M50 MATHEMATICA Policy Research

REPORT

Evaluation of the Independence at Home Demonstration: An Examination of the First Four Years

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ACRONYMS

ACSC	Ambulatory care sensitive condition
ACO	Accountable care organization
ADL	Activities of Daily Living
AHRQ	Agency for Healthcare Research & Quality
CCW	Chronic Conditions Warehouse
CI	Confidence interval
CMMI	Center for Medicare & Medicaid Innovation
CMS	Centers for Medicare & Medicaid Services
COPD	Chronic obstructive pulmonary disease
DM	Diabetes mellitus
DME	Durable medical equipment
E&M	Evaluation and management
ED	Emergency department
EMR	Electronic medical records
ESRD	End-stage renal disease
FFS	Fee-for-service
HCC	Hierarchical Condition Categories
IAH	Independence at Home
ICD	International Classification of Diseases
IRF-PAI	Inpatient Rehabilitation Facility Patient Assessment Instrument
LL	Lower limit
MDRG	Modified Diagnostic-Related Group
MDS	Minimum Data Set
MS-DRG	Medicare Severity Diagnosis-Related Group
MV	Mechanical ventilation
NP	Nurse practitioner
NPV	Negative predictive value
OASIS	Outcome and Assessment Information Set
OLS	Ordinary least squares
PA	Physician assistant
PACE	Program of All-Inclusive Care for the Elderly
PBPM	Per beneficiary per month
PPS	Prospective Payment System
PPV	Positive predictive value
PQI	Prevention Quality Indicator

SBAR	Situation, Background, Assessment, Recommendation
SNF	Skilled nursing facility
TIN	Tax identification number
UL	Upper limit
VPA	Visiting Physicians Association

EXECUTIVE SUMMARY

Section 3024 of the Patient Protection and Affordable Care Act (Public Law 111-148) mandated the Independence at Home (IAH) demonstration to test a payment incentive and service delivery model for providing home-based primary care to chronically ill and functionally limited Medicare beneficiaries. In June 2012, the Centers for Medicare & Medicaid Services (CMS) launched the IAH demonstration. Under the IAH demonstration, physicians and nurse practitioners direct home-based primary care teams with the goal of reducing health care expenditures and improving health outcomes.

Current Medicare payment policy includes a higher payment for visits made in the home (in contrast to an office) under the Medicare fee schedule. As part of the IAH demonstration, practices may earn additional incentive payments if they generate sufficient savings and meet required standards for a set of quality measures. For the IAH demonstration to result in Medicare savings, the costs or savings associated with the IAH practices' providing home-based primary care—plus any savings from the demonstration payment incentive—must net out to lower overall expenditures for Medicare, after accounting for the cost of incentive payments paid by CMS. The legislation requires an independent evaluation to determine the impact of the demonstration on beneficiaries' Medicare expenditures and other health-related outcomes. This report presents the evaluation findings for the first four years of the IAH demonstration.

Exhibit ES.1. Requirements of practices for participation in the IAH demonstration

- Be led by physicians or nurse practitioners who provide home-based primary care as part of a team
- Be organized at least partly for the purpose of providing physician services
- Be experienced in providing home-based primary care to patients with several chronic illnesses
- Make in-home primary care visits and be available around the clock every day
- Use electronic medical records, remote monitoring, and mobile diagnostic technology
- Provide services to at least 200 IAH-eligible beneficiaries each year
- Report information on patients, services provided, and required quality measures to CMS

A. Background on the IAH demonstration

The law mandating the IAH demonstration, Section 3024 of the Patient Protection and Affordable Care Act of 2010, describes the eligibility requirements for both practices and beneficiaries. Demonstration clinicians have to be experienced at delivering home-based primary care and have teams led by physicians or nurse practitioners that may include physician assistants, clinical staff, and other health and social services staff. The practices must adhere to a set of guidelines consistent with providing high-quality home-based primary care (Exhibit ES.1). Beneficiaries who receive care from the IAH practices are eligible for the demonstration if they meet several health status and health care use criteria (Exhibit ES.2). Congress limited the demonstration to 10,000 beneficiaries.

Exhibit ES.2. Requirements for beneficiaries' eligibility for the IAH demonstration

- Have at least two chronic conditions
- Require human assistance with at least two activities of daily living
- Have had hospitalization and acute or subacute rehabilitation services in the prior 12 months
- Be in the Medicare fee-for-service program
- Not be in long-term care or hospice at the time of enrollment in the demonstration

This evaluation report covers the first four years of the demonstration. The demonstration began in June 2012 for a three-year period and was subsequently extended to five years. Year 5 of the demonstration ended in September 2017; however, Congress extended the demonstration for two additional years as part of the Bipartisan Budget Act of 2018, and Year 6 began on January 1, 2019.

The demonstration began with 15 sites, and CMS added 3 sites in September 2012, for a total of 18 sites. During the demonstration, 4 sites discontinued participation in the demonstration. Thus, 14 sites contributed to this evaluation report (Figure ES.1).

Figure ES.1. Location of practices that participated in Year 4 of the IAH demonstration

• Single practices   ○ Consortium

All practices met the demonstration requirements, including using an electronic medical record and available to beneficiaries at all hours of the day. However, the practices had different structural characteristics as well as different approaches to delivering care. For example, the extent to which the practices were integrated with other health care providers varied. Five practices were part of the Visiting Physicians Association, which had a corporate leadership team that sought to standardize operations and care delivery methods across all their participating practices. Four practices were privately owned and not attached to an overarching health system or corporation. The remaining five sites (including one consortium) were integrated into health systems affiliated with a university or a medical school. The sites embedded within larger health systems had the potential to obtain more technical, managerial, and financial resources to implement the demonstration and manage patient care.

B. Overview of the IAH demonstration evaluation

In this evaluation report, we examine the effects of the two key components of the demonstration: the demonstration payment incentive and the receipt of home-based primary care.

1. The demonstration payment incentive is an intervention in which IAH practices may earn an additional payment if their chronically ill, functionally limited patients' Medicare expenditures are below an estimated spending target and if the practice meets required standards for a set of quality measures. To evaluate this intervention, we examine several questions:

•   What was the effect of the demonstration payment incentive on Medicare expenditures and health care use?

•   How did the IAH practices change the way they delivered care during the demonstration, and did those changes affect the quality of care?

•   How did IAH beneficiaries and their caregivers perceive the care they received?

2. The receipt of home-based primary care can be evaluated by examining the Medicare expenditures and health care use of chronically ill, functionally limited patients who start home-based primary care. This analysis included patients from practices that participated in the IAH demonstration as well as other home-based primary care clinicians in the same geographic area.

The legislation required the inclusion of all IAH-eligible beneficiaries in the IAH demonstration—both new patients and those who received home-based primary care from the IAH practices before the start of the demonstration. To measure the combined effects of the demonstration payment incentive and the home-based primary care model, the patients in our sample would have had to be IAH-eligible and new to home-based primary care. However, there were too few IAH-eligible patients new to home-based primary care during the demonstration period to reliably measure the combined effects.

As a result, we used two different samples for the main analyses. For the evaluation of the demonstration payment incentive, the sample consisted of all IAH-eligible patients of the IAH practices, including those who received home-based primary care before the start of the demonstration. For the evaluation of the effects of home-based primary care, the sample included all new recipients of home-based primary care who were IAH eligible and lived in a market served by an IAH practice. Because these two analyses used different samples of beneficiaries, we present their results separately. Caution should be exercised in attempting to combine the two sets of results. We discuss additional limitations of these analyses elsewhere in this report.

C. What were the effects of the demonstration payment incentive on Medicare expenditures and other outcomes?

Under the IAH demonstration, CMS provides the opportunity for practices to receive an additional payment if their eligible patients' Medicare expenditures are lower than an estimated spending target and the practice meets required standards for a set of quality measures. This payment structure is designed to (1) reward practices that provide IAH home-based primary care effectively and (2) incentivize practices to reduce Medicare expenditures without compromising quality of care. We examined the effects of the demonstration payment incentive on Medicare expenditures, health care use, and quality of care using measures of potentially avoidable hospital use.

To examine the effect of the demonstration payment incentive on beneficiaries' expenditures and health care use, we compared the changes in these outcomes for IAH beneficiaries to those for a matched comparison group during the same period. We used data from two years before the demonstration and the first four years of the demonstration. The year before the demonstration served as the baseline year for our calculations of the effects of the demonstration. In each year, the IAH group consisted of beneficiaries who met demonstration eligibility requirements and received home-based primary care from an IAH practice. Because the IAH group in each of the two pre-demonstration study years received home-based primary care from an IAH practice, any observed effect of the demonstration reflects only the change in outcomes resulting from the demonstration payment incentive. The observed effect does not reflect any change in outcomes caused by receiving home-based primary care from an IAH practice. The comparison group consisted of IAH-eligible beneficiaries from the same geographic area who did not receive

home-based primary care. We used a matching process to identify the comparison beneficiaries. On average, the comparison beneficiaries had the same health status and demographic characteristics as the IAH beneficiaries, as measured by secondary data sources.

We measured changes over time in Medicare expenditures and health care use for IAH beneficiaries relative to the comparison group. Specifically, we examined the average annual change in the outcome across four years of the demonstration and the average change in the outcome separately for each year.

The following are key takeaways of the effects of the demonstration payment incentive on Medicare expenditures and hospital use:

- Estimates of the annual change in Medicare expenditures that combined the first four demonstration years showed reductions relative to the pre-demonstration year after accounting for other trends with the comparison group; however, these reductions were not statistically significant. The reduction across all years was $161 per beneficiary per month (PBPM), or 3.7 percent of the IAH beneficiaries' average Medicare expenditures in the year before the demonstration.

- The probability that the demonstration payment incentive decreased Medicare expenditures over the course of four years by any amount was 69 percent, there was a 31 percent probability that it increased expenditures. In addition, the probability that the demonstration payment incentive decreased expenditures by at least $100 PBPM—about 2 percent of the average—over the course of four years was just 29 percent.

- We found no evidence that the demonstration payment incentive reduced hospital admissions or the probability of having an unplanned hospital readmission over the four-year demonstration period. However, potentially avoidable hospitalizations decreased for IAH beneficiaries.

- Total emergency department (ED) use significantly decreased for IAH beneficiaries over the four-year demonstration period. However, we found no effect on potentially avoidable ED use not accompanied by a hospital admission.

- In Year 4, the estimated reduction in Medicare expenditures was $282 PBPM. This estimate was the largest reduction in expenditures in any of the four years but was not statistically significant.

- The estimated reduction in hospital admissions was larger in Year 4 than previous years, but it was not statistically significant. However, the number of ED visits and the probability of an unplanned readmission decreased in Year 4, and both estimates were statistically significant in Year 4.

