and extended longevity will lead to significant increases in ADRD cases in the coming decades—as many as triple the current cases by 2050. Meanwhile, the cost is projected to be $1.2 trillion per year by 2050 (Alzheimer's Association 2013). Facing the unprecedented challenge of the epidemic of ADRD, families, providers, and policy makers are anxious to find innovative solutions to reform the care delivery model to meet the special need of ADRD patients.

Among those searching for solutions, how to improve the efficiency and quality of care delivered in the community setting to patients with ADRD is at the center of the debate (Alzheimer's Association 2013). Published work to date has mainly focused on nursing home residents and finds that older adults with ADRD are more likely to be institutionalized and die in a nursing home (Smith et al. 2001; Mitchell et al. 2005). But these analyses ignore the fact that the majority of ADRD patients live in the community and receive a continuum of care from families and various providers such as home health care, ambulatory care clinics, and hospitals (Weber et al. 2011; Callahan et al. 2012). Using a nationally representative sample of the Medicare population, the Alzheimer's Association estimates that 65 to 70 percent of older adults with ADRD live in the community (Alzheimer's Association 2013).

Medicare home health care (HHC) plays an important role in the care of older adults with ADRD in the community, particularly when patients are discharged from a hospitalization. Nevertheless, providing care to patients with ADRD in their residential environment is very challenging due to common cognitive and behavioral problems related to ADRD and the complexity in care needs (Ward-Griffin et al. 2012). As a result, the health outcomes of ADRD patients could be compromised, which could lead to multiple transitions between HHC and hospital. Such transitions in care represent additional challenges to individuals with ADRD, their families, and healthcare providers, and each HCC-to-hospital transfer adds to the risk of worse outcomes and higher cost (Coleman 2003).

To date, there are few existing studies investigating the outcomes of HHC for older adults with ADRD living in the community. Nor have there been detailed empirical analyses of ADRD patients' dynamic transitions into and out of HHC, as well as their associated Medicare expenditures. Previous studies mainly focused on the use of, and transition into and out of, nursing home care by older adults with ADRD. For instance, prior work suggests that nursing home residents with ADRD are at high risk of hospital transfer due to the high frequency of other comorbid conditions, particularly infections. Hospitalizations are costly and associated with burdensome interventions, and such transitions between nursing home and hospital are uncomfortable, hazardous, and frequently avoidable for patients with ADRD (Fillenbaum et al. 2001; Bynum et al. 2004; Mitchell et al. 2009; Goldfeld et al. 2011; Givens et al. 2012).

In the context of HHC, problematic transitions between home health and hospital are exactly part of the rationale for care management programs, as well as for new models of care such as the patient-centered medical homes and Accountable Care Organizations

(ACOs) (Coleman 2004; Bielaszka-DuVernay 2011). Due to pressures from health care reform to reduce expenditures and hospital readmissions and improve quality of care among Medicare beneficiaries, it is important to better understand the events that may influence outcomes of HHC for older adults with ADRD, including their dynamic transitions in care, given the magnitude of ADRD in the coming decades.

Therefore, the primary objective of this study is to conduct an in-depth investigation of the likelihood of using any HHC by patients with ADRD, the likelihood, timing, and frequency of hospital transfers by patients with ADRD conditional on HHC admission, and the associated Medicare costs.

II. Hypotheses

Based on relevant evidence in the literature and our primary objectives for this study, we formulate the following hypotheses:

1. Patients with ADRD living in the community are more likely to use HHC compared with non-ADRD patients.
2. Conditional on HHC use, patients with ADRD are more likely to be transferred to a hospital (hospitalization) during a HHC stay.
3. Conditional on HHC use, patients with ADRD are more likely to be transferred more than once to a hospital (hospitalization) during a HHC stay.
4. Conditional on HHC admission, patients with ADRD are more likely to be transferred to a hospital sooner compared with non-ADRD patients.
5. As a result, HHC patients with ADRD will spend more on health care, as measured by annual total Medicare expenditures.

III. Data and Methods

Data

This study draws from two major data sets from 2002 to 2005: the Medicare Current Beneficiaries Survey (MCBS) Cost and Use files and the Outcome and Assessment Information Set (OASIS). We link the OASIS with MCBS at the patient level using a unique beneficiary identifier included in both data sets.

MCBS is a longitudinal and multipurpose survey of a nationally representative sample of the Medicare population. The sample frame is a rotating panel design with each beneficiary surveyed for no more than four years. The survey is conducted through several interviews with beneficiaries (or proxies for beneficiaries who cannot participate in an interview) over the course of a year. The advantages of MCBS for this analysis are: first, it contains detailed information on demographics, social economic status, family structure, etc. Second, it includes detailed information on all chronic conditions a beneficiary has. More importantly, it is linked with the administrative Medicare enrollment and claims files. Thus, it provides virtually complete and consistently defined data on beneficiaries' health insurance coverage, health care utilization, diagnoses, and expenditures including inpatient, outpatient, home health, and short-term institutionalization.

OASIS was established by the Centers for Medicare and Medicaid Services (CMS) in 2000 for home health agencies (HHAs) to collect and transmit assessment data on HHC users. It contains information from comprehensive assessments for HHC users upon their admission and discharge, as well as hospitalization and/or recertification if there is any. OASIS assessments serve as the basis for assigning patient episodes to one of the 153 Home Health Resource Groups (HHRGs) for reimbursement. In addition, assessments form the basis for measuring HHC users' outcomes for purposes of outcome-based quality improvement. Assessments include basic demographic, environmental and support system at home, functional abilities, cognitive functioning, diagnoses for home health admission, and diagnosis and discharge date on prior hospitalization if there is any. Assessments are also designed to measure changes in a patient's health and functional status between two time points. More importantly, OASIS captures all hospital transfers during a patient's home health stay, which enables us to examine patients' transitions into and out of HHC. A home health stay is defined as the period between a HHC admission and discharge. Therefore, a single home health stay might have more than one HHC episode until the patient is discharged from HHC. There is no limit on how many episode a patient can have; however, each new episode needs recertification by a physician.

Identifying ADRD patients

The MCBS enables us to identify individuals with ADRD. MCBS contains not only survey information that uniquely incorporates ADRD history but also reliable claims data that have diagnosis codes for ADRD from inpatient, outpatient, and physician service events, as well as use of prescribed drugs for ADRD. Detailed description of identifying patients with ADRD is described in prior study (Yang et al. 2011). Specifically, we categorized observations as having ADRD if the patient met any of the following three criteria: (1) the survey participant or the proxy answered "yes" to the survey question "Has a doctor ever told you that you had Alzheimer's disease or dementia?" in the survey; or (2) had at least one of the following International Classification of Diseases-ninth revision-Clinical Modification (ICD-9-CM) diagnosis codes in their inpatient, outpatient, or physician services event files: 290 or 331.0; or (3) ever took any ADRD-targeted prescription drugs which were identified by the reported drug names in the prescription drug event files. These drugs include donepezil (Aricept), rivastigmine (Exelon), galantamine (Reminyl or Razadyne), and memantine (Namenda). Because dementia is not reversible, respondents with 2 or 3 years of observations were coded as having dementia in all subsequent years if they were identified as a dementia patient in one year. We classified survey respondents without any of the three criteria in any year as not having dementia.

Study sample

Our study sample consisted of Medicare beneficiaries aged 65 or older. The 2002 to 2005 MCBS data used to predict the likelihood of any HHC use includes 36,041 person-year observations. The dataset of HHC users together with OASIS assessments from 2002 to 2005 includes 4,156 HHC stays, represented by 2,680 unique HHC users. Among these HHC users, we identified 499 patients with ADRD who account for 887 HHC stays.

Dependent variables

Home health care use in the MCBS is captured by two major variables in the survey part: whether the beneficiary had "one or more home health visits in the calendar year" and the "total home health visits in the calendar year." We coded a beneficiary in MCBS as a HHC user if the value of "one or more home health visits in the calendar year" is 1 and the value of "total home health visits in the calendar year" is larger than 0.

Hospital transfers during a HHC stay are captured in the OASIS assessment. We examine three types of hospital transfer-related dependent variables: any hospital transfer during a HHC stay, total number of hospital transfers during a HHC stay, and the time to the first hospital transfer after HHC admission. The time to the first hospital transfer is calculated as the difference between date of hospital transfer and date of HHC admission.

Total Medicare health care expenditures are defined in our analysis as the sum of expenditures paid by Medicare across major types of services events from the claims data, including inpatient, outpatient, physician visits, skilled nursing facility, home health, and other medical services. All expenditures were converted to 2005 dollars using the Consumer Price Index for medical care from the U.S. Bureau of Labor Statistics.

Key independent variables

The key independent variable is whether the HHC user has ADRD or not. The identification of ADRD cases is described in the data and method section. In addition, a patient's cognitive impairment and frequency of being confused are assessed in OASIS. These two assessments also serve as covariates, as they represent major characteristics of ADRD patients and indicate potential difficulties in taking care of patients. Primary diagnosis upon HHC admission also serves as an independent variable. Primary diagnosis is grouped into seven major categories: cardiovascular/cerebrovascular disease, respiratory system disease, diabetes, orthopedic related, urinary and renal related, skin disease such as ulcer and abscess, and rehabilitation.

Demographics include age, gender, race/ethnicity, and marital status. Race/ethnicity is reported in the MCBS survey as five mutually exclusive categories: white, black, Hispanic/Latino, Asian, and others. Due to the small sample size of Asian and others, they will be combined into one category in the study, i.e. "others". Socioeconomic status (SES) is measured by the educational and income level of the survey respondent. Income includes earnings from any employment, social security, pension benefits, and income from assets, and is measured continuously. Education is measured by years of education obtained and is categorized into two groups for the analysis: less than high school including high school, and more than high school. A patient's Medicaid eligibility is also included as a covariate.

Health status is assessed with four groups of measures. First, general health status is measured by self-reported health and includes five categories: excellent, very good, good, fair, or poor. In the regression analysis, general health status is grouped into two categories: better than good health including good, and worse than good health (fair and poor). Second, OASIS assesses the severity of a patient's condition upon admission. The assessment is conducted at three major levels: symptoms controlled with current therapy; symptoms controlled with difficulty; symptoms poorly controlled. Symptoms controlled with current therapy is excluded from the regression analysis as reference group. Third, functional limitations are assessed by whether or not beneficiaries have difficulties with activities of daily living (ADLs). The total number of ADLs that a patient has is included in the regression analysis. Fourth, chronic conditions are examined based on chronic diseases reported in the survey that are leading causes of disability and death among the older population. Leading causes include cardiovascular diseases (heart diseases, stroke, and hypertension), respiratory system diseases, cancer, and dementia (Ferrucci and Guralnik 1997). In addition, diabetes and arthritis are also measured. Each variable is coded as 1 if the patient has that condition. We also create a measure of the total number of chronic conditions that is used in the regression analysis.

Other covariates include a patient's caregiver type and caregiver's major responsibility. Caregiver type is grouped into three categories: no caregiver at home, family member/relatives/friends as caregiver, and paid caregiver. Caregiver's responsibility covers three domains: caregiver assists with ADLs, caregiver assists with instrumental activities of daily living (IADLs), and caregiver assists with medical care. It is important to include caregiver-related covariates since patients with ADRD typically receive substantial assistance from caregivers at home or home health provider on a part-time or intermittent basis. Patients with ADRD pose challenges to both caregiver and home health providers, and health-related responsibilities are often shared between them.

Regression analysis

We first use the entire 2002-2005 MCBS sample to predict any HHC use during a calendar year based on a patient's ADRD status and other covariates. Covariates include demographics, SES, self-reported health status, comorbid chronic conditions, prior health care utilization such as any hospitalization and outpatient visits, and also a supply side factor measured by the number of HHAs per 10,000 Medicare beneficiaries in the state. Some of these covariates have been used by other studies as well (Liu et al. 1998; Hadley et al. 2000; Langa et al. 2001). Given the binary nature of the dependent variable, the model is estimated as logit in (1) below. ADRD stands for a patient with ADRD, X_{is} contains all other covariates most of which are listed in Table 2, i stands for beneficiary, and s stands for the state where the beneficiary resides.

$$\text{logit}(\textit{Any HHC Use}_{is}) = \beta_0 + \beta_1 \textit{ADRD}_{is} + \beta_2 \mathrm{X}_{is} + \beta_3 \textit{Supply Side}_{is} + \sum_{s=1}^{S} \beta_{4s} \textit{State}_s + \mu_{is} \quad (1)$$

Second, conditional on HHC admission, we separately model any hospital transfer and the total number of hospital transfers within a HHC stay based on a patient's ADRD status and other covariates. Therefore, the unit of analysis is HHC stay. To model hospital transfers, we use patients' demographics, SES, self-reported health status, and comorbid chronic conditions. More importantly, we also include the patient's primary diagnosis upon HHC admission, severity rating of patient's condition upon HHC admission, assessments of the patient's cognitive functioning and behavior problems, and information on the patient's caregiver. Any hospital transfer is binary in nature, so is model as logit in (2) below, while the total number of hospital transfers has the nature of a count variable, so that equation (3) below will be estimated using negative binomial regression. Cognitive impairment is coded as 1 if OASIS assesses the patient as cognitively impaired. Behavior problem is coded as 1 if the patient has behavior problems at least several times each month. X_i contains all other covariates, most of which are listed in Table 1.

$$\begin{aligned}\text{logit}(\mathit{Any\ hospital\ transfer}_i\,) = {} & \beta_0 + \beta_1\,\mathit{ADRD}_i\, + \beta_2\,\mathit{Cognitive\ impairment}_i + \beta_3\,\mathit{Behavior\ problem}_i + \\ & \beta_4\,\mathit{Condition\ severity}_i + \beta_5\,\mathit{HHC\ diagnosis}_i + \beta_6\,\mathit{Caregiver\ type}_i + \\ & \beta_7\,\mathit{Caregiver\ responsibility}_i + \beta_8\,\mathrm{X}_i + \mu_i \end{aligned} \tag{2}$$

$$\begin{aligned}\mathit{Total\ hospital\ transfers}_i\, = {} & \beta_0 + \beta_1\,\mathit{ADRD}_i\, + \beta_2\,\mathit{Cognitive\ impairment}_i + \beta_3\,\mathit{Behavior\ problem}_i + \\ & \beta_4\,\mathit{Condition\ severity}_i + \beta_5\,\mathit{HHC\ diagnosis}_i + \beta_6\,\mathit{Caregiver\ type}_i + \\ & \beta_7\,\mathit{Caregiver\ responsibility}_i + \beta_8\,\mathrm{X}_i + \mu_i \end{aligned} \tag{3}$$

In addition, we examine the distribution of the time durations from HHC admission to hospital transfer within a HHC stay, conditional on ADRD status and other covariates. Kaplan–Meier survival curves were plotted for these time distributions. The Cox proportional hazards model is used to examine whether ADRD status is an independent predictor of time to the first hospital transfer when the model controls for other covariates.

IV. Results

Summary statistics are provided in Table 1. The first column contains variables used in the regression analyses. The second column shows statistics for the sample of all HHC stays in our analytical sample. The third column provides statistics for HHC stays for non-ADRD patients, while the fourth column shows statistics for HHC stays for ADRD patients. As expected, patients with ADRD are more likely to be female, older, black, and Medicaid eligible ($p<0.01$). Compared with non-ADRD HHC patients, patients with ADRD scored poorly on all health status measures, particularly in cognitive functioning and behavior problems ($p<0.01$). With regard to comorbid chronic conditions, patients with ADRD have a lower prevalence of obesity and diabetes ($p<0.05$), but a higher prevalence of cardiovascular/cerebrovascular disease ($p<0.01$). Nevertheless, patients with ADRD have similar primary diagnoses for HHC admission compared with non-ADRD patients. In addition, ADRD patients are more likely to be assisted by caregivers in all three domains: medical care, ADLs, and IADLs ($p<0.01$). Finally, patients with ADRD are less likely to be admitted to HHC from a prior hospitalization ($p<0.01$), and they are more likely to have at least one hospital transfer during a HHC stay and tend to use HHC longer ($p<0.01$).

In Table 2 we show the odds ratios for variables of interests used to predict any HHC use during the calendar year based on our first logit model (1). Our results are consistent with prior studies (Langa et al. 2001; McKnight 2006). For instance, prior hospitalization, black, Medicaid eligibility, number of helpers at home, and difficulties with ADLs are all strong predictors of any HHC use. Any HHC use is also positively associated with the availability of HHC service in the state where a patient resides (odds ratio = 1.35, $p < 0.01$). More importantly, our results show that after controlling for these patient characteristics and the supply side factor, ADRD is a strong predictor for any HHC use in the calendar year (odds ratio = 1.37, $p < 0.01$). This result supports our hypothesis 1.

The first column of Table 3 presents the odds ratios from our second logit model (2), which examines factors associated with any hospital transfer during a HHC stay. ADRD status is a strong positive predictor for any hospital transfer (odds ratio = 1.30, $p < 0.05$), which supports our hypothesis 2. Among other covariates, health status measures have statistically significant positive effect on hospital transfer except for symptoms controlled with difficulties. In particular, the odds ratio for symptoms poorly controlled upon HHC admission is 1.66 ($p < 0.05$), and the odd ratios for number of ADLs and comorbid chronic conditions are 1.10 ($p < 0.01$) and 1.11 ($p < 0.01$) respectively. Interestingly, moderate to severe cognitive impairment is positively associated with hospital transfer (odds ratio = 1.55, $p < 0.01$) even after other covariates are controlled. The patient's primary diagnoses for HHC admission are not associated with hospital transfer except for two diagnoses. One is skin related disease, such as ulcer and abscess, which is positively associated with hospital transfer (odds ratio = 1.58, $p < 0.05$); and the other is rehabilitation diagnosis, which is negatively associated with hospital transfer (odds ratio = 0.81, $p < 0.1$). Finally, if a caregiver at home assists a patient with medical care, this patient is more likely to have a hospital transfer during a HHC stay (odds ratio = 1.47, $p < 0.01$). On the one hand, this might indicate that patients with assistance for medical care from caregivers have more severe and complex health conditions; on the other hand, it might indicate that when a caregiver assists with medical care, the caregiver knows better about the patient's condition and needs, and as a result, facilitates patient's hospital transfer.

The second column in Table 3 presents results from the negative binomial regression to estimate the effect of ADRD status on total number of hospital transfers during a HHC stay while controlling for other covariates. The incident rate of hospital transfers for ADRD patients is 1.26 times the incident rate for non-ADRD patients (IRR=1.26, $p < 0.05$). Thus, patients with ADRD not only are more likely to have a hospital transfer during a HHC stay, but also have more hospital transfers on average compared with non-ADRD patients when controlling for other covariates. This is supportive of our hypothesis 3. The sign and significance level of other covariates are consistent with those from the second logit model predicting any hospital transfer. Health status measures except for symptoms controlled with difficulties and moderate to severe cognitive impairment all have a statistically significant positive effect on number of hospital transfers. For instance, symptoms poorly controlled upon HHC admission is associated with 1.72 times more of incident rate of hospital transfers ($p < 0.05$). Number of comorbid chronic conditions is associated with 1.11 times more of incident rate of hospital transfers ($p < 0.01$).

The third column in Table 3 presents results from the OLS regression to estimate the effect of ADRD status on annual Medicare expenditures while controlling for other covariates. Although ADRD status is associated with a greater likelihood of hospital transfer, it does not have a significant effect on the patient's annual total Medicare expenditure (coefficient=974.6, $p = 0.65$). One explanation is that HHC users with ADRD tend to be less likely to start HHC after an inpatient stay, meaning that they might be spending less on average prior to using HHC compared with non-ADRD patients. In addition, we can only capture a patient's total Medicare expenditures for the calendar year. Another other possible explanation is that patients with ADRD are more likely to be hospitalized during a HHC stay for some less medically needed reasons. As a result, their hospital stays could cost less than those hospital stays by non-ADRD patients. However, the OASIS does not precisely capture the specific reason for a hospital transfer. Most hospital transfers have the reason coded as "Other reasons".