1. Effects of the demonstration payment incentive on Medicare expenditures

Although we observed no statistically significant change in overall average annual expenditures across four years, the expenditure estimates for the IAH group appeared to decrease more over time relative to the comparison group, with Year 4 showing the largest decrease in expenditures (Figure ES.2 and Figure ES.3). The estimated reductions in expenditures increased from $120 PBPM in Year 1 to $282 PBPM in Year 4. However, these annual estimates were not

statistically significant, and there was considerable uncertainty in them. In other words, although expenditures may have decreased by $161 PBPM on average across the four years, the true effect on expenditures could have been substantially a smaller or larger decrease.

We estimated the aggregate effect of the IAH demonstration payment incentive on expenditures across all IAH beneficiaries in each year by multiplying the expenditure reductions PBPM by the number of beneficiaries. At this time, we do not know how much the sites will be paid through Year 4, so we cannot yet determine whether the amounts shared with the practices will be more, or less, than the decrease in expenditures that may have been generated by the payment incentive. However, for the first three years of the demonstration, the incentive payments were close to the estimated expenditure reduction. Over the first three years, CMS paid $24,210,149 in incentive payments to IAH practices, while we estimated that the incentive reduced expenditures by $24,693,393; the difference was $483,244.

The reduction in PBPM and total dollar expenditures observed could have been achieved by the sites as a result of the demonstration payment incentive. However, because of the limited number of sites and beneficiaries served—a design feature driven by the congressionally imposed beneficiary cap—the evaluation had only a low probability of detecting an effect of this size as statistically significant.

Figure ES.2. Estimated effect of the IAH demonstration payment incentive on Medicare expenditures for the four demonstration years and by year

Source: Mathematica's analysis of data from the IAH implementation contractor and Medicare claims and enrollment data for 2009–2016 obtained from the Virtual Research Data Center for IAH and matched comparison group beneficiaries in all IAH practices that participated in demonstration Year 4.

Notes: The total unweighted number of observations across all years was 243,947. The estimate for each year was calculated as the difference in means between IAH beneficiaries in that year and the year before the demonstration minus the difference in means between comparison beneficiaries during the same time, as shown in Figure ES.3. The figure reports the four-year average annual effect and the estimated effect in each year. The horizontal lines represent 90 percent confidence intervals. If zero was within the confidence interval (denoted by horizontal lines), the estimated effect (denoted by a dot) was not statistically significantly different from zero at the 90 percent confidence level. Details on the methods we used to produce these estimates are in Appendix B.

*/**/***The difference is statistically significant at the 0.10/0.05/0.01 level.

IAH = Independence at Home; PBPM = per beneficiary per month.

Figure ES.3. Effects of the IAH demonstration payment incentive on Medicare expenditures in each demonstration year which were not statistically significant
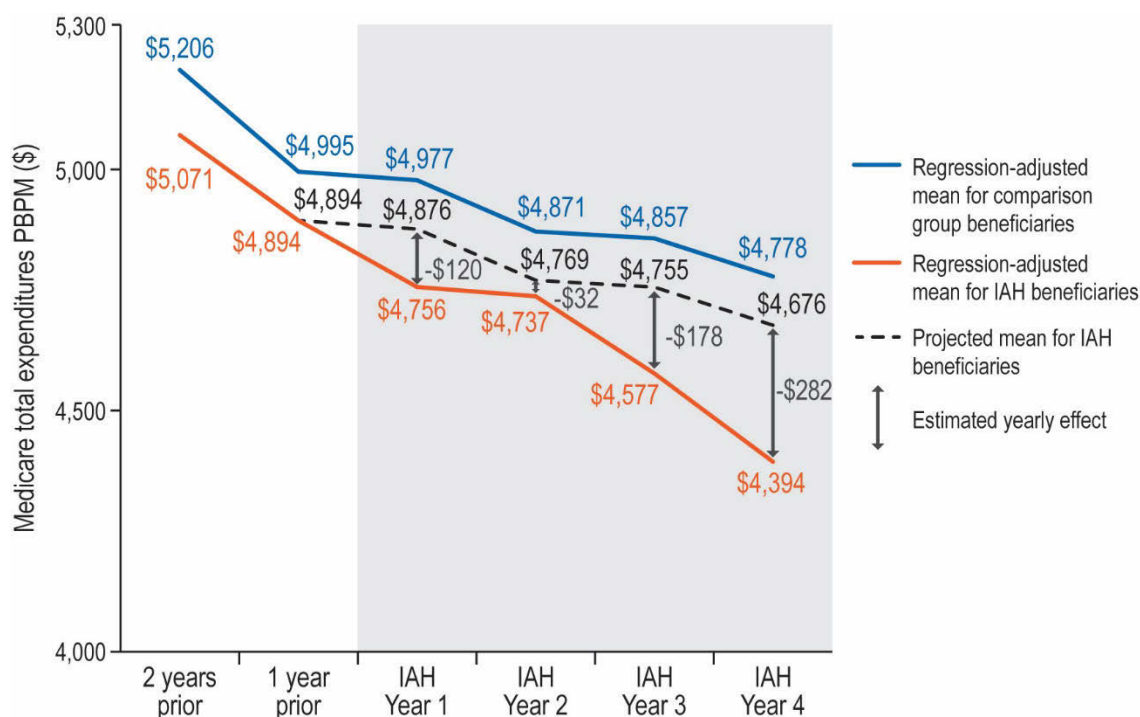
Source: Mathematica's analysis of data from the IAH implementation contractor and Medicare claims and enrollment data for 2009–2016 obtained from the Virtual Research Data Center for IAH and matched comparison group beneficiaries in all IAH practices that participated in demonstration Year 4.

Notes: The total unweighted number of observations across all years was 243,947. Details on the methods we used to produce these estimates are in Appendix B.

IAH = Independence at Home; PBPM = per beneficiary per month.

To aid in understanding how the IAH demonstration payment incentive affected Medicare expenditures, we analyzed the likelihood that expenditures decreased for the IAH group relative to the comparison group. For the combined four years, there was a 69 percent probability that the demonstration payment incentive reduced Medicare expenditures and a 31 percent probability that it increased expenditures (Figure ES.4). Because implementing a demonstration payment incentive requires incurring additional costs, we estimated the probability that the demonstration payment led to a reduction of $100 PBPM or more (2 percent of average Medicare expenditures). The probability that the demonstration payment incentive reduced expenditures by $100 PBPM or more over four years was just 29 percent. The probability that the demonstration reduced expenditures by $100 PBPM or more in Year 1 was 41 percent, but it fell in Year 2 to only 2 percent. Then, the probability that the demonstration reduced expenditures by $100 PBPM or more increased to 38 percent in Year 3 and 73 percent in Year 4.

Figure ES.4. Probability of an effect of the IAH demonstration payment incentive on Medicare expenditures for the four demonstration years and by year
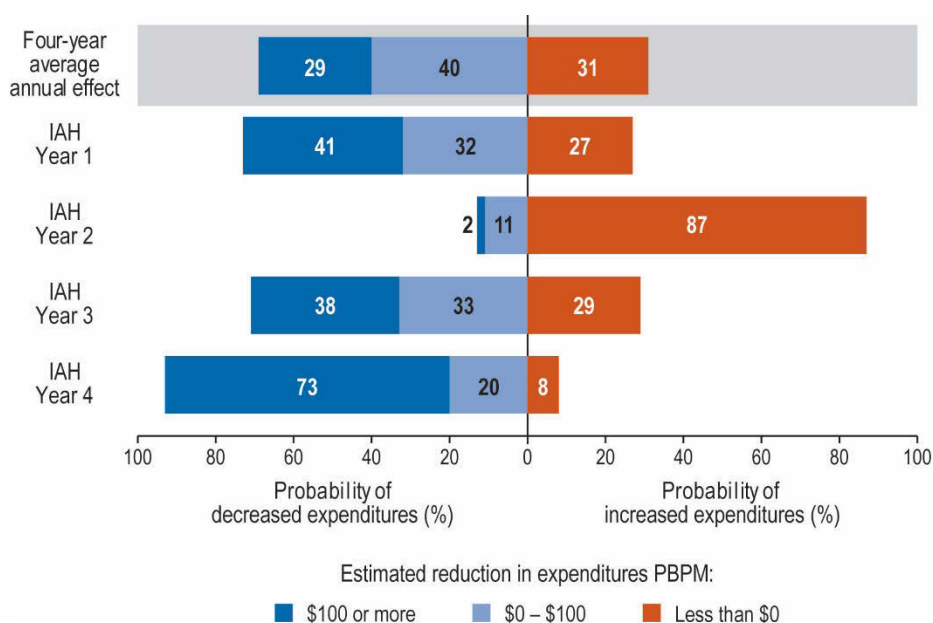
Source: Mathematica's analysis of data from the IAH implementation contractor and Medicare claims and enrollment data for 2009–2016 obtained from the Virtual Research Data Center for IAH and matched comparison group beneficiaries in all IAH practices that participated in demonstration Year 4.

Notes: The IAH group average Medicare expenditures in the year before the demonstration was $4,397 PBPM, suggesting that an impact of $100 PBPM represented an expenditure reduction of 2.3 percent. The total unweighted number of observations across all years was 243,947. Results are based on the Bayesian model, described in Appendix B.

IAH = Independence at Home; PBPM = per beneficiary per month.

It is not possible to say with certainty what factors contributed to the substantial variation in estimated expenditure reductions across the four years of the demonstration. For example, most IAH practices reported that they made relatively few changes in staffing and care delivery during Year 1 relative to the previous year, yet we estimated a 41 percent probability of the demonstration payment incentive reducing expenditures $100 PBPM or more in Year 1. Perhaps of more interest was the large increase in expenditure reduction from Year 3 to Year 4. That large increase may have been related to improvements in the care provided by IAH practices, possibly because practices had more time to improve care processes. However, it is also possible that the large difference between Years 3 and 4 was related to other factors. For example, the increased expenditure reduction in Year 4 coincided with several IAH practices' participating in accountable care organizations. However, we have no strong evidence about whether such participation may have led to higher or lower expenditure reductions in Year 4 than would have occurred without participation in accountable care organizations.

2. Effects of the demonstration payment incentive on hospital use

As was the case for total Medicare expenditures, we found no strong evidence that the demonstration reduced overall use of hospital care over the four-year demonstration period. Although most of the impacts on hospital use were not statistically significant, the estimated impacts of the demonstration on the use of hospital care grew more favorable from Year 2 to Year 4, which followed the same trend for total Medicare expenditures (Figure ES.5). Even

though the total number of hospital admissions did not change significantly, the decline in the number of potentially avoidable hospitalizations across the four years was statistically significant (results not shown). Potentially avoidable hospitalizations are hospitalizations that could be largely prevented if primary and specialty care is provided in a timely and effective manner. The estimated decreases in potentially avoidable hospitalizations were larger in Years 3 and 4 than in Years 1 and 2.

Figure ES.5. Estimated effect of the IAH demonstration payment incentive on hospital use for the four demonstration years and by year
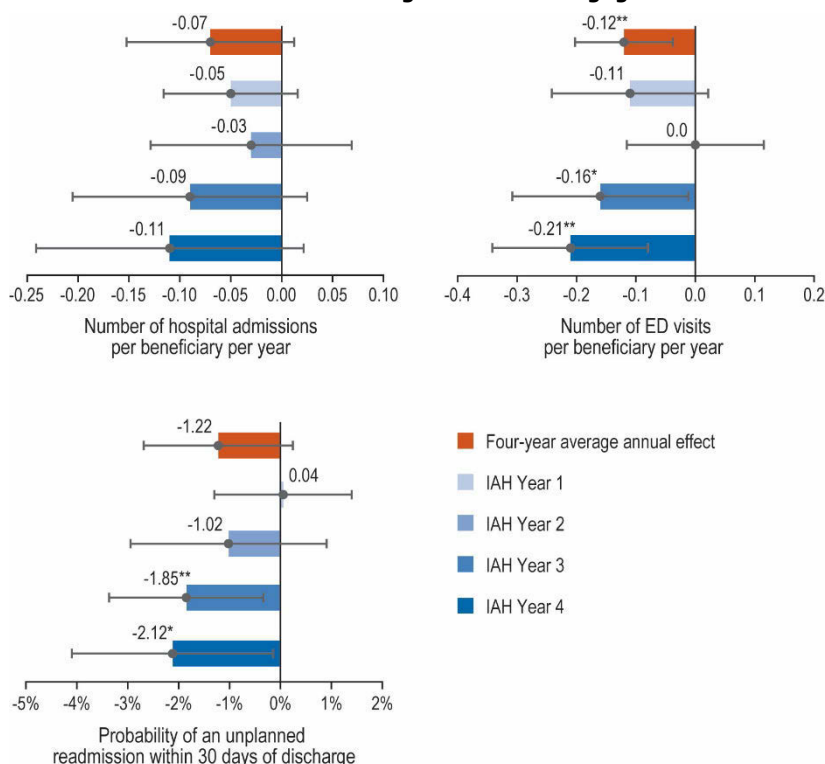
Source: Mathematica's analysis of data from the IAH implementation contractor and Medicare claims and enrollment data for 2009–2016 were obtained from the Virtual Research Data Center for IAH and matched comparison group beneficiaries in all IAH practices that participated in demonstration Year 4.

Notes: The total unweighted number of observations across all years was 243,947. The estimate for each year was calculated as the difference in means between IAH beneficiaries in that year and the year before the demonstration minus the difference in the means between comparison beneficiaries during the same time. The figure reports the four-year average annual effect and estimated effect in each year. The horizontal lines represent 90 percent confidence intervals. If zero was within the confidence interval (denoted by vertical lines), the estimated impact (denoted by a dot) was not statistically significantly different from zero at the 90 percent confidence level. The probability of unplanned readmission equaled zero for beneficiaries who did not have a qualifying hospital discharge or an unplanned readmission within 30 days of a qualifying hospital discharge during the measurement period. Details on the methods we used to produce these estimates are in Appendix B.

*/**/***The difference is statistically significant at the 0.10/0.05/0.01 level.

ED = emergency department; IAH = Independence at Home.

We also examined ED use, because we expected the IAH practices to target ED visits for reduction during the demonstration. We found a statistically significant reduction in ED visits over the four-year demonstration period (by 0.1 visit per beneficiary per year, or 4 percent). The estimated impact of the demonstration on ED visits fell from zero in Year 2 to a reduction of 0.21 visits per beneficiary per year in Year 4. However, potentially avoidable ED visits not

accompanied by a hospital admission did not decrease during the demonstration (results not shown).

The estimated effect of the demonstration on the probability of having an unplanned hospital readmission decreased from -1.02 in Year 2 to -2.12 in Year 4. These results suggest the demonstration may have reduced both the number of ED visits and the probability of having at least one unplanned readmission among IAH beneficiaries in Years 3 and 4.

3. Translating effects per person into total Medicare expenditures reduced or events averted during the four demonstration years

Cumulatively over the first four demonstration years, the demonstration might have reduced Medicare expenditures by as much as $50 million before accounting for the distribution of incentive payments to the IAH practices (Table ES.1)[1]. This gross estimate was not statistically significant and was imprecise, so we could not confidently conclude that the demonstration payment incentive reduced expenditures by $50 million. In Year 1, we estimated that the demonstration may have lowered expenditures by nearly $10 million but that amount decreased to just $2 million in Year 2. In Year 3, we estimated that the demonstration may have lowered expenditures by nearly $13 million, which represented a sixfold increase over the aggregate amount of reductions in Year 2. The Year 4 estimated reduction of more than $25 million was a near doubling of the Year 3 result. The larger Year 3 and Year 4 aggregate estimates of expenditure reduction resulted mainly from the larger PBPM impact estimate in those years relative to the estimates in Years 1 and 2. The substantial growth in the number of participating beneficiaries also contributed to the greater aggregate expenditure reduction in Year 4, since the number of IAH beneficiaries in Year 4 (9,504 beneficiaries) was substantially larger than any other year. Underlying the $50 million in reduced expenditures across the four demonstration years were 1,879 fewer hospital admissions and 3,462 fewer ED visits for the 32,550 beneficiaries. However, the wide confidence interval, or lack of precision, around these estimates suggests that both the cumulative and annual estimates for the effects of the demonstration payment incentive on expenditures and hospital use could have been considerably higher or lower.

Table ES.1. Estimated effects of IAH demonstration payment incentive on outcomes: Aggregate results

	Total Medicare expenditures		Number of hospital admissions		Number of ED visits		Number of beneficiaries having an unplanned readmission	
	Aggregate impact	90 percent CI	Aggregate impact	90 percent CI	Aggregate impact	90 percent CI	Aggregate impact	90 percent CI
Year 1	-$9,741,494	-$22,412,928; $2,929,941	-328	-719; 63	-728	-1,599; 143	3	-105; 111
Year 2	-$2,193,523	-$18,161,99; $13,774,946	-177	-751; 397	0	-669; 669	-74	-214; 66

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[1] The estimated expenditure reductions we report across the four demonstration years and for each individual year in this paragraph do not account for the cost of incentive payments CMS made to IAH practices. CMS had not determined the payments for Year 4 as of the writing of this report.

Table ES.1 (*continued*)

	Total Medicare expenditures		Number of hospital admissions		Number of ED visits		Number of beneficiaries having an unplanned readmission	
	Aggregate impact	90 percent CI	Aggregate impact	90 percent CI	Aggregate impact	90 percent CI	Aggregate impact	90 percent CI
Year 3	-$12,758,376	-$31,413,98; $5,897,234	-542	-1,235; 151	-963*	-1,854; -72	-140*	-254; -25
Year 4	-$25,470,413	-$55,862,945; $4,922,119	-827	-1,816; 162	-1,579*	-2,568; -589	-201*	-389; -14
Cumulative aggregate impact through Year 4	-$50,061,345	-$124,489,320; $24,366,631	-1,879	-4,226; 469	-3,462*	-5,940; -984	-411	-911; 89

Source: Mathematica's analysis of data from the IAH implementation contractor and Medicare claims and enrollment data from 2009–2016 obtained from the Virtual Research Data Center for IAH and matched comparison group beneficiaries in all IAH practices that participated in demonstration Year 4.

Notes: This table shows the aggregate impact estimates for key outcomes for IAH-eligible beneficiaries over all IAH practices during Years 1 through 4 of the demonstration. These calculations are based on the beneficiary-level estimates reported in Figures ES.2 and ES.5 and on the number of IAH beneficiaries and eligible beneficiary months in each year. The aggregate results for total expenditures, number of hospital admissions, and ED visits were calculated by multiplying the beneficiary-level estimated effect by the number of IAH beneficiary months (for expenditures) or by the number of IAH beneficiary months in each year divided by 12 (for admissions and ED visits that were measured yearly). The aggregate results for unplanned readmission were calculated by multiplying the beneficiary-level estimated effect by the number of IAH beneficiaries in each year. The numbers in this table might not correspond exactly to Figures ES.2 and ES.5 because of rounding. The total numbers of IAH beneficiaries in the analysis sample were 8,216 in Year 1; 7,266 in Year 2; 7,564 in Year 3; and 9,504 in Year 4. The numbers of eligible beneficiary months for the same numbers of IAH beneficiaries were 79,396 in Year 1; 69,768 in Year 2; 72,215 in Year 3; and 90,223 in Year 4.

CI = confidence interval; ED = emergency department; IAH = Independence at Home.

*/**/***The difference is statistically significant at the 0.10/0.05/0.01 level.

The aggregate gross reductions in expenditures shown in Table ES.1 are the estimated expenditure reductions associated with the demonstration payment incentive as an intervention. To estimate the effect of the demonstration payment incentive, we measured the changes in IAH beneficiaries' Medicare expenditures and hospital use over time relative to concurrent changes in those outcomes for the comparison group. This approach—which compared each IAH practice against its starting point—assesses the effect of the demonstration payment incentive.

The strategy that we used to assess the effect of the demonstration payment incentive on Medicare expenditures differs from the strategy CMS uses to calculate incentive payments for IAH practices. CMS's incentive payment calculation is derived from whether the IAH practices had lower Medicare expenditures than their estimated spending target and whether the IAH practices met required quality criteria. The incentive payment calculation does not require an IAH practice to actually reduce Medicare expenditures relative to expenditures for the IAH practice's beneficiaries before the demonstration. Because the two objectives (evaluating the effect of the demonstration payment incentive and calculating the actual incentive payments) and their respective analytic strategies differed, the incentive payments that CMS reported during the course of the demonstration are not equivalent to the expenditure reductions reported here as outcomes of the demonstration payment incentive.[2]

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[2] For CMS's public release of incentive payment results, see https://innovation.cms.gov/initiatives/independence-at-home.

4. Effect of the demonstration payment incentive on mortality

In addition to examining the impact of the demonstration on expenditures and utilization, we examined whether the demonstration was associated with increased mortality among IAH beneficiaries. Better access to high-quality primary care under the demonstration may allow IAH beneficiaries to make more informed choices about managing their care. Because the demonstration targets a population that has multiple chronic conditions and significant functional limitations, some beneficiaries' choices, made according to their values and preferences, may lead to an earlier death. Therefore, we did not expect the demonstration to reduce mortality. However, we wanted to ensure that the demonstration payment incentive did not result in an unintended consequence of more deaths and so we examined changes in mortality for the IAH group relative to changes for the comparison group.

We found no compelling evidence that the demonstration adversely affected mortality across the four demonstration years. In the first three years, there was no effect on mortality. In Year 4, the demonstration patients' mortality rates declined, whereas rates for the comparison group increased, suggesting that, if anything, IAH patients had fewer deaths than anticipated given their poor health status.