Among other covariates, health status measures have significantly positive effects on annual Medicare expenditure. Patients with poorly controlled symptoms upon HHC admission spend \$4,566 more on average ($p < 0.01$). Patients with one more chronic condition would cost Medicare \$2,130 more ($p < 0.01$).

Figure 1 displays the time to first hospital transfer for HHC users with and without ADRD. The time is defined as the difference between the date of the first hospital transfer and the date of HHC admission. This figure show that patients with ADRD are transferred to hospital relatively sooner than non-ADRD patients (Hazard ratio=1.10, $p < 0.1$). This is supportive of our hypothesis 4. Table 4 presents hazard ratios for some other covariates included in the Cox's proportional hazards model. As expected, using HHC after a hospitalization predicts early hospital transfer (Hazard ratio=1.37, $p < 0.01$), as does having poorly controlled symptoms upon HHC admission (Hazard ratio=1.37, $p < 0.1$). The number of comorbid chronic conditions has a positive but not very significant effect on early hospital transfer (Hazard ratio=1.06, $p < 0.1$). With regard to primary diagnosis for HHC admission, only skin related disease significantly predicts early hospital transfer (Hazard ratio=1.45, $p < 0.05$).

V. Discussion

In this study, we use two nationally representative data sets of Medicare population to investigate HHC use and care transition during a HHC stay by older adults with ADRD living in the community. To our knowledge, this is the first comprehensive investigation of the impact of ADRD on Medicare service utilization and expenditures, focusing specifically on the interplay between ADRD, home health care use, hospitalizations, and expenditures.

We find that older adults with ADRD living in the community are more likely to use HHC, controlling for other covariates such as demographics and comorbid chronic conditions. This is consistent with the findings from other studies (Alzheimer’s Association

2012, 2013). However, our results add to the literature by showing that HHC users with ADRD are less likely to be admitted to home health following a hospital discharge; but when they are admitted to HHC, they tend to stay longer compared with non-ADRD HHC users. The longer stay suggests that HHC users with ADRD are more complex in terms of care needs and take more time to improve on their conditions being treated under home health.

HHC users with ADRD are more likely to be transferred to a hospital during a HHC stay and resume HHC after the hospitalization when controlling for other covariates such as the diagnosis upon HHC admission and other comorbid chronic conditions. Prior work focused only on hospitalization among institutionalized patients with ADRD. Additionally, after being admitted to home health, HHC users with ADRD are transferred to a hospital sooner than non-ADRD HHC users. Finally, HHC users with ADRD have more hospital transfers on average, i.e. transferred to a hospital more often, during a home health stay than non-ADRD HHC users.

These results indicate that, among HHC users, patients with ADRD are more demanding in care than non-ADRD users, including the burden of transitions in care that arise because of the dynamic nature of movement into, out of, and back into home health again for older adults with ADRD. When the complicated demand from patients with ADRD cannot be met or managed by home health providers in the residential environment, hospital transfers may occur as a result. Additionally, following a hospital transfer, the transition back to home to resume HHC might not be linear for patients with ADRD. Instead, the patient could have a short stay in a skilled nursing facility between the hospital discharge and the resumption of HHC (although such transitions to SNFs are not the focus of this study). Each additional transition between care settings poses a new risk for failure in communication, duplication of services, provision of care inconsistent with patients' and families' goals, and inefficient use of health care resources (Coleman 2003).

Such results suggest there is room for improvement in the quality and efficiency of HHC for patients with ADRD, especially by focusing on ADRD management and reducing unnecessary transitions between home health and hospital for patients with ADRD. Home health care plays an important role in the care continuum for older adults with ADRD living in the community, particularly in managing the various comorbid chronic conditions that ADRD patients normally have. However, there are not many integrated services under HHC to deal with the typical symptoms of ADRD, including cognitive impairment and behavior problems. These symptoms complicate the patient's care needs and make it very challenging to provide other essential services. For example, home health care can increase the skilled services provided by nurses and/or therapists who have special training in managing ADRD symptoms. In addition, families provide the majority of everyday hands-on care to patients with ADRD living in the community, and they have the commitment to keep their loved ones at home; however, they might not necessarily have the skills required to provide the interventions or environmental changes that are critical to prevent or alleviate behavior problems by patients with ADRD. Therefore, Medicare might well consider integrating caregiver education into its HHC benefit, with the aim of improving the effectiveness of home management for the ADRD patient. These efforts could potentially improve the overall quality and efficiency of HHC for patients with ADRD, which is critical to reduce the likelihood they will have unnecessary care transitions between home health and hospital.

One barrier to improving quality of HHC for patients with ADRD is that the current HHC prospective payment system (PPS) gives little weight to the diagnosis of ADRD when assigning patients into one of the 153 Home Health Resource Groups (HHRGs). HHRGs constitute the main basis for Medicare to reimburse home health providers. Although patients with ADRD are difficult to care for due to their cognitive impairment and possible behavior problem, their special demand does not translate to higher prospective reimbursement rate, and as a result, no corresponding increase in resource use (Coleman et al. 2008). Therefore, we suggest that Medicare consider a “carve out” that recognizes the care intensity received by patients with ADRD. For instance, ADRD can be properly given more weight when admitted HHC patients are diagnosed by clinicians as having ADRD. This would guarantee that patients with ADRD can receive adequate resources and services they need, and in turn improve the quality of HHC for patients with ADRD. In our sample, the difference between the unadjusted mean of Medicare inpatient expenditures for ADRD patients who had any hospital transfer during a HHC stay versus who did not is $9,100 any hospital. Therefore, in the best scenario, if increased reimbursement rate for ADRD patients can improve quality of care and reduce their hospital transfers, savings to Medicare from ADRD patients living in the community are achievable. This has important implication to Medicare program in the coming decades given the magnitude of ADRD and limited budget of the program.

Finally, care coordination and care management across sites of care, such as home health and the hospital, for ADRD patients will be essential in any innovative care delivery model. Examples of such models include Accountable Care Organizations (ACOs) and the patient-centered medical home. To provide collaborative care management for older adults with ADRD living in the community, more attention will need to be directed to reducing unnecessary and burdensome hospital transfers, particularly during a HHC stay. Bundled payments and shared financial responsibility between home health and hospital under the

ACO model will offer incentive for providers to reduce unnecessary transitions. Because historically delaying institutionalization is a high priority for patients, providers, and payers, timing of nursing facility care is often used as an outcome (Callahan et al. 2012). On the contrary, hospital transfers during a home health stay are often ignored by patients, payers, and policy makers. Efforts to improve care management and coordination for ADRD patients living in the community may offer more cost-savings and quality improvement opportunities than simply seeking to avoid nursing facility use. Future research will need to investigate the effectiveness of care management and coordination on reducing unnecessary hospital transfers during HHC stay among ADRD patients.

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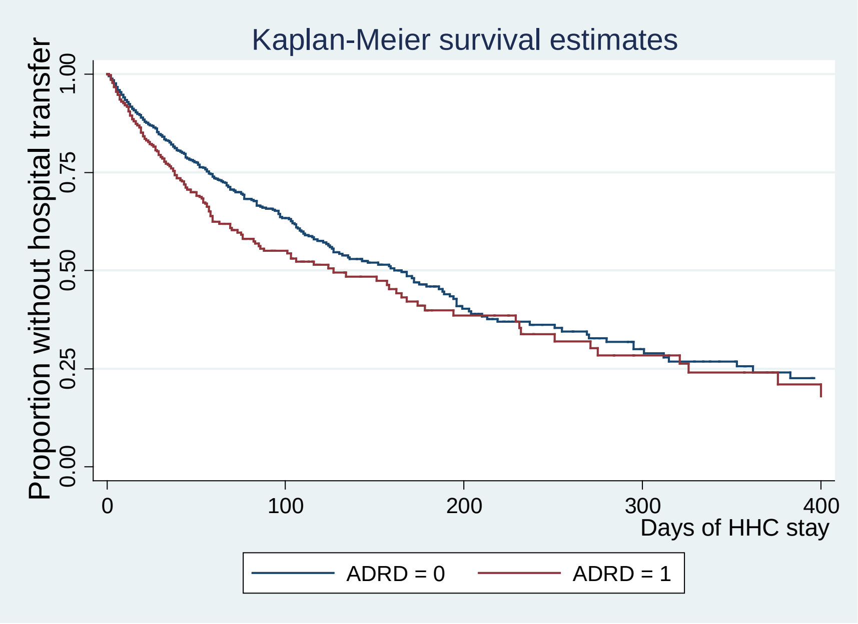

Figure 1: Time to first hospital transfer after HHC admission

Table 1: Summary statistics (means): characteristics of HHC stays

	All HHC stays (N=4,156)	HHC stays by non-ADRD patients (N=3,269)	HHC stays by ADRD patients (N=887)
Female	0.65	0.64	0.69
Age	80.5	79.9	83.1
White	0.82	0.84	0.76
Black	0.13	0.12	0.18
More than high school	0.32	0.32	0.31
Married†	0.38	0.38	0.38
Medicaid eligibility	0.27	0.26	0.32
Income (in $2005)	23,118	23,538	21,458
Health status			
General health status: worse than good	0.50	0.48	0.59
Symptoms controlled with difficulties			
Symptoms poorly controlled	0.35	0.34	0.37
Moderate to severe cognitive impairment	0.12	0.06	0.38
Presence of confusion everyday	0.14	0.07	0.42
Presence of behavior problems at least several times each month	0.09	0.06	0.23
Comorbid chronic conditions			
Obesity	0.13	0.14	0.11
Hypertension	0.74	0.74	0.74
Cardiovascular/cerebrovascular	0.52	0.50	0.59
Respiratory disease	0.24	0.23	0.24
Diabetes	0.30	0.31	0.26
Cancer	0.25	0.25	0.24
Primary diagnosis for HHC admission			
Cardiovascular/cerebrovascular	0.20	0.20	0.19
Respiratory disease	0.08	0.08	0.08
Diabetes	0.06	0.07	0.05
Orthopedic related	0.03	0.04	0.03
Urinary and renal related	0.02	0.02	0.01

ADRD	0.01	0	0.04
Skin related disease	0.04	0.04	0.05
Rehabilitation	0.13	0.13	0.13
Caregiver: family/friends	0.72	0.71	0.74
Caregiver: paid help	0.07	0.06	0.10
Caregiver assists ADLs	0.50	0.46	0.63
Caregiver assists IADLs	0.73	0.72	0.80
Caregiver assists medical care	0.62	0.58	0.70
Health care use			
Any hospitalization prior HHC	0.50	0.52	0.44
Any SNF stay prior HHC	0.09	0.09	0.10
Any hospital transfer during HHC	0.24	0.22	0.34
Length of HHC stay	67.2	63.5	84.4

† The reference group for marital status includes single, widowed, or married-separate.