D. How did practices change during the demonstration, and how did beneficiaries view their care?

To identify changes the IAH practices made to improve their performance overall and on quality measures tracked as a condition of participation in the demonstration,[3] we collected information from practices each year about how they operated and identified the changes they made. Also, whenever a financial incentive is offered to reduce care, there is concern that clinicians might reduce the time spent on clinician-patient relationships, resulting in dissatisfaction with care received. To understand whether the demonstration affected patients' perceptions of care, we collected information from patients and their caregivers to understand how they perceived the care provided by IAH practices.

The following are key takeaways of practice changes during the demonstration and beneficiaries' perceptions of care:

- To provide follow-up contacts with patients within 48 hours of hospital or ED visit, as required by the demonstration, many practices added staff to their care teams such as nurse case managers. Some practices expanded their use of electronic medical records or electronic health information exchanges.

- Some practices tried to reduce admissions, readmissions, and ED visits by making care more comprehensive and responsive to patients' needs, for example, increasing follow-up for patients with high rates of hospital use.

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[3] The six quality measures included follow-up contact and in-home medication reconciliation within 48 hours of hospital or ED use, three measures of hospital use (hospital admissions, ED visits for ambulatory care–sensitive conditions, and all-cause hospital readmissions), and annual documentation of patient preferences.

- Many practices reported improvement over the course of the IAH demonstration in their relationships with outside providers. Care partners of IAH practices generally reported strong working relationships with IAH practices.

- Practices reported a variety of efforts to improve overall quality of care, for example, conducting chart audits to identify areas for improvement and meetings to discuss solutions for managing patients. Also, some IAH practices focused on improving communication and coordination of round-the-clock coverage for care.

- We found some evidence of increased use of nurse practitioners relative to other primary care clinicians; nine practices increased their use of nurse practitioners in Year 4 compared with Year 2.

- A large majority of patients and their caregivers reported high levels of satisfaction with home-based primary care, found it accessible, and reported that clinicians take their opinions into account.

Our analysis suggests that the IAH sites sought to change their practices with the goal of improving care. In some cases, practices started, then subsequently discontinued, strategies they deemed ineffective. Overall, however, many practices reported developing and continuing systematic approaches to following up rapidly on transitions in care, for example, adding staff dedicated to tracking hospital admissions and discharges. Some practices also implemented quality improvement processes, and many of those practices reported that their efforts extended beyond care and management of IAH patients to practice-wide changes such as tracking quality measures and auditing patients' charts. In addition, some practices added social workers or other staff to coordinate care for their patients with other organizations and reported that they had improved relationships with outside providers in an effort to reduce acute hospital care. Importantly, we could not rule out the possibility that IAH practices would have made some of the changes described here even without the demonstration. Therefore, we could not be certain that observed effects on potentially avoidable hospital admissions were caused by the changes made by IAH practices that we discuss in this section.

Despite the introduction of the demonstration payment incentive, beneficiaries and caregivers were very satisfied with the care they received from IAH practices during the demonstration. About 93 percent of beneficiaries and caregivers reported that they were either satisfied or very satisfied with the overall quality of care they had received from the IAH practice in the past six months. A large majority of beneficiaries preferred receiving primary care in their home a lot more than in an office or clinic, and a similarly large share of caregivers preferred that the beneficiary receive primary care at home.

E. Did home-based primary care reduce Medicare expenditures and hospital use?

To study home-based primary care, we created a sample that included beneficiaries new to home-based primary care regardless of whether they received home-based primary care at an IAH practice. These additional beneficiaries satisfied eligibility requirements for the IAH demonstration (Exhibit ES.2) and lived in the same geographic area as the IAH practices. Approximately one-fourth of the sample were patients of an IAH practice and others were patients of non-IAH practices who provide but do not necessarily specialize in home-based

primary care; they also may not necessarily meet the infrastructure and experience standards required of IAH practices.

For this analysis, we examined changes in expenditures and hospital use for beneficiaries new to home-based primary care relative to a comparison group who received office-based care and had similar demographic characteristics and health status. The home-based primary care beneficiaries had the majority of their primary care visits in the home for the six-month period after their first home visit, but they could switch back to office-based primary care after those six months. Comparison beneficiaries did not receive a primary care home visit during their first six months in the sample; however, after that, they could switch to home-based primary care. Approximately 15 percent of home-based primary care recipients stopped receiving the majority of their primary care in their home after the initial six months; 3 percent of the comparison beneficiaries had at least one home visit after the initial six-month period.

The home-based primary care beneficiaries started home-based care during the period of 2010 to 2014 and were followed for up to two years after they started care; we followed the matched comparison beneficiaries over the same period. However, on average, 16 percent of the beneficiaries died during the first six-month period; another 11 percent died during the second six-month period. The attrition due to mortality as well as potentially nonrandom cross-overs between home-based and office-based primary care presented challenges to this analysis.

We compared the differences between the home-based primary care recipients and their matched comparison beneficiaries, focusing on the changes in expenditures and health care use that occurred in the two years after the home-based primary care recipients had their first home visit. This approach allowed us to control for observable differences in health status at the start of care and the effect of external factors on changes in health care expenditures. We also examined how Medicare expenditures changed for specific health care components, to identify drivers of change. In addition, because we did not know whether the practitioners who were not participating in the demonstration met the demonstration requirements (for example, were available around the clock every day or used team-based care), we examined whether the subset of patients served by the IAH practices had more favorable results. We did this using the same approach but limited our analysis to the home-based primary care beneficiaries attributed to IAH practices. Finally, some of these Medicare beneficiaries may have switched to home-based primary care because they wanted a style of medical care that emphasized, when appropriate, palliative or hospice care during the last months of their life. We conducted a descriptive analysis to better understand expenditure outcomes for patients when they were near death.

The following are key takeaways of the effects of home-based primary care on Medicare expenditures and hospital use:

- Home-based primary care, as delivered in the Medicare program to chronically ill and functionally limited patients, did not lower Medicare expenditures relative to office-based care. Instead, we found that home-based primary care led to expenditures higher in total than those for comparison beneficiaries. These higher expenditures were in part the result of higher expenditures for services in the home as well as for hospital care.

- IAH practices had similarly higher levels of total Medicare expenditures for their new patients as found in the full sample. Note that this analysis included beneficiaries who

received care at an IAH practice before the IAH demonstration as well as those who received care during the demonstration.

• Home-based primary care did not have a statistically significant effect on total Medicare expenditures during the first six months after the initial home visit. However, the probability that home-based primary care led to relatively higher expenditures was 77 percent in the second quarter (months 4 through 6). In addition, home-based primary care recipients had significantly higher expenditures relative to the comparison group during the remaining 18 months in the study period.

• Home-based primary care recipients had more potentially avoidable hospital admissions and ED visits during the first year after starting than they would have otherwise. We were not able to assess any differences in measures such as quality of life or patient satisfaction.

• Descriptive analysis suggested that expenditures during the last three months of life for home-based primary care beneficiaries were lower than those for the comparison beneficiaries, perhaps reflecting different end-of-life preferences.

• The costs associated with home-based primary care might be decreasing. Patients who entered home-based primary care in later years (2013 and 2014) had a smaller increase in costs relative to the comparison group than those who entered in earlier years (2010 and 2011).

1. Effects of home-based primary care on total Medicare expenditures

We found no evidence that home-based primary care reduced Medicare expenditures relative to office-based care. In the first year after entering home-based primary care, Medicare expenditures were $256 more PBPM (approximately 6 percent of the $4,556 mean monthly expenditure) for beneficiaries who received home-based care relative to beneficiaries in the comparison group (Figure ES.6 and Figure ES.7). In the second year after entering home-based primary care, Medicare expenditures were $367 more PBPM.

Figure ES.6. Estimated effect of home-based primary care on total Medicare expenditures
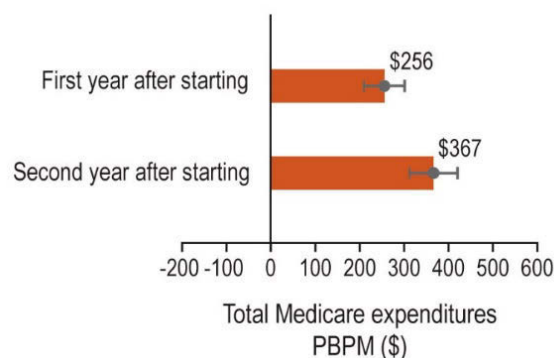
Source: Medicare claims and enrollment data for 2010–2016 obtained from the Virtual Research Data Center for home-based primary care recipients and matched comparison group beneficiaries.

Notes: Expenditures are measured PBPM. The estimate for each year was calculated as the difference in means between home-based primary care recipients and comparison beneficiaries in that year minus the difference in the means in the year before the entry into home-based care. The error bars represent 90 percent confidence intervals. If the confidence

interval included zero, then the estimated impact was not statistically significantly different from zero. Details on the methods we used to produce these estimates are in Appendix D.

PBPM = per beneficiary per month.

Figure ES.7. Mean annual Medicare expenditures for home-based primary care recipients and comparison beneficiaries and estimated yearly effect of home-based primary care on Medicare expenditures
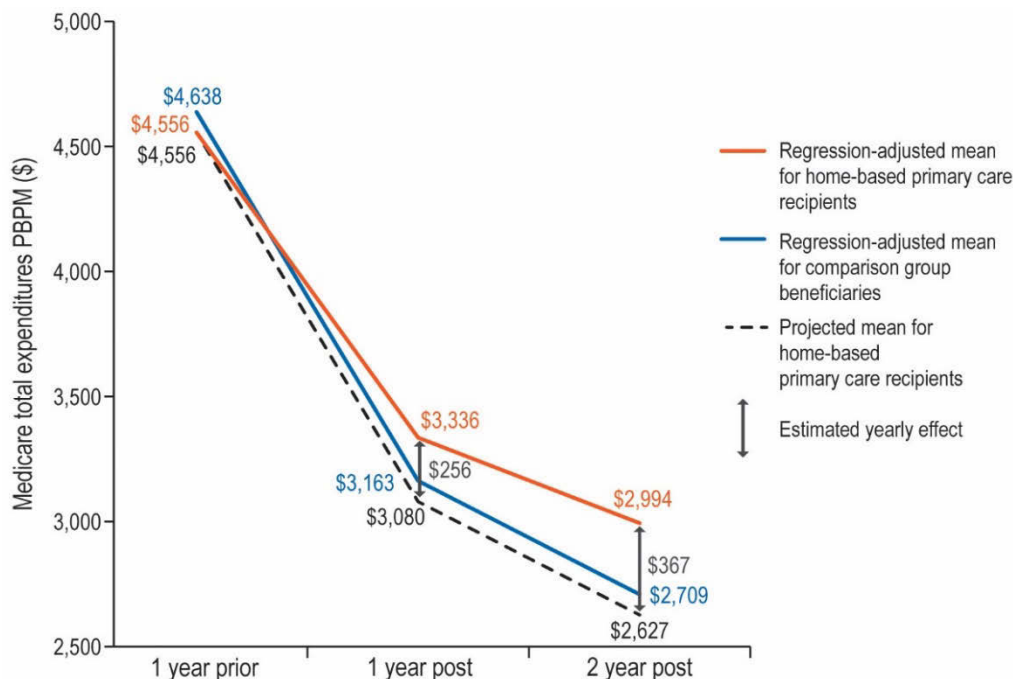
Source: Medicare claims and enrollment data for 2010–2016 obtained from the Virtual Research Data Center for home-based primary care recipients and matched comparison group beneficiaries.

Notes: Expenditures are measured PBPM. Details on the methods we used to produce these estimates are in Appendix D.

PBPM = per beneficiary per month.

The probability of an effect of home-based primary care on Medicare expenditures changed substantially over the first four quarters. The probability that home-based primary care reduced expenditures by any amount was 47 percent in the first quarter after the start of care (Figure ES.8). However, the probability of an expenditure reduction decreased in subsequent quarters; in fact, the probability that home-based primary care increased expenditures in quarters three through eight was nearly 100 percent. As noted above, beneficiaries could switch into or out of home-based primary care after the initial six months; approximately 15 percent stopped home-based primary care during the next six months although approximately 4 percent resumed receiving home-based primary care in the following 6-month period. Without additional analyses that accommodate ever-changing matched groups, we cannot say how this switching affects our results. We do know, however, that the probability that home-based primary care led to relatively higher expenditures was 77 percent in the second quarter before there was any switching (Figure ES.8).

Figure ES.8. Probability of an effect of home-based primary care on total Medicare expenditures
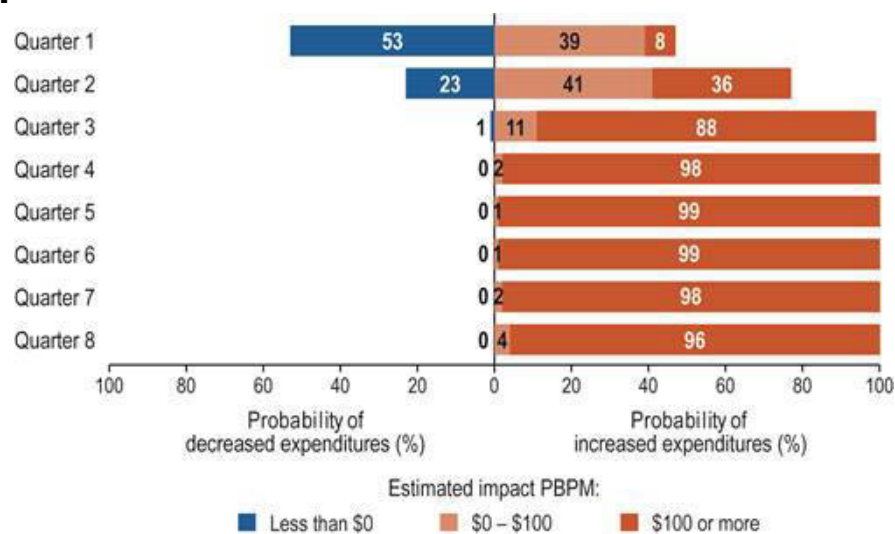
Source: Medicare claims and enrollment data for 2010–2016 obtained from the Virtual Research Data Center for home-based primary care recipients and matched comparison group beneficiaries.

Note: Results are based on a Bayesian model using quarterly outcomes, which is described in Appendix D. PBPM = per beneficiary per month.

2. Effects of home-based primary care on categories of Medicare expenditures

The higher total expenditures for those receiving home-based primary care were driven by the larger increase in expenditures for home health services (for example, skilled nursing care and physical and occupational therapy provided by a home health agency) relative to the increase for the matched comparison group, especially in the first year after the start of home-based primary care. Expenditures for other services in the home (hospice and durable medical equipment) were also higher for patients receiving home-based primary care. Expenditures for services provided by physicians and other clinicians were also slightly higher for such patients.

Perhaps surprisingly, expenditures for hospital services were also higher for home-based primary care patients than for the matched comparison group—approximately 5 percent higher during the first year and almost 7 percent higher during the second year. This finding was unexpected because home-based primary care is hypothesized to reduce the need for hospital care by providing better access to timely primary care services. However, hospital admissions, ED visits, and the probability of an unplanned readmission were all higher for those who received home-based primary care than for the comparison group, resulting in higher inpatient expenditures. For example, the average number of hospital admissions per beneficiary in the first year after the start of home-based primary care was 8.7 percent higher than for the comparison group; the average number of ED visits during that first year was more than 19 percent higher for beneficiaries receiving home-based primary care.

Home-based primary care recipients also had a small but significantly larger number of potentially avoidable hospital admissions than they would have otherwise: 0.06 more in the first year (13 percent higher) and 0.02 more in the second year (4 percent higher). They also had 20 percent more potentially avoidable ED visits not accompanied by a hospital admission; however,

the difference in potentially avoidable ED visits in the second year was not statistically significant.

There are several possible explanations for these findings. Although the IAH practices may have focused on controlling hospital costs in part by reducing ED visits and hospital admissions, it is possible that clinicians delivering home-based primary care but who were not in the IAH demonstration were not focused on these goals, since they were not a part of the demonstration. In a subanalysis, we estimated the impact of home-based primary care using only those beneficiaries who received home-based primary care from IAH clinicians and their matched comparisons. The results were qualitatively the same as results for the full sample.

Another possible explanation for the increased cost of these patients' care is that the matched comparison group differed systematically from the set of beneficiaries who received home-based primary care in ways that were not observable in administrative data and that affected hospital use and expenditures. To examine this possibility, we re-estimated the model, using a sample of recent home-based primary care recipients and comparison beneficiaries who responded to a survey we conducted. The information from the survey enabled us to estimate the impact of home-based primary care on expenditures, controlling for differences in self-reported health status as well as attitudes and preferences, as measured in the survey. Adding these additional control measures had little effect on the estimated impacts of home-based primary care on expenditures. However, as in any observational study, we could not rule out the possibility that other unobserved differences may have influenced our results.

Finally, although after the initial six-month period some of the beneficiaries in our sample changed the kind of primary care they were receiving, we did not remove those individuals from our sample. If there were systematic differences between beneficiaries who switched out of home-based primary care and those who switched into that care, our groups might not have been well-matched after the first six months and the analysis could produce an inaccurate measure of the effect of home-based primary care. Using a quarterly Bayesian model, we found no statistically significant effect of home-based primary care on total Medicare expenditures during the first two quarters, when there was no switching, followed by an increase in expenditures during the remaining six quarters.

3. End-of-life care

One reason some Medicare fee-for-service beneficiaries might have chosen to receive home-based primary care was a preference for a style of medical care during the last months of their lives that de-emphasized institutional care, specialty care, and complex treatment plans and emphasized in-home primary care—and, when appropriate, referral to palliative or hospice care. We conducted a descriptive analysis of expenditures in the three months before death.

When we compared end-of-life expenditures for home-based primary care recipients and comparison beneficiaries who died during the 24 months after starting care, we found that those who received home-based primary care had lower expenditures in the last three months of life. Total expenditures over the last three months of life for decedents in the home-based care group were $23,238, versus $27,541 for decedents in the comparison group—a difference of about 16 percent. Beneficiaries who died within two years after beginning home-based primary care experienced significantly lower expenditures in the last three months of life for inpatient,

outpatient, physician or supplier, and skilled nursing facility care than did comparison beneficiaries who died during that period.

4. Effects of home-based primary care in each year of the study period

Because our analysis included beneficiaries who started this mode of care during the period of 2010 to 2014, we examined whether the results for those who started home-based primary care in the later years of that period were consistent with those who began earlier. We refer to the population who became eligible and started home-based care in a given year as a year's "panel"; for example, those who had their first home visit in 2010 would be included in the 2010 panel. Medicare beneficiaries who entered home-based primary care in 2010 had increases in expenditures that were $355 PBPM higher than the comparison group beneficiaries in the first year after starting home-based primary care. The difference declined to $154 for the 2014 panel. In part, this change reflected relatively smaller increases over time in home health expenditures experienced by those receiving home-based primary care. The relatively higher number of hospital admissions among home-based primary care recipients relative to the comparison group beneficiaries also steadily declined across the five panels, from 0.20 more hospital admissions per beneficiary per year in the first year after starting home-based primary care for the first panel (2010) to 0.14 more admissions for the last panel (2014).

A number of different factors could have accounted for this smaller difference in expenditures in the later years. One was that the number of beneficiaries receiving home-based primary care increased over this period. All beneficiaries had to meet the IAH eligibility requirements. Nevertheless, it is possible that changes in patient characteristics that we could not control for were the source of these changes. That is, over time, home-based primary care clinicians may have changed the types of beneficiaries to whom they provided services, reaching beneficiaries who were healthier or entered home-based care earlier in their disease progression in ways that we could not measure; if that were the case, their expenditures would become less elevated relative to the comparison group for reasons unrelated to home-based primary care. However, it is also possible that home-based primary care clinicians changed the delivery of care over time and began to deliver care in a way that resulted in patients' using fewer hospital and outpatient services or that new clinicians entered the market and provided care in a way that was less expensive than more established clinicians.

F. Discussion

Congress mandated the IAH demonstration to test a combined payment incentive and service delivery model for Medicare beneficiaries with multiple chronic conditions and functional limitations. Ideally, we would have combined our evaluation of the demonstration payment incentive with the evaluation of home-based primary care, but we were unable to do so because some beneficiaries in IAH had been already receiving home-based primary care at the start of the intervention. Therefore, we separately assessed the two components of the IAH demonstration: (1) the effect of the demonstration payment incentive on Medicare expenditures and other outcomes and (2) the effect of entering home-based primary care on Medicare expenditures and other outcomes.

It's not necessarily surprising that the results of the two analyses differ; the studies answered different questions, focused on beneficiaries in different circumstances, and included different

types of home-based primary care practices. Our analysis of the demonstration payment incentive examined a group of experienced, home-based primary care practices that met key infrastructure requirements to answer the question: When offered a financial incentive, did a select group of practices reduce Medicare expenditures for a subset of their chronically ill, functionally limited patients? This analysis focused on whether IAH practices can reduce Medicare expenditures by changing the way they practice home-based primary care. In contrast, our analysis of home-based primary care answered the question: Did chronically ill, functionally limited beneficiaries have lower Medicare expenditures over a two-year period after starting home-based primary care? This analysis focused on the effect of changing the site at which beneficiaries receive their primary care rather than the effect of the demonstration's financial incentive.