Table 2: Results from multivariable logistic regression predicting any HHC use during the calendar years between 2002 and 2005 (N=36,002)

	Odds ratio
ADRD	1.37***
Any prior hospitalization	4.69***
Any hospital outpatient visit	2.08***
Number of physician visits	1.02***
Age	1.04***
Female	1.03
White	1.01
Black	1.48***
More than high school education	1.11**
Medicaid eligible	1.37***
Number of helpers at home	1.32**
General health status: worse than good	1.09**
Having difficulty with	
Bath	1.63***
Use toilet	1.16*
Walk	1.28***
Comorbid chronic conditions	
Stroke	1.17**
Diabetes	1.08*
Arthritis	1.17**
# of HHAs per 10K Medicare population in the state	1.35***

Notes: * *P*<0.1 ** *P*<0.05 *** *P*<0.01
All regressions include state dummies. Standard errors are corrected for clustering at the state level.

Table 3: Results from multivariable regressions predicting any hospital transfer, total number of hospital transfers, and annual Medicare expenditures among HHC users (N=3,907)

	Any hospital transfer	Total hospital transfers	Annual Medicare expenditures ($)
	Logit	*Negative binomial*	*OLS*
	Odds ratio	Incident rate ratio	Coefficient
ADRD	1.30**	1.26**	974.6
Moderate to severe cognitive impairment	1.55***	1.43**	412.7
Presence of confusion everyday	0.84	0.78*	− 1,215**
Female	0.75***	0.81**	− 3,156***
Age	1.00	1.00	− 388***
White	1.50**	1.63***	− 3,182
Black	1.46*	1.54**	423.8
More than high school	0.89	0.83**	467.8
Income	0.97	0.98	577.1**
Married†	0.84*	0.90	− 1,470
Medicaid eligibility	1.32***	1.37***	715.5
Health status			
Symptoms controlled with difficulties	1.24	1.30	3,316
Symptoms poorly controlled	1.66**	1.72**	4,566***
Number of ADLs	1.10***	1.09***	1,020***
Number of Comorbid chronic conditions	1.11***	1.11***	2,130***
Admit to HHC after a hospitalization	1.16*	1.16*	3,480***
Major diagnosis for HHC admission			
Cardiovascular/cerebrovascular	0.88	0.88	2,154*
Respiratory disease	1.34	0.94	− 1,159
Diabetes	1.15	1.19	2,414
Orthopedic related	1.03	1.00	212.7
Urinary and renal related	0.75	0.51	6,264
Skin related disease	1.58**	1.21	4,075*
Rehabilitation	0.81*	0.92	3,658***
Caregiver: family/friends	0.91	0.83	− 3,315*
Caregiver: paid help	0.86	0.70	− 4,250
Caregiver assists ADLs	1.02	1.06	3,914***

Caregiver assists IADLs	0.93	0.98	1,728
Caregiver assists medical care	1.47***	1.34***	3,290***

Notes: * $P<0.1$ ** $P<0.05$ *** $P<0.01$

Table 4: Selected results from Cox's proportional hazards model predicting time to first hospital transfer (N=3,907)

	Hazard ratio
ADRD	1.10*
Moderate to severe cognitive impairment	1.22*
Admit to HHC after a hospitalization	1.37***
Female	0.77***
Health status	
Symptoms controlled with difficulties	1.23
Symptoms poorly controlled	1.37*
Presence of confusion everyday	0.96
Number of ADLs	1.01
Number of Comorbid chronic conditions	1.06*
Major diagnosis for HHC admission	
Skin related disease	1.45**
Caregiver assists medical care	1.36***

Notes: * *P*<0.1 ** *P*<0.05 *** *P*<0.01

CHAPTER 3

Medicare Home Health and Hospice Care Use Near the End-of-life: Is There a Substitute Effect?

Abstract

Care near the end-of-life consumes a disproportionate share of expenditures and is a logical target for efforts to reduce spending, promote efficiency, and improve quality in health care. Among end-of-life care options, home health care (HHC) and hospice care are two major components of community-based health care services reimbursed by Medicare. Although these two options have different eligibility criteria and emphasize different goals of care, their overlap of covered services and different reimbursement rates make them potential substitute for each other. By using the Medicare Current Beneficiary Survey Cost and Use File from 1992 to 2005, we investigate whether or not hospice care serves as substitute for HHC when the reimbursement rate for HHC changes, and how the individual-level Medicare expenditures in beneficiaries' last year of life are associated with different choices of these community-based options. We find evidence that beneficiaries substituted hospice care for HHC in their last year of life after the Medicare reimbursement rate for HHC was reduced by the Balanced Budget Act of 1997. Additionally, we find that hospice care is more efficient than HHC with regard to providing community-based services near the end-of-life. We conclude that when the reimbursement rates to HHC and/or hospice care are modified in the future, the potential substitution between them should be taken directly into account, as they have different implications for Medicare expenditures on end-of-life

care. More incentives should be provided to promote hospice care use near the end-of-life rather than impede the use.

I. Introduction

Care near the end-of-life consumes a disproportionate share of expenditures and is a logical target for efforts to reduce spending and promote value in health care. These efforts include promoting palliative care and community-based care over unnecessary intensive care and institutionalized care (Lynn and Adamson 2003; Wennberg et al. 2008). Home health care (HHC) and hospice care are two major components of community-based end-of-life care options reimbursed by Medicare. For Medicare beneficiaries in their late-stage of life, both types of care are important and provide practical resources that enable them to stay in the community and reduce unnecessary and expensive inpatient or nursing home care.

Despite their importance to beneficiaries, the rapid increase in Medicare expenditures for HHC and hospice has become a major concern to policy makers. Between 2001 and 2010, Medicare expenditures on HHC increased by 130%, from $8.5 billion to $19.5 billion, while Medicare expenditures on hospice increased by 290%, from $3.2 billion to $12.6 billion (MedPAC 2012). These numbers are expected to continue increasing as our population ages at an unprecedented speed. In addition to the growing aging population, the desire to "age in place" continues to rise and, in turn, will add to the demand for such community-based care (Kirby and Lau 2010).

In response, the Affordable Care Act (ACA) implemented substantial reductions to Medicare HHC reimbursement rates and authorized the Centers for Medicare & Medicaid Services (CMS) to make additional future cuts if necessary (Congressional Research Service 2010). With regard to hospice, ACA required reductions in the hospice market basket update starting from 2013 through 2019 and authorized CMS to implement revisions to the hospice payment methodology no earlier than October 1, 2013 that are aiming at constraining Medicare expenditures on hospice care (Abt 2012). How these reductions and revisions will eventually affect the utilization of these community-based end-of-life care by Medicare beneficiaries is not clear. However, to date, debates around these reductions and revisions are only able to rely on prior studies which tend to separately focus on each type of care while ignoring the potential interrelationship between them. In addition, although a prior study has shown that hospice care reduced Medicare program expenditures during the last year of life by an average of $2,309 per hospice user (Taylor et al. 2007), the cost associated with HHC use in the last year of life is unclear. This study tries to fill these gaps in the literature by considering HHC and hospice care use near end-of-life in a more integrated way.

In the current study, by utilizing the 1992-2005 Medicare Current Beneficiaries Survey (MCBS) datasets, we aim to build upon prior studies and provide an in-depth investigation on the patterns of , and interrelationship between, HHC and hospice care use of Medicare beneficiaries in the last year of life. We choose the period of 1992-2005 because the most recent major payment and eligibility reform to HHC and hospice was implemented by the Balanced Budget Act (BBA) of 1997. The key research questions we try to answer are: first, what are the utilization patterns of these community-based services in beneficiaries' last year of life and how is the pattern affected by the BBA? Second, could HHC and hospice care serve as substitute for each other? Third, we also examine how the individual level Medicare expenditures in beneficiaries' last year of life are associated with different choices of these community-based end-of-life care options.

II. Background

HHC and hospice care

HHC and hospice are both covered by Medicare Part A without any patient cost sharing such as copayment, but have different eligibility and reimbursement criteria. To be eligible for HHC, a beneficiary has to be homebound and need intermittent or part-time skilled nursing/therapy services. If a patient meets these criteria, a physician must certify the need, determine a plan of care, and prescribe services. HHC is provided on a basis of 60-day episode, and there is no limit on episodes of use. To be eligible for hospice care, a physician and a hospice medical director must certify that the beneficiary is terminally ill, with approximately six months or less to live if his/her illness develops in its normal course. Meanwhile, the patient has to forgo Medicare coverage for intensive conventional treatments for the terminal illness. Hospice care is provided on the basis of 90-day period. After the first 90-day period, the patient can be recertified for another 90 days. After the second 90-day period, the patient can be recertified for an unlimited number of 60- day periods, as long as he or she remains eligible.

Due to the nature of the services, HHC and hospice care share several common features that make it possible for them to substitute each other. First, both types of care are provided in beneficiaries' residential environment[3], so that it gives patients, family members, and caregivers more choices and flexibilities in care arrangement. Second, both of them provide skilled nursing services, as well as skilled therapy services such as physical therapy and occupational therapy. For example, almost 90% of hospice care is skilled nursing care

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[3] All home health care is provided in beneficiaries' residential environment, while 90% of hospice care is provided in a residential environment (ref).

(Abt 2012). Third, both benefits support home health aide assistance, typically with activities of daily living (ADLs), to facilitate skilled nursing or therapy services and to prevent patient deterioration or maintain patient condition. Fourth, both types of care could be provided by the same agency. In 2010, one quarter of Medicare-certified hospices are also Medicare-certified home health agencies (HHAs) (National Association for Home Care & Hospice 2010). The agencies that provide both types of care have the advantage of lower administrative cost by coordinating beneficiaries' benefits between HHC and hospice care.

HHC and hospice care in the BBA of 1997

The BBA of 1997 contained provisions to constrain the explosive growth in the utilization and costs of Medicare HHC in the 1990s by reforming the payment system of HHC. Specifically, the BBA first mandated an Interim Payment System (IPS) in 1997 that significantly tightened up HHC reimbursement level while the HHC Prospective Payment System (PPS) was under development. The intention of the IPS was to create an incentive for HHAs to provide care more efficiently. However, one of the unintended consequences is that HHAs tended to select healthier patients to serve and/or discharge patients sooner (Komisar 2002; McCall et al. 2003; McKnight 2006). As a result, substitution between HHC and other similar services such as skilled nursing facility care were found by prior research (Buntin et al. 2009). Although the IPS did not specifically target HHC use in the last year of life, late-stage beneficiaries could be particularly affected because they normally tend to be sicker and frailer. After three years of development, Medicare HHC PPS was implemented in October 2000. The HHC reimbursement rate was better under PPS compared with that under IPS (Huckfeldt et al. 2012).

In contrast, the BBA made policy changes to strengthen the hospice care benefit and promote hospice care use by Medicare beneficiaries with terminal illness. For example, the BBA contained provisions to help ensure that patients whose prognosis improves or who choose to resume curative care can leave hospice and return at a later date, and provisions to protect beneficiaries and agencies from liability when hospice claims are denied because the patient was not terminally ill (HHS 1999). Although the eligibility requirement of prognosis of six months or less life expectancy was not modified, these policy changes in fact relaxed hospice eligibility requirements. This relaxation made substitution between HHC and hospice care more feasible than before. For instance, one study showed that HHC utilization rates dropped substantially and hospice care utilization rates increased for Medicare enrollees diagnosed with cancer after the implementation of HHC IPS (Kilgore et al. 2009). However, their results are difficult to generalize because of the focus on cancer patients only.

III. Data and Methods

Data

We used the data from 1992-2005 Medicare Current Beneficiaries Survey (MCBS) Cost and Use Files for analyses. MCBS is a longitudinal and multipurpose survey of a nationally representative sample of the Medicare population funded by CMS. The survey is conducted through several interviews with beneficiaries (or proxies for beneficiaries who cannot participate in an interview) over the course of a year. The advantages of MCBS for this analysis are that it contains information on demographics, socioeconomic status, self-reported health status, living arrangement, and many other beneficiary characteristics that are likely important predictors of beneficiaries' utilization of community-based care in the death year. Particularly, it includes detailed information on functional status measured by ADLs and beneficiaries' comorbid chronic conditions, as well as number of helpers with ADLs at home. Additionally, it is also linked to the administrative Medicare enrollment and claims files. Thus, it provides virtually complete and consistently defined data on beneficiaries' health care use and expenditures including HHC and hospice care, as well as inpatient, outpatient, physician visits, and short-term institutional care.

Sample

Our study population includes community-dwelling Medicare fee-for-services (FFS) decedents who were age 65 or older between 1993 and 2005. In order to focus on studying the pattern and relationship of HHC and hospice care use in beneficiaries' death year, data from each person's last survey year observed before death is examined. In summary, using the MCBS Time-Line Files (Ric-9) from 1993–2005, we select all community-dwelling FFS beneficiaries who died, and our final analytical sample includes 6,310 beneficiaries[4].

Dependent variables

The primary dependent variable is a polytomous measure of the type of community-based services that the beneficiary used in the death year. The types include HHC use only, hospice care use only, both HHC and hospice care use, and no HHC and hospice care use. No HHC and hospice care use will serve as the reference group. The second dependent variable is a dichotomous measure of whether or not a decedent used any hospice care in the

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[4] Date of death is linked from the Medicare enrollment files to the survey. We do not have access to cause of death data in order to exclude respondents who had an accidental death, because there is no mechanism that we know of to link National Death Index data to the MCBS survey. Given the very small likelihood of hospice use for these persons, we ideally would have eliminated persons who died from accidents.

year prior to death. Thus, the variable is coded as 1 if the beneficiary used any hospice care regardless of his/her HHC use in the year prior to death. The third dependent variable is the natural logarithm of total Medicare expenditures at the decedent level in the death year. Total Medicare expenditure is calculated as the sum of all Medicare covered services.

Hospice care use in the MCBS is captured by two variables in The Cost and Use Administrative Identification Records (Ric-A) files: admission date and discharge date of hospice care, and one variable in The Cost and Use Services Summary of Medicare Claims (Ric-SS) files: Medicare payments for hospice care. If a beneficiary had any Medicare payments for hospice care in the year prior to death and the admission date and discharge date are present, the beneficiary is coded as hospice care user. Home health care use in the MCBS is captured by two variables in The Cost and Use Administrative Identification Records (Ric-A) files: “one or more home health visits in the calendar year” and “total home health visits in the calendar year”. We coded a beneficiary in MCBS as a HHC user if the value of “one or more home health visits in the calendar year” is 1 and the value of “total home health visits in the calendar year” is larger than 0.

Explanatory variables

The first two explanatory variables of interest are the dichotomous ones indicating the period between 1997 and 2000, i.e. after the BBA was enacted and before the HHC PPS was implemented, and the period between 2001 and 2005, i.e. after the HHC PPS was implemented.

Demographics include age, gender, marital status, and race/ethnicity. Marital status is coded as “1” if the beneficiary was married and “0” if the beneficiary is widowed or single. Race/ethnicity is reported in the survey as five mutually exclusive categories: white, black, Hispanic/Latino, Asian, and others. Due to the small sample sizes for Asian and others, they will be combined into one category in the analysis, i.e. “others”.

Socioeconomic status is measured by the educational and income level of beneficiaries. Education is measured continuously in the survey as total years of education. We categorize years of education into two levels: less than high school including high school, and more than high school. Income is also measured continuously in MCBS and contains earnings from social security, pension benefits, any employment, and income from assets.

Health status is assessed with three groups of measures. First, general health status is measured by self-reported health and includes five categories: excellent, very good, good, fair, or poor. Second, functional status is assessed by whether or not the beneficiary has difficulties with ADLs. Each ADL is corresponding to a dummy variable coded as “1” if the beneficiary had difficulty with that ADL. Third, concurrent chronic conditions are controlled for based on chronic diseases reported in the survey. These chronic conditions include cardiovascular disease, cancer, cerebrovascular disease, respiratory system diseases, diabetes, hypertension, and Alzheimer’s disease/dementia.

The number of informal caregivers that the beneficiary had at home in the death year is included as a covariate. In addition, we control for the number of children that the beneficiary had. We also include a beneficiary’s living arrangement. Living arrangement in MCBS has three categories: living alone, living with spouse or with child, and living with others. In the analysis, we group living arrangement into two levels: living alone and living with someone.

In addition to beneficiaries’ Medicare Part A and Part B coverage, we control for beneficiaries’ Medicaid eligibility and other private health insurance coverage. Private health insurance includes either employer-sponsored insurance or self-purchased insurance.

Therefore, health insurance coverage is measured by grouping beneficiaries into the following three mutually exclusive groups: Medicare Part A and Part B (Medicare fee-for-services), dual eligible (Medicare fee-for-services and Medicaid), and Medicare fee-for-services and private insurance coverage.

Supply side factor has an important role in HHC and hospice care utilization (Iglehart 2009). Therefore, we include in the analysis the number of hospice care providers and the number of HHAs per 10,000 Medicare beneficiaries at the state level that are extracted from the Area Resource File (ARF). Additionally, we control for whether or not the beneficiary lived in a metropolitan area.

Methods

The payment policy changes to HHC in 1997 and 2000 provide a natural experiment opportunity to study their effect on HHC and hospice care use in the last year of life. We adopt the pre-post design and name the study periods based on the year when the payment policy change takes place, The first period is from 1992 to 1996, named the pre-BBA period; the second is from 1997 to 2000, named the post-BBA period; the third is from 2001 to 2005, the HHC-PPS period. We then examine the utilization pattern of these community-based services by beneficiaries in the death year and how the pattern is affected by the policy changes.