For the IAH demonstration to result in Medicare savings, the costs or savings associated with home-based primary care in expansion areas—plus any savings from the demonstration incentive structure—must net out to lower overall expenditures for Medicare, after accounting for the cost of incentive payments paid by CMS. However, we are unable to simply combine the estimated costs associated with home-based primary care and estimated savings that may have been associated with the demonstration payment incentive to obtain the overall effect of both parts of the demonstration, because they are calculated using different approaches and different populations of beneficiaries.

This evaluation was not designed to draw conclusions about how the IAH demonstration payment incentive might affect outcomes for Medicare beneficiaries who receive home-based primary care from practices other than those in the demonstration. In addition, the study did not assess how the demonstration payment incentive or home-based primary care might affect outcomes for Medicare beneficiaries who do not meet the demonstration eligibility criteria (for example, Medicare beneficiaries who have multiple chronic conditions but do not require human assistance with daily activities).

Our findings suggest that the IAH demonstration payment incentive may have reduced expenditures and use of some types of hospital care. Qualitative information we gathered annually from the practices suggested that IAH practices made changes in how they provided care during the demonstration. When interpreting the impacts of the demonstration payment incentive on expenditures and hospital use, we took into account changes reported by IAH practices, the consistency of the direction (increase or decrease) of the effects of the demonstration, and the possibility that the effects increased over time. We also considered the fact that because of the small size of the demonstration, we had only a low probability of detecting a reduction in expenditures of 3.7 percent—which is the average annual estimated effect of IAH on expenditures across the four years—as statistically significant. Taken together, this information suggested that the IAH demonstration payment incentive might have decreased expenditures and hospital use, particularly in later years of the demonstration. However, the estimates were not statistically significant, and there could have been differential changes over time in unobserved characteristics of IAH and comparison beneficiaries, which could have caused bias in the estimated effects of the demonstration payment incentive. The possibility of differential changes in unobserved patient characteristics between the year before the demonstration and later demonstration years make it more challenging to interpret the impact of the demonstration payment incentive in the later years and to draw firm conclusions.

We also found that home-based primary care is associated with higher expenditures. However, we have reason to believe that the costs associated with home-based primary care might be decreasing, even without the demonstration. Patients who entered home-based primary care in later years (2013 and 2014) had a smaller increase in costs relative to the comparison group than those who entered in earlier years (2010 and 2011). The additional expenditures associated with home-based primary care could decline without the offer of an incentive to reduce expenditures if either or both of the following occurs: clinicians learn how to deliver home-based primary care more effectively over time or more effective clinicians start delivering home-based primary care and less effective clinicians stop delivering such care.

There are also reasons to believe that the demonstration payment incentive will not be able to generate savings for Medicare. First, we measured only modest reductions in expenditures, which were subject to considerable uncertainty and which we could not confidently attribute to the demonstration payment incentive. The statistically insignificant changes in expenditures could mean that the incentive structure is a weak instrument for achieving changes in care patterns.

Second, as a technical matter, it has been challenging to evaluate the demonstration for the beneficiaries targeted by the demonstration (Exhibit ES.3). Key challenges were the small sample sizes, difficulty replicating IAH eligibility criteria in administrative data, and the poor health of the IAH beneficiaries. Some beneficiaries died before the sites could reasonably affect their expenditures. Even if the practices grow substantially, measuring the effects of the demonstration payment incentive and home-based primary care would remain challenging. Of primary concern is the fact that administrative data have limited usefulness for identifying beneficiaries who are at the same stage in their illness and have functional status and non–health-related characteristics similar to the IAH beneficiaries.

Exhibit ES.3. Key challenges for evaluating the demonstration

- **Small sample sizes.** The demonstration practices were relatively small and the number of beneficiaries who met the demonstration criteria was a subset of those patients. With such small numbers of participants, site-level evaluation results may be subject to random fluctuations as a result of chance.

- **Savings compared with whom?** To adhere to the mandated beneficiary eligibility criteria, CMS allowed demonstration sites to assess eligibility and enroll patients. Those eligibility criteria could not be flawlessly replicated in administrative data, which made it difficult to develop a comparison group against which to measure expenditures.

- **Measuring effects.** The law allowed patients who had received home-based primary care before the demonstration (sometimes for years) to enroll, hampering the ability to measure the effects of home-based primary care by IAH practices.

- **Identifying the comparison group.** The eligibility criteria identified beneficiaries who could be acutely ill and temporarily disabled or chronically ill and permanently disabled. These criteria made it challenging to select comparison beneficiaries who were at the same stage in their illness—an especially difficult issue given that many of the eligible beneficiaries were near death.

- **Identifying patients in other incentive payment programs.** Some patients are referred to an IAH practice through the practice's relationships with an accountable care organization. Although CMS is able to ensure that it does not make incentive payments to two organizations for the same beneficiary, we could not assess how these other programs may have affected the evaluation's estimated expenditure reductions.

Despite these concerns, there are reasons to be open-minded about the potential for the demonstration payment incentive and home-based primary care—or some variation of the incentive and service delivery model—to reduce Medicare expenditures. Although the impact of the payment incentive on expenditures was not statistically significant in any of the first four years of the demonstration, the magnitude increased substantially in Years 3 and 4, relative to Years 1 and 2. If it takes time for providers to alter the ways in which they deliver care, and if the demonstration's increased reduction in expenditures over time reflects changes that the practices made, then it is possible that a payment incentive in home-based primary care could eventually reduce Medicare expenditures.

We found that changing to home-based primary care led to higher total expenditures than continuing to receive office-based care. However, previous research shows that expenditures for patients receiving home-based primary care were lower (Edes et al. 2014; De Jonge et al. 2014). These conflicting results could be due to differences in study design, differences in the model of home-based primary care, or both. For example, unlike previous research, we estimated the effect of home-based primary care relative to a comparison group of similar patients using data from before and after the first home visit. In contrast to previous research, which focused on a well-defined model operating within a single health system, our study included the full range of practices who offer home-based primary care. There is substantial variation in how IAH practices provide home-based primary care and the health care settings in which they operate. There is likely even more variation among non-IAH practices, such as those who typically provide office-based primary care but offer home-based primary care for a minority of their patients. Well-defined models of home-based primary care may reduce expenditures in some health care settings, but that result may not apply to the broad spectrum of clinicians providing this care to similarly chronically ill, functionally impaired Medicare beneficiaries.

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I.   INDEPENDENCE AT HOME EVALUATION

Section 3024 of the Patient Protection and Affordable Care Act (Public Law 111-148) mandated the Independence at Home (IAH) demonstration to test a payment incentive and service delivery model for providing home-based primary care to chronically ill and functionally limited Medicare beneficiaries (Appendix A). In June 2012, the Centers for Medicare & Medicaid Services (CMS) launched the IAH demonstration. Under the IAH demonstration, physicians and nurse practitioners (NPs) direct home-based primary care teams with the goal of reducing health care expenditures and improving health outcomes.

Under current Medicare payment policy, Medicare pays clinicians more for making home visits than for seeing beneficiaries in an office setting. However, home-based primary care services are not widely available (Yao et al. 2016). Some clinicians report that a barrier to expansion of home-based primary care is that Medicare does not fully cover their costs. The demonstration provides an opportunity for home-based primary care practices to receive additional Medicare payments if their chronically ill, functionally limited patients' Medicare expenditures are below an estimated spending target and if the practice meets required standards for a set of quality measures. If the additional payments cover IAH practices' costs, then the payments could provide resources for the practices to increase the number of beneficiaries they treat. In turn, if the growth results in more high-cost beneficiaries receiving lower-cost care, it could reduce Medicare costs. If the demonstration reduces expenditures greater than the incentive payments paid to practices, then the demonstration will yield a net reduction in Medicare expenditures.

A.   Description of the IAH demonstration

The law mandating the IAH demonstration stipulated the key features of participating practices and beneficiaries, elements of implementing the program, data to collect, and incentives to establish. The eligibility criteria for IAH demonstration practices required that (1) practices be experienced with delivering home-based primary care, (2) the home-based primary care team is led by physicians or nurse practitioners, and (3) the team may include physician assistants (PAs), clinical staff, and other health and social services staff. The practices had to adhere to a set of guidelines consistent with providing high quality home-based care (Exhibit I.1). These criteria resulted in a group of participating practices who had prior experience providing home-based primary care.

The legislation established eligibility requirements for the IAH demonstration to identify beneficiaries who were likely to both need and benefit from home-based primary care. Eligible fee-for-service (FFS) beneficiaries with Medicare Parts A and B must have had two or more chronic conditions and required human assistance for two or more activities of daily living (ADLs). These beneficiaries must have had a hospitalization and received rehabilitation services in the prior 12 months. Beneficiaries in long-term care, Programs of All-Inclusive Care for the Elderly, or hospice at the time of consideration for enrollment were precluded from participating. The legislation required that each IAH demonstration site serve at least 200 eligible beneficiaries

per demonstration year and limited the total number of participants to 10,000 beneficiaries annually during the demonstration.[4]

1.   Demonstration payment incentive

CMS's incentive payment calculation is derived from whether the IAH practices had lower expenditures than their estimated spending target and whether the IAH practices met required standards for a set of quality measures. CMS established annual spending targets for each participating practice based on the demonstration beneficiaries' expected Medicare FFS expenditures. Practices had to meet or exceed required standards for at least three of the six quality measures that the demonstration rules tied to payment (Table I.1). Incentive payments were proportional to the difference between a practice's spending target and actual expenditures and the number of quality performance standards met.

> **Exhibit I.1. Requirements of practices for participation in the IAH demonstration**
>
> - Be led by physicians or NPs who supply home-based primary care as part of a team
> - Be organized at least partly for the purpose of providing physician services
> - Be experienced in providing home-based primary care to patients with several chronic illnesses
> - Make in-home primary care visits and be available around the clock every day
> - Use electronic health records, remote monitoring, and mobile diagnostic technology
> - Provide services to at least 200 eligible beneficiaries each year
> - Report to CMS information on patients, services provided, and required quality measures

Table I.1. Quality measures used to calculate incentive payment

Quality measure	Threshold needed to receive full payment
1. Hospital admissions for ambulatory care–sensitive conditions (ratio of observed-to-expected)	1.0 or lower
2. All-cause hospital readmissions within 30 days (ratio of observed-to-expected)	1.0 or lower
3. Emergency department (ED) visits for ambulatory care-sensitive conditions (ratio of observed-to-expected)	1.0 or lower
4. In-home medication reconciliation within 48 hours of hospital discharges and ED visits	50 percent or higher
5. Annual documentation of patients' preferences	80 percent or higher
6. Follow-up contact within 48 hours of hospital admissions, hospital discharges, and ED visits	50 percent or higher

Note: These measures apply only to beneficiaries enrolled in the IAH demonstration, not all patients treated by the practice.

2.   Expected pathways to improving care and reducing Medicare expenditures

Providing primary care in the home may have several advantages for some beneficiaries, such as the following: better communication with caregivers; allowing the clinician to obtain information that may improve health care; and identifying changes to the home environment (such as safety improvements) that will improve outcomes. The demonstration has several features designed to focus on strong providers (who meet the eligibility requirements) and

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[4] In February 2018, Congress increased the maximum to 15,000 (under H.R. 1892, Bipartisan Budget Act of 2018). The limit of 15,000 will apply to calculating incentive payments for demonstration Years 6 and 7.

improve access to care and delivery of care, as shown in Figure I.1. Specifically, the IAH demonstration does the following:

1. Requires that participating practices use home-based primary care teams directed by physicians or NPs. The practice must have experienced clinicians who make home visits; are available at all hours of the day; carry out individualized care plans; and use electronic health information systems, remote monitoring, and mobile diagnostic technology. These requirements, which are similar to those used in the medical home model, are designed to promote comprehensive care to Medicare beneficiaries across multiple settings.

2. Requires that IAH beneficiaries be chronically ill and functionally dependent and have had recent acute care use. These requirements target a population that may benefit from improved access via home-based care because they may have difficulty accessing and managing health care.

3. Offers the possibility of receiving an incentive payment should Medicare expenditures be lower than the target amount. This provides the incentive for practices to change care in ways that could result in the reduction of Medicare expenditures.

4. Links the potential amount of the demonstration payment incentive to the achievement of quality measures that may be indicators of high quality, effective care. (Exhibit I.2) Because the demonstration offers an incentive to reduce Medicare expenditures, CMS established quality measures so that practices cannot reduce Medicare expenditures by providing sub-standard care.

5. Requires practices to report other measures that may be associated with good quality care, including fall risk assessments and depression screenings, to promote the provision of such care.

Figure I.1. Expected pathways for the IAH demonstration improving care and reducing Medicare expenditures
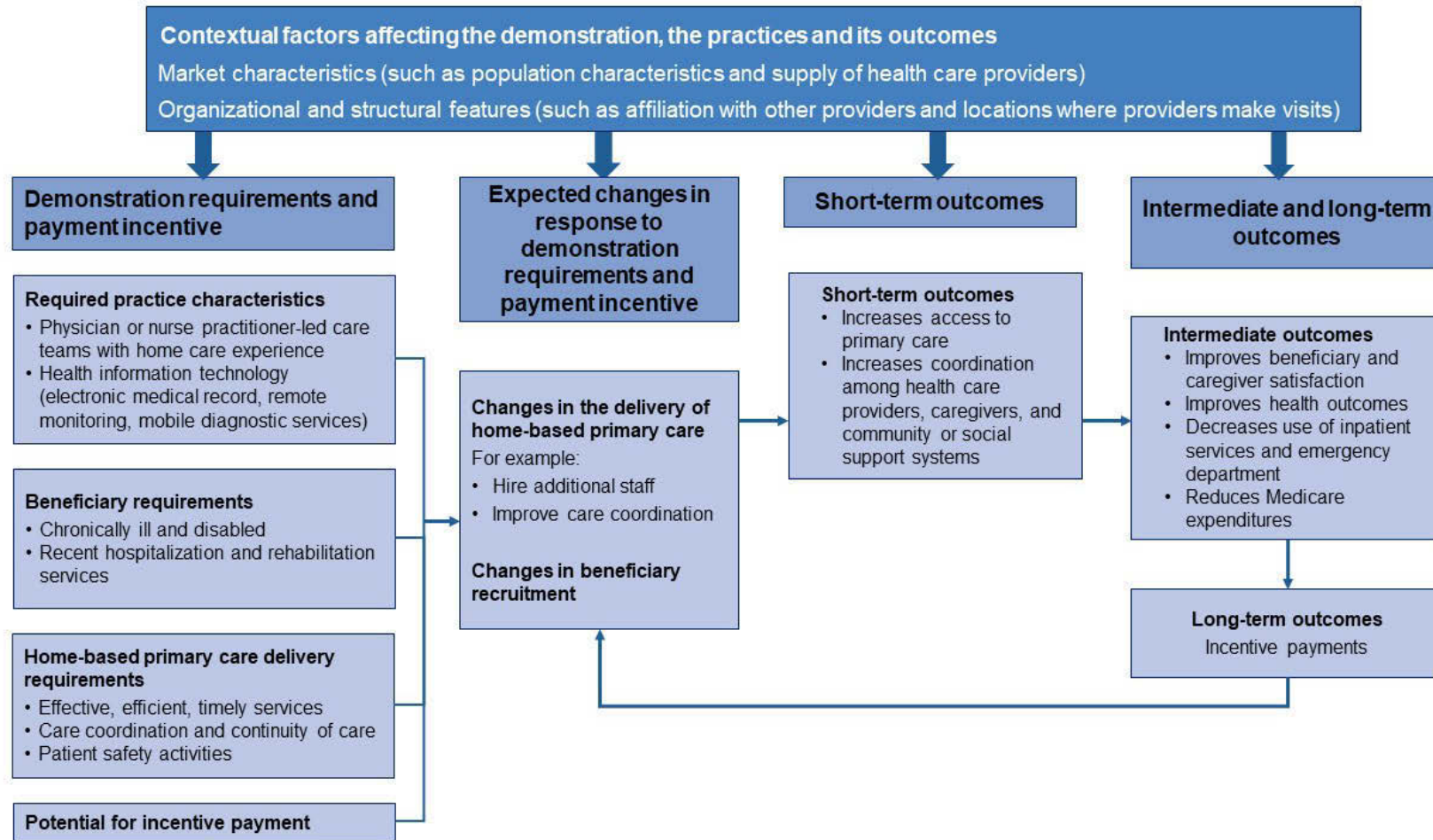
Overall, the demonstration requirements and the payment incentive are intended to improve access to primary care and improve the delivery of care. In turn, these improvements may reduce the use of hospital care and Medicare expenditures. Exhibit I.2 describes the outcomes that the program seeks to improve.

Exhibit 1.2 Performance expectations

The legislation that mandated the IAH demonstration envisioned that the demonstration would result in:

- Fewer preventable hospitalizations
- Fewer hospital readmissions
- Fewer emergency department (ED) visits
- Improved health outcomes commensurate with the beneficiary's stage of chronic illness
- Improved efficiency of care, such as by reducing duplicative diagnostic and laboratory tests
- More lower-cost, high-value health care services
- Satisfaction among beneficiaries and family caregivers

3. IAH participants

In June 2012, the first cohort of 15 demonstration sites started the demonstration, and three IAH sites began in September 2012 as consortia practices (Table I.2). The Atlanta site left the demonstration during the first year, and two consortia practices (Stuart and Chicago) left during Year 2. The sites left the demonstration because of internal business issues and reporting difficulties.[5] All sites ended participation three years after their entry dates.

As a result of the Medicare Independence at Home Medical Practice Demonstration Improvement Act of 2015, all active demonstration sites reentered the program in October 2015, the start of the two-year extension.[6] Congress extended the demonstration for two additional years as part of the Bipartisan Budget Act of 2018, and Year 6 began on January 1, 2019.

Table I.2. Demonstration sites

Individual practices		
Austin, Texas	Durham, North Carolina	Louisville, Kentucky
Boston, Massachusetts	Flint, Michigan	Milwaukee, Wisconsin
Brooklyn, New York	Jacksonville, Florida	Portland, Oregon
Cleveland, Ohio	Lansing, Michigan	Wilmington, Delaware
Dallas, Texas	Long Island, New York	
Consortia practices		
Atlanta, Georgia (2 practices)	Richmond, Virginia (3 practices)	Stuart, Florida (2 practices)
Chicago, Illinois (7 practices)		

To understand the features of the IAH practices and identify the changes they made to improve care, we collected and analyzed interview data from the IAH practices and analyzed the

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[5] The analysis of the effect of the demonstration payment incentive excluded practices that withdrew from the demonstration (Atlanta, Chicago, and Stuart) and one practice that CMS terminated for cause after it completed three years (Louisville).

[6] The legislation to extend the demonstration for Years 4 and 5 was signed after Year 3 ended for the sites that began in June. The demonstration for all participants restarted in October 2015.

IAH practices' claims data.[7] Every IAH site had significant experience providing home-based primary care before the IAH demonstration. However, the sites differed substantially in their approaches to care. We grouped each IAH practice on the basis of their structural and operational characteristics. In this section, we summarize care delivery patterns according to each of the three types of practices: (1) Visiting Physicians Association (VPA) practices, (2) academic medical center practices, and (3) independent practices.[8] We obtained information about the sites of care from claims data in Years 2 and 4 of the demonstration. Table I.3 and Tables B.43 and B.44 in Appendix B provide site-by-site information on practices' structural and operational characteristics. For more details on this analysis, see Appendix B, Section VII.

a.   Visiting Physicians Association

The five VPA practices (Dallas, Flint, Jacksonville, Lansing, and Milwaukee) had similar structural and operational characteristics. VPA is a corporation with multiple home-based primary care practices operating in multiple states; five of those practices were in the demonstration. Each practice had a patient care coordinator who was the main point of contact for patients and has access to the VPA corporate infrastructure for finance, human resources, data analytics, and data support. Patients (both IAH beneficiaries and others) were assigned to a mobile care team consisting of one physician and one medical assistant; visits occurred at least once every four weeks.[9] Medical assistants provided administrative and clinical support to physicians. Each office had one clinical educator for case management support. Physicians provided most visits to IAH beneficiaries.

VPA used a centralized call center in Troy, Michigan, to provide standardized 24-hour support to local practice staff, including after-hours on-call services; prescription refills; and orders for home health, hospice, and durable medical equipment (DME). The care coordination function was initially transferred from local practices to the centralized call center, but patient care coordinators returned to local practice sites after clinicians and patients expressed dissatisfaction with this change.

Clinicians in VPA practices reportedly had an average panel size of 175 patients. In four of the VPA sites, more than 65 percent of visits occurred in private homes. In the other VPA site, Milwaukee, 70.6 percent of visits took place in assisted living facilities or other group living facilities.

VPA staff provided some weekend and nonbillable visits. Each VPA practice reported conducting weekend visits for routine care as well as for urgent reasons, such as meeting the

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[7] We collected data during site visits and telephone calls beginning in February 2013 (halfway through the first year of the demonstration) and concluding in February 2017 (halfway through the fifth year of the demonstration). During site visits, we spoke with administrators, clinicians, and staff at each IAH practice.

[8] Information in this section is drawn from site visits we conducted February to May 2013 and February to July 2014. In January and February 2017, we conducted telephone interviews to confirm and update information for all practices.

[9] The term *patients* in this section refers to all patients of the practice regardless of IAH enrollment status.

48-hour requirement post-discharge. VPA clinical educators often conducted home visits to patients, although those visits were not billable.