We use multinomial logistic model in (1) to analyze how the utilization of HHC and hospice care in the death year is affected by the policy changes while adjusting for other covariates. We use ordinary least squares regression in (2) to analyze the impact of utilizing different types of community-based services on total Medicare expenditures in the death year and how the impact is affected by the policy changes while adjusting for other covariates. The variable both in (2) means using both HHC and hospice care in the death year.

$$\begin{aligned}\text{Multinomial logit}(\mathit{type\ of\ care}_{is}) = {} & \beta_0 + \beta_1 \mathit{post\text{-}BBA}_{is} + \beta_2 \mathit{HHC\text{-}PPS}_{is} + \beta_3 \mathit{informal\ caregiver}_{is} + \\ & \beta_4 \mathit{number\ of\ children}_{is} + \beta_5 \mathit{living\ arrangement}_{is} + \\ & \beta_6 \mathit{Medicaid}_{is} + \beta_7 \mathit{private\ insurance}_{is} + \beta_8 \mathit{functional\ status}_{is} + \\ & \beta_9 \mathit{chronic\ conditions}_{is} + \beta_{10} \mathit{supply\ \text{side}}_{is} + \\ & \beta_{11} \mathrm{X}_{is} + \sum_{s=1}^{S} \beta_{12s} \mathit{State}_s + \mu_{is} \end{aligned} \tag{1}$$

$$\begin{aligned}\mathit{Total\ Medicare\ expenditure}_{is} = {} & \beta_0 + \beta_1 \mathit{HHC}_{is} + \beta_2 \mathit{hospice}_{is} + \beta_3 \mathit{both}_{is} + \\ & \beta_4 \mathit{HHC} * \mathit{post\text{-}BBA}_{is} + \beta_5 \mathit{hospice} * \mathit{post\text{-}BBA}_{is} + \beta_6 \mathit{both} * \mathit{post\text{-}BBA}_{is} + \\ & \beta_7 \mathit{HHC} * \mathit{HHC\text{-}PPS}_{is} + \beta_8 \mathit{hospice} * \mathit{HHC\text{-}PPS}_{is} + \beta_9 \mathit{both} * \mathit{HHC\text{-}PPS}_{is} + \\ & \beta_{10} \mathit{informal\ caregiver}_{is} + \beta_{11} \mathit{number\ of\ children}_{is} + \beta_{12} \mathit{living\ arrangement}_{is} + \\ & \beta_{13} \mathit{Medicaid}_{is} + \beta_{14} \mathit{private\ insurance}_{is} + \beta_{15} \mathit{functional\ status}_{is} + \\ & \beta_{16} \mathit{chronic\ conditions}_{is} + \beta_{17} \mathit{supply\ \text{side}}_{is} + \beta_{18} \mathrm{X}_{is} + \sum_{s=1}^{S} \beta_{19s} \mathit{State}_s + \mu_{is} \end{aligned} \tag{2}$$

The dependent and independent variables are the same as these introduced in the previous section, where X includes a vector of demographics, socioeconomic status, and self-reported health status. Supply side includes the number of hospice care providers per 10,000 Medicare beneficiaries and the number of HHAs per 10,000 Medicare beneficiaries at the state level. State_s stands for state dummies. Subscript *i* stands for individual, and subscript s stands for the state where the individual *i* resided.

IV. Results

Descriptive results

Summary statistics using data from 1992 to 2005 are provided in Table 1. The first column contains labels of major explanatory variables that are used in our study. The second column shows statistics for patients who neither used HHC nor hospice care in the year prior to death. The third column provides statistics for patients who only used HHC in the year prior to death, while the fourth column provides statistics for patients who only used hospice care in the year prior to death. The last column shows statistics for those who used both HHC and hospice care in the year prior to death.

Among all beneficiaries who died between 1993 and 2005 in our sample, 3,410 (54%) had neither HHC nor hospice care in the death year, 1,502 (23.8%) used HHC only, 888 (14.1%) used hospice care only, and 510 (8.1%) used both HHC and hospice care. Compared with patients using HHC only, hospice care only patients are more likely to be white (88% versus 81%, $p<0.01$), married (48% versus 41%, $p<0.01$), male (52% versus 46%, $p<0.01$), having more than high school education (30% versus 20%, $p<0.01$), living with someone (76% versus 69%, $p<0.01$), and residing in a metropolitan area (79% versus 69%, $p<0.01$). Hospice care only patients also have higher income on average and are less likely to be Medicaid eligible (17% versus 27%, $p<0.01$). In addition, compared with patients using HHC only, hospice care only patients have lower prevalence rates for every indicator of having difficulty with ADLs. Decedents with cancer are much more likely to be seen using hospice care than using HHC (44% versus 25%, $p<0.01$). With regard to other health care utilization, hospice care only patients have the lowest rates for hospitalization (51%) and outpatient visit (49%), as well as lowest total annual Medicare expenditures ($18,312), among all four types of patients. In contrast, HHC only patients have the highest rates for these indicators among all four types of patients.

Based on statistics in the last column, on average, a decedent who used both types of care in the year prior to death is a typical HHC only patient in terms of functional limitations and concurrent chronic conditions but with higher education level, higher income level, and more likely to be married and to live with someone in a metropolitan area. More interestingly, patients who used both types of care still spend less than HHC only patients on average ($28,643 versus $32,150).

Figure 1 presents the unadjusted percentage of decedents using different types of care across the three stratified time periods. Trends in the percentage change significantly after the implementation of the BBA in 1997. In the pre-BBA period, it is more common for beneficiaries to use HHC only in the last year of life (32.1% on average between 1992 and 1996). The percentage of beneficiaries using hospice care only stays constantly around 7.5% in the pre-BBA period, so does the percentage of beneficiaries using both types of care (around 5.1%). However, in the post-BBA period between 1997 and 2000, as the percentage of beneficiaries using HHC only plummets from 32.8% in 1996 to 20% in 2000, the percentage of hospice only patients almost doubles from 8.1% in 1996 to 15.2% in 2000, showing a potential substitution of hospice care for HHC at the aggregate level. Meanwhile, patients using both HHC and hospice care almost doubles, as well, in the post-BBA period, from 6.2% in 1996 to 11% in 2000. Moving into the third period, HHC-PPS, the percentage of patients using hospice only eventually exceeds the percentage of HHC only patients in 2001 and continues its upward trend until 2004. While using hospice care becomes dominant, the percentage of HHC only patients only fluctuates marginally between 16% and 18%. Although the total number of patients using hospice care in the death year continues to grow in the HHC-PPS period, the percentage of beneficiaries using both HHC and hospice care basically stays constant around 8%.

We further present in Table 2 summary statistics of selected characteristics for the three types of patients in each study time period. Trends are observed among some of these characteristics across the three time periods. For instance, when comparing the pre-BBA period with the HHC-PPS period, hospice only patients with more than high school education increases from 20% to 35%, and hospice only patients living with someone increases from 66% to 77%. In the post-BBA period, prevalence rates of selected functional limitations increase for hospice care only patients as well as for patients using both types of care, while the rates drop for HHC only patients. Particularly, prevalence rates of selected functional limitations for patients using both types of care exceed prevalence rates for HHC only patients in the post-BBA period and HHC-PPS period. With regard to concurrent chronic conditions, the most noteworthy trend is the decline in hospice care only patients with cancer (53% to 37%) and the increase in hospice care only patients with other chronic conditions (for example, Alzheimer's disease, 8% to 17%; cardiovascular/cerebrovascular disease, 36% to 47%), which is consistent with findings from another study (MedPAC 2011). Therefore, after the BBA of 1997, patients using both HHC and hospice care tend to be the sickest ones in their last year of life.

Regression results

Table 3 presents results from the multinomial logit model in (1). Relative risk ratios (RRR) are reported. Decedents with no HHC and hospice use serve as the reference group. Compared with the reference group, the RRR for decedents to use HHC only in the death year is 0.75 ($p<0.01$) in the post-BBA period and 0.61 ($p<0.01$) in the HHC-PPS period, controlling for other covariates. In other words, it becomes less likely for decedents to use HHC only in the death year after the BBA lowered Medicare reimbursement rate to HHC.

In contrast, the RRR for decedents to use hospice care only in the death year is 1.84 ($p<0.01$) in the post-BBA period and 2.53 ($p<0.01$) in the HHC-PPS period while controlling for other covariates. In other words, it becomes much more likely for decedents to use hospice care in the death year after the BBA lowered the Medicare reimbursement rate to HHC and strengthened the hospice benefit at the same time. Therefore, the substitute effect persists after adjusting for other covariates. In addition, it is also more likely for decedents to use both HHC and hospice care in the post-BBA and HHC-PPS periods; however, the RRR in post-BBA (RRR=2.03, $p<0.01$) is larger and more significant than the RRR in HHC-PPS (RRR=1.80, $p<0.05$).

In order to better illustrate the changes in probabilities of using different types of services across the three periods and the substitute effect, we also compute the in-sample predicted probabilities based on the multinomial logit model. Results are presented in Figure 2. While the predicted probability of using only HHC in the death year decreases significantly from 0.29 to 0.21, the probability of using only hospice care more than doubles from 0.07 to 0.13 after the BBA of 1997. Therefore, the marginal effects of payment policy change to HHC in 1997 on the probability of using HHC only is -0.08, and on the probability of using hospice care only is 0.06. In other words, it becomes more likely for beneficiaries to substitute hospice care for HHC after the BBA of 1997. After the HHC PPS was implemented in 2000, the probability of using HHC only continues to decline from 0.21 to 0.16, whereas the probability of using hospice care only continues to increase from 0.13 to almost 0.22. Therefore, the marginal effects of payment policy change to HHC in 2000 on the probability of using HHC only is -0.05, and on the probability of using hospice care only is 0.08.

RRRs of other covariates from the multinomial logit model are in the expected directions. For instance, being white is associated with lower likelihood of HHC use (RRR=0.73, p<0.01) and a higher likelihood of hospice care use (RRR=1.34, p<0.01). Higher education level is associated with higher likelihood of hospice use (RRR=1.26, p<0.05). Being Medicaid eligible predicts higher likelihood of HHC use (RRR=1.43, p<0.01) and lower likelihood of hospice care use (RRR=0.78, p<0.05). Having cancer is still a strong predictor for hospice care use (RRR=2.70, p<0.01), although cancer patients no longer constitutes the majority of hospice care users. These findings are consistent with prior studies. Adding to prior research, we also find that not living alone, having more children, living in a metropolitan area, and living in the area with more hospice providers are associated with higher likelihood of using hospice care.

Table 4 presents the marginal effects of utilizing different types of care on total Medicare expenditures in the death year across the three time periods. We also create Figure 3 to illustrate the changes in marginal effects of using different type of services on total Medicare expenditures across the three time periods. The reference group is no HHC and hospice care use in the death year. Among the three types of patients, those who used hospice care only have the lowest total Medicare expenditures on average in the death year across all three time period. In other words, using hospice care only has the smallest marginal effect on total Medicare expenditures in the death year, although the effect continues increasing through the time periods and is only statistically significant in the HHC-PPS period. Using HHC only and using both types of care have similar trends of marginal effect on total Medicare expenditures, i.e. both their marginal effects decrease in the post-BBA period and increase in the HHC-PPS period. For example, the marginal effect of using HHC only on total Medicare expenditures in the death decreases from $7,017 to $5,569 in the post-BBA period and increases again to $8,301 in the HHC-PPS period. The trend is consistent with the overall trend of changes in Medicare reimbursement to HHC. The BBA substantially reduced Medicare reimbursement to HHC and as a result expenditures on HHC between 1997 and 2000 (McCall et al. 2001, 2003; Komisar 2002; Zhu 2004), but improves the reimbursement rate after 2000 under HHC PPS (Huckfeldt et al. 2012).

V. Discussion

In this study, we use a nationally representative data set of Medicare population to investigate the patterns of, and interrelationship between, HHC and hospice care use associated total Medicare expenditures in their last year of life. To our knowledge, this is the first comprehensive investigation on these questions in the context of major HHC reimbursement policy changes.

We find that the percentage of beneficiaries using any type of HHC and hospice care or both in the last year of life increases from 42 % in 1993 to 51% in 2005. However, the pattern of HHC and hospice care use changes substantially during this period, as reimbursement for HHC was reduced by the BBA of 1997 before being increased in 2000. First of all, the percentage of beneficiaries using HHC only drops dramatically in the post-BBA period and becomes relatively stable after 2001 when no major reimbursement changes were made to HHC. Second, the percentage of beneficiaries using hospice care starts increasing and substitutes for HHC in the post-BBA period. More importantly, the percentage eventually exceeds the percentage of using HHC in 2001 and becomes the dominant choice of community-based end-of-life care since then. This is also illustrated by the changes in predicted probability of using different types of care in Figure 2. Third, the percentage of beneficiaries using both types of care also significantly increases in the post-BBA period. This might indicate a different type of substitution between HHC and hospice care due to changes in Medicare reimbursement. Beneficiaries are more likely to switch from HHC benefit to hospice benefit in the post-BBA period. Results of our regression analysis also indicate that any HHC use is strongly associated with higher likelihood of subsequent hospice care use in the post-BBA period. Prior research also shows that if a hospice provider and a HHA are commonly owned, a management strategy may be to move patients from the HHC benefit into hospice earlier, because hospice per diem rates become higher in the post-BBA period (Van Houtven et al. 2009).

The decision-making process of end-of-life care choices is complex, and is often made jointly by physicians, patients, family members, and caregivers. Patients might utilize one type of community-based services instead of another or utilize both sequentially as we show in the study. Although the preferences of patients and family members play an important role in the process, our findings show that Medicare reimbursement rates to these services have a substantial impact on the decision-making as well. Our finding of the substitute effect between HHC and hospice care in the context of Medicare HHC reimbursement changes emphasizes the importance of considering them in a more integrated way.

We also find that use of hospice care is associated with the smallest marginal effect on total Medicare expenditures in the last year of life compared with other types of use, i.e. HHC only or both HHC and hospice care. Due to the extremely high Medicare expenditures on end-of-life care and the increasing demand for community-based palliative care in recent years (Yang et al. 2003; Goodman et al. 2011; Lorenz et al. 2008; Cutler et al. 2013), researchers have repeatedly emphasized the important role hospice care can play in end-of-life care to improve the quality of life for both patients and families and save Medicare expenditures (Miller et al. 2003; Morrison and Meier 2004; Taylor et al. 2007). Our finding illustrate that among different types of community-based end-of-life care services, hospice care is more efficient than HHC in the death year. Hospice care and HHC might serve same purposes to certain beneficiaries, but hospice care costs Medicare much less. Hence, future revisions to hospice care reimbursement method should take into account the potential substitution between HHC and hospice care where the former has much higher marginal effect on total Medicare expenditure in the last year of life than the latter. Additionally, the policy implication is that more incentives should be provided to promote hospice care use for the end stage patients.

ACA mandates reimbursement reductions to both types of care; nevertheless, these reductions are designed separately without considering the potential effect of substitution. For instance, based on our finding, if the reduction in HHC reimbursement makes hospice care reimbursement more generous, we will see more beneficiaries substituting hospice care for HHC as community-based end-of-life care option. Beneficiaries who substitute hospice care for HHC will cost Medicare less on average for end-of-life care. Nevertheless, the reimbursement reduction and revisions to hospice care might offset this substitute effect and even change the direction of the substitution, i.e. substitute HHC for hospice. Particularly, the settlement of a recent class action law suit (Jimmo v. Sibelius) in 2012 will eventually allow HHC to be provided also for the purpose of only maintaining a patient's condition. This liberalization of HHC eligibility is likely to have a significant impact on demand for HHC as a community-based end-of-life care option.

Our study does not answer which type of care provides better quality of care and improves qualify of life. Further examination of how incentives provided by reimbursement structures affect clinical practice and the value of these community-based services are warranted. Studies comparing the quality of care in home health and hospice would be also important.

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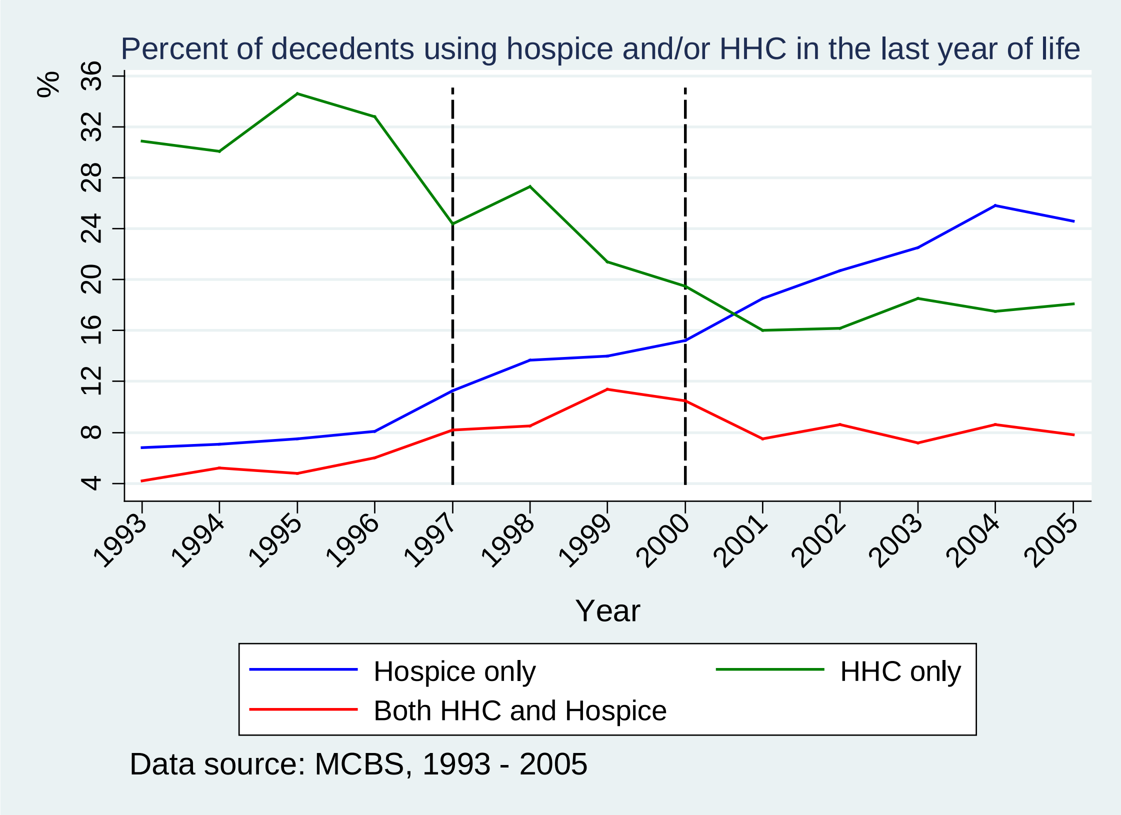

Figure 1: Percentage of beneficiaries using hospice care and HHC in the death year

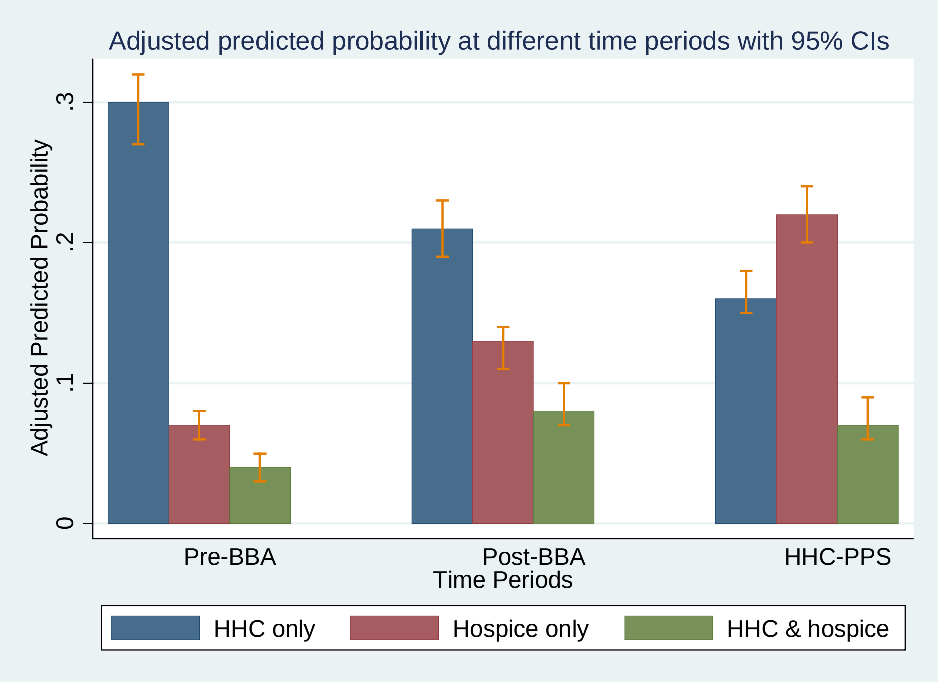

Figure 2: Adjusted predicted probability of the choice of HHC and/or Hospice Care in the death year