All VPA practices had electronic systems that enable clinicians to collect data, communicate with the care team, and submit orders during a home visit. Each VPA risk-stratified patients on the basis of their history of hospitalization and ED visits to determine the needed level of care and the frequency of proactive phone calls to patients and caregivers. Two practices developed relationships with hospitals and their staff; those staff notified the practice directly when one of its patients was hospitalized or visited the ED, whereas the remaining three received automated notices from hospitals.

b. Academic medical centers

Seven IAH practices (Boston, Cleveland, Long Island, Philadelphia, Richmond, Washington, and Wilmington) were part of nonprofit academic medical centers or health systems with academic missions.[10] This status gave them access to institutional resources and information technology systems and support. Clinicians in these settings were typically responsible for training and education in addition to clinical care, so many see patients only part time. Across these practices, patients were assigned to a care team on the basis of geographic service area, with some adjustment to ensure that clinicians have panels of roughly equal size. In Boston, Cleveland, and North Shore, physicians conducted all or most visits; in Philadelphia, Richmond, and Washington, NPs conducted most of the visits. In Wilmington, NPs and physicians conducted most of the visits.

The care teams at the academic medical centers consisted of physicians, NPs, PAs, and social workers. Social workers were key members of the care team for many academic medical center practices, as they coordinated home health services and referred patients to social services and supports.

The seven academic medical center practices conducted most visits in home settings, and three (Long Island, Philadelphia, and Washington) conducted no visits in assisted living facilities. Academic medical centers reported average panel sizes ranging from 40 to 200 patients per clinician.

All but one academic medical center provided nonbillable visits, such as those conducted by social workers or nurses not acting under a physician's direction or as part of a home health episode. Most also provided weekend visits, but only for urgent issues or to meet the 48-hour follow-up requirement. Two of the academic medical centers conducted regular visits after hours, and one provided after-hours visits only for urgent issues.

Academic medical centers varied in their use of technologies to facilitate care delivery and planning. Most relied on clinical judgment to determine the level of care, rather than using a formal risk-stratification system, which groups the beneficiaries into high- and low-risk groups to aid in care planning. Similarly, most centers checked in on patients as needed, as determined by clinicians' recommendations. Nearly all academic medical centers were notified

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[10] Three practices (Philadelphia, Richmond, and Washington) participated as one consortium, which the demonstration considers as one site for the purpose of calculating incentive payments.

automatically of patients' hospitalizations or ED visits from at least some hospitals with which they built relationships. Unlike the other practices, which all had remote access to electronic medical records (EMRs) in the field, one academic medical center was unable to access patients' data remotely, collect new data on patients, or submit orders during a home visit.

c.   Independent practices

The demonstration included four independent practices (Austin, Brooklyn, Durham, and Portland) that are diverse in size, structure, and operating practices.

The number and type of clinicians conducting home visits in independent practices differed across each site, with some practices having an equal mix of physicians, NPs, and PAs conducting home visits and others relying primarily on NPs or physicians. Some practices assigned patients to one clinician; others assigned them to a team of two or more clinicians. In the Brooklyn and Durham practices, physicians provided most of the visits to Medicare beneficiaries, whereas in Portland, NPs provided most of those visits.

Nonmedical support staff served multiple functions among the independent practices. All four independent practices had staff dedicated to coordinating care for patients; however, the type of staff used to coordinate care varied across the sites. For example, some had nurse care managers and others trained medical assistants or similar staff to be patient care coordinators. Some independent practices had a social worker on staff to assist with care coordination and address behavioral health issues; others relied on the social work staff at home health agencies to connect patients to needed services. Additional support staff in independent practices, such as patient liaisons, were responsible for a variety of activities, including scheduling home visits, connecting patients to specialists, referring patients to social services and resources, and communicating with home health agencies.

The sites of care by independent practices varied across the sites—from nearly all visits conducted in private home settings (Brooklyn) to a high of 86.9 percent conducted in assisted living facilities (Durham). Average panel size also varied widely, ranging from 80 to 200 patients per clinician.

Most of the independent practices reported conducting weekend or after-hours visits for both urgent and nonurgent reasons. Some of the independent practices provided nonbillable visits by social workers and nurse care managers.

One independent practice reported risk-stratifying patients as a way to determine the intensity of care the practice would provide, whereas the remaining three reported relying on clinicians' judgment for these determinations. These practices reported using different methods for learning of patient hospitalizations and ED visits, with one relying on patients and caregivers to notify practice clinicians, and others receiving notice through health information exchanges.

Table I.3. Characteristics of IAH practices, as of 2017

Site	Affiliation	Full-time clinicians making house calls	Part-time clinicians making house calls	Visits per clinician per day	Other staff involved in care team
Dallas, TX	US Medical Management	17 clinicians[a]	None	8 or 9	18 MAs, 2 clinical educators on site, 1 scheduler, 1 patient care coordinator, 1 practice manager [b]
Flint, MI	US Medical Management	23 clinicians[a]	None	8 or 9	24 MAs, 5 clinical educators on site, 1 scheduler, 1 patient care coordinator, 1 practice manager [b]
Jacksonville, FL	US Medical Management	14 clinicians[a]	2 clinicians	8 or 9	10 MAs, 1 clinical educator on site, 1 scheduler, 1 patient care coordinator, 1 practice manager [b]
Lansing, MI	US Medical Management	10 clinicians[a]	None	8 or 9	11 MAs, 2 clinical educators on site, 1 scheduler, 1 patient care coordinator, 1 practice manager [b]
Milwaukee, WI	US Medical Management	12 clinicians[a]	None	8 or 9	11 MAs, 1 clinical educator on site, 1 scheduler, 1 patient care coordinator, 1 practice manager [b]
Boston, MA	Boston Medical Center	None	6 physicians	4	5 nurses, 1 office manager, 3 ambulatory service representatives, 1 project coordinator
Cleveland, OH	Cleveland Clinic	7 physicians, 3 NPs	1 PA	6 or 7	3 RNs, 4 MAs, 1 nurse manager, 1 social worker, 3 schedulers, 1 pharmacist
Long Island, NY	Northwell Health	4 physicians, 2 NPs	2 physicians	6	6 nurses, 6 medical coordinators, 5 social workers, 1 clinical data analyst, 1 DME coordinator
Philadelphia, PA[c]	University of Pennsylvania	1 NP	3 physicians 1 NP	6	1 social worker
Richmond, VA[c]	Virginia Commonwealth University	2 physicians, 6 NPs	2 physicians 1 NP	3 to 6	2 RNs, 1 consulting pharmacist, 3 social workers, 1 office manager, 3 patient access representatives
Washington, DC[c]	MedStar Health	6 physicians, 5 NPs	1 NP	6	1 RN, 1 LPN, 5 MAs, 1 social worker, 1 outcomes analyst
Wilmington, DE	Christiana Care Health Systems	1 physicians, 3 NPs	4 physicians 1 PA, 1 NP	6	1 phlebotomist, 4 RNs, 4 MAs, 3 social workers, 1 office manager
Austin, TX	Kindred Health Care	4 physicians 9 NPs, 4 PAs	2 physicians	10	5 LPNs, 2 MAs serving as patient service coordinators, 2 intake coordinators, 1 office manager, 1 medical record personnel
Brooklyn, NY	None	10 physicians, 15 PAs, 9 NPs[d]	None[d]	8 to 10	Quality assurance nurse, patient liaison[d]
Durham, NC	None	33 physicians, 35 PAs, 7 NPs	None	10 to 15	6 podiatrists, 2 psychologists, 1 social worker, 130 additional office support staff, 40 of whom are MAs serving in clinical service, management, and scheduling capacities

Table 1.3 (*continued*)

Site	Affiliation	Full-time clinicians making house calls	Part-time clinicians making house calls	Visits per clinician per day	Other staff involved in care team
Portland, OR	None	4 physicians, 3 NPs, 1 PAs	1 physician 1 PA, 3 NPs	4 or 5	17 RNs, 4 LPNs, 7 social workers, care coordinators, care coordinator supervisor, DME specialist

Source: Information from interviews with practice staff conducted in 2015 and 2017.

[a]VPAs did not provide a breakdown of physicians, NPs, and PAs.

[b]Additional care team staff are located at the corporate office in Troy, Michigan, and provide support to local sites: 1 social worker, 1 DME intake, 1 care manager.

[c]These three sites (Philadelphia, Richmond, and Washington, DC) are considered one practice for purposes of the demonstration.

[d]The Brooklyn, New York, site did not provide information in 2017 on the number of full- and part-time clinicians making house calls, or other staff involved in the care team.

DME = durable medical equipment; IAH = Independence at Home; LPN = licensed practical nurse; MA = medical assistant; NP = nurse practitioner; PA = physician assistant; RN = registered nurse; VPA = Visiting Physicians Association.

In the year before the demonstration, more than half of IAH beneficiaries were age 80 or older, and 40 percent were dually eligible for Medicare and Medicaid (Table I.4). The demonstration eligibility criteria focused on Medicare beneficiaries who were chronically ill and disabled. As a result, about 43 percent of IAH beneficiaries had 10 or more chronic conditions, and 55 percent required human assistance with at least five ADLs. On average, IAH beneficiaries incurred nearly $4,400 in Medicare expenditures per beneficiary per month (PBPM) in the year before the demonstration. They had an average of 1.78 hospital admissions and 2.90 ED visits per year. About 18 percent of IAH beneficiaries died within twelve months.

Table I.4. IAH beneficiaries' demographic characteristics and health status, Medicare expenditures, and service utilization in the year before the demonstration

Variable name	Value for IAH beneficiaries in the year before the demonstration
Demographic characteristics and health status	
Percentage age 80 or older	51.73
Percentage dually eligible for Medicare and Medicaid	40.12
Average HCC score	3.52
Percentage with 10 or more chronic conditions	42.69
Percentage requiring human assistance with at least 5 activities of daily living	55.00
Total Medicare expenditures per beneficiary per month	**$4,397**
Inpatient hospital services	$1,741
SNF services	$605
Home health services (Parts A and B)	$781
Hospice services	$153
Outpatient services	$253

Table 1.4 (*continued*)

Variable name	Value for IAH beneficiaries in the year before the demonstration
Physician/supplier services	$715
Durable medical equipment	$150
Numbers of key utilization events per beneficiary per year	
Number of hospital admissions[a]	1.78
Number of potentially avoidable hospital admissions[b]	0.46
Number of ED visits	2.90
Visits by primary care clinicians[c]	11.24
Visits by specialists	5.66
Probability of key utilization events	
Probability of having a qualifying hospital discharge and an unplanned readmission within 30 days of discharge (percentage)[d]	19.55
Probability of home health use (percentage)	91.26
Probability of hospice use (percentage)	17.86
Probability of skilled nursing facility use (percentage)	41.01
12-month mortality (percentage)	18.13

Source: Mathematica Policy Research's analysis of data from the IAH implementation contractor and Medicare claims and enrollment data for 2010–2016 obtained from the Virtual Research Data Center for treatment