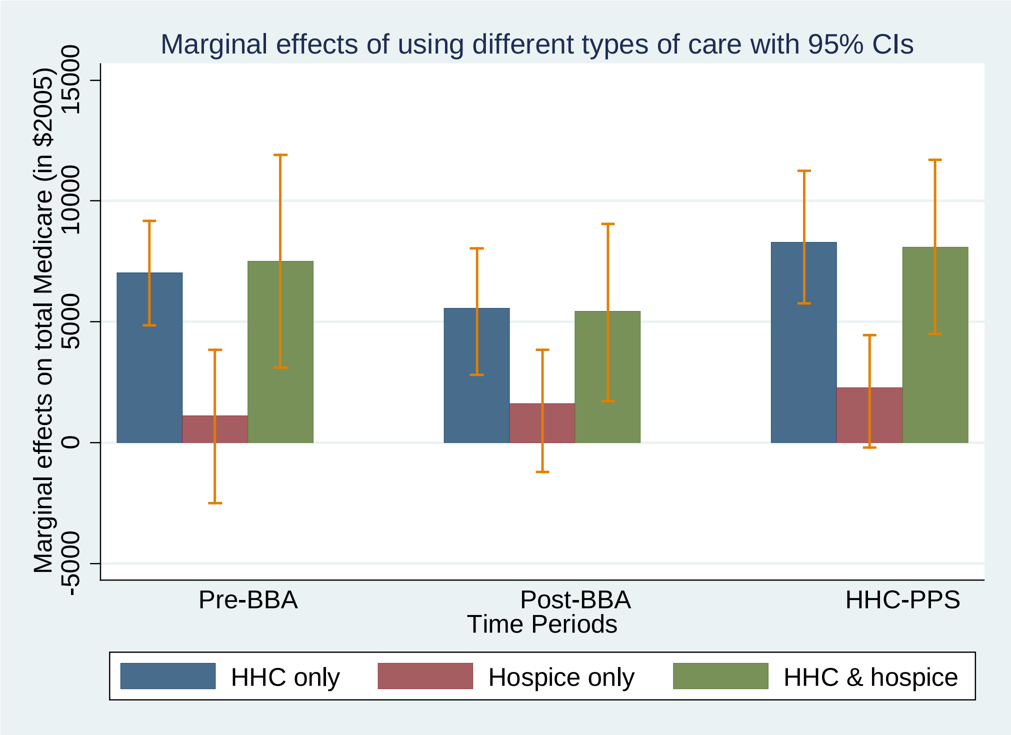

Figure 3: Marginal effects of HHC and Hospice care on total Medicare expenditure in the death year

Table 1: Summary statistics of key explanatory variables by types of patients (means)

	No hospice and HHC use	HHC only patients	Hospice only patients	Patients using both hospice and HHC
	(N=3,410)	(N=1,502)	(N=888)	(N=510)
Age	80.7	82.2	80.7	81.5
Female	0.48	0.54	0.48	0.58
White	0.86	0.81	0.88	0.88
Black	0.10	0.15	0.08	0.09
Hispanic	0.01	0.01	0.02	0.01
Married†	0.43	0.41	0.48	0.45
More than high school education	0.24	0.20	0.30	0.27
Have informal caregiver(s)	0.55	0.75	0.66	0.72
Live with someone	0.68	0.69	0.76	0.74
Number of children	2.6	2.7	3.0	3.0
Metropolitan area	0.68	0.69	0.79	0.77
Medicaid eligibility	0.20	0.27	0.17	0.21
Private insurance	0.57	0.57	0.65	0.72
Income (in $2005)	23,868	21,634	26,305	24,099
General health status*	3.3	3.7	3.5	3.8
Having difficulty with any ADLs				
Bath	0.35	0.55	0.38	0.54
Out of bed/chair	0.31	0.47	0.32	0.48
Dress	0.24	0.42	0.27	0.41
Eat	0.10	0.18	0.15	0.21
Use toilet	0.19	0.36	0.21	0.34
Walk	0.52	0.70	0.55	0.66
Chronic conditions				
Cardiovascular/cerebrovascular	0.51	0.55	0.46	0.51
Cancer	0.22	0.25	0.44	0.45
Diabetes	0.23	0.29	0.20	0.23
Respiratory disease	0.20	0.24	0.21	0.26
Alzheimer's disease/dementia	0.10	0.14	0.15	0.14
Hypertension	0.60	0.62	0.56	0.55
Health care use				
Any hospitalization	0.61	0.84	0.51	0.70

Any hospital outpatient visit	0.53	0.78	0.49	0.72
Number of physician visits	2.5	4.5	3.3	4.8
Medicare expenditures in the year prior to death (in $2005)				
Hospice	N/A	N/A	4,886	4,863
HHC	N/A	4,000	N/A	3,083
Total expenditure	18,458	32,150	18,312	28,643

* General health status is self-reported and measured in a scale from 1 to 5. 1 means excellent

† The reference group of married includes single, widowed, or married-separate.

Table 2: Summary statistics of selected explanatory variables by type of patients and study periods (means)

	HHC only patients			Hospice only patients			Both hospice and HHC patients		
Year	92 - 96	97 - 00	01 - 05	92 - 96	97 - 00	01 - 05	92 - 96	97 - 00	01 - 05
	N=708	N=417	N=377	N=164	N=248	N=476	N=116	N=194	N=205
More than high school	0.19	0.20	0.22	0.20	0.30	0.35	0.20	0.26	0.32
Live with someone	0.71	0.71	0.66	0.66	0.75	0.77	0.66	0.76	0.70
Medicaid eligibility	0.25	0.27	0.30	0.16	0.16	0.17	0.16	0.21	0.22
Income (in $2005)	21,461	23,074	20,367	23,418	28,724	27,043	21,804	24,923	24,768
Having difficulty with any ADLs									
Bath	0.58	0.55	0.48	0.33	0.41	0.39	0.49	0.56	0.55
Out of bed/chair	0.52	0.47	0.38	0.29	0.32	0.33	0.46	0.51	0.50
Dress	0.46	0.41	0.33	0.20	0.28	0.28	0.38	0.44	0.41
Chronic conditions									
Cardiovascular/cerebrovascular	0.56	0.57	0.50	0.36	0.45	0.47	0.44	0.57	0.50
Cancer	0.25	0.20	0.27	0.53	0.47	0.37	0.53	0.44	0.40
Diabetes	0.30	0.31	0.25	0.21	0.18	0.20	0.26	0.24	0.21
Respiratory disease	0.21	0.25	0.28	0.17	0.22	0.25	0.29	0.25	0.25
Alzheimer's disease/dementia	0.12	0.14	0.16	0.08	0.16	0.17	0.03	0.11	0.18
Hypertension	0.61	0.63	0.65	0.49	0.52	0.60	0.41	0.55	0.64
Medicare expenditures in the death year (in $2005)									
Hospice	N/A	N/A	N/A	5,437	4,008	5,153	5,133	4,360	5,171
HHC	4,483	3,665	3,463	N/A	N/A	N/A	2,925	3,179	3,092
Total expenditure	29,429	32,080	35,321	15,320	14,320	19,559	27,568	29,045	28,942

Table 3: Results from the multinomial logit model predicting types of services used (N=6,255)

	HHC only patients	Hospice only patients	Patients using both hospice and HHC
	Relative risk ratio	Relative risk ratio	Relative risk ratio
Post-BBA	0.75***	1.84***	2.03***
HHC-PPS	0.61***	2.53***	1.80**
Age	1.03***	1.00	1.01
Female	1.06	1.05	1.46***
White	0.73***	1.34**	1.10
Married	1.12	1.07	1.18
More than high school education	0.97	1.26**	1.22
Have informal caregiver(s)	1.77***	1.44***	1.91***
Live with someone	0.85*	1.14**	0.99
Number of children	1.02	1.08***	1.07***
Metropolitan area	0.94	1.65***	1.51***
Medicaid eligibility	1.43***	0.78**	1.29*
Private insurance	1.14*	0.84*	1.12*
Income (in $2005)	0.88**	0.99	0.85**
General health status	1.18***	1.14**	1.17**
Having difficulty with any ADLs			
Bath	1.29**	1.05	1.29*
Out of bed/chair	0.93	0.89	1.51***
Dress	1.17*	0.94	1.15
Eat	1.02	1.53***	1.37**
Use toilet	1.55***	0.99	1.19*
Walk	1.20**	0.99	0.80
Chronic conditions			
Cardiovascular/cerebrovascular	0.86**	0.73**	0.83*
Cancer	0.96	2.70***	2.55***
Diabetes	1.26***	0.78*	0.96
Respiratory disease	1.17**	0.85	1.18
Alzheimer's disease/dementia	0.92	1.13	0.82
Hypertension	1.01	0.83**	0.70***

# of HHAs per 10K Medicare population in the State	1.12**	1.02	0.96
# of hospice per 10K Medicare population in the State	0.97	1.34**	1.23

Notes: * *P*<0.1 ** *P*<0.05 *** *P*<0.01
State dummies are included.

Table 4: Results from the ordinary least square regression on total Medicare expenditures in the death year (in $2005)

	Marginal effect on total Medicare expenditures N=6,236
HHC use only in pre-BBA	7,017***
HHC use only in post-BBA	5,569***
HHC use only in HHC-PPS	8,301***
Hospice use only in pre-BBA	1,127
Hospice use only in post-BBA	1,630
Hospice use only in HHC-PPS	2,278*
Both HHC & hospice in pre-BBA	7,513***
Both HHC & hospice in post-BBA	5,446**
Both HHC & hospice in HHC-PPS	8,104***

Notes: * *P*<0.1 ** *P*<0.05 *** *P*<0.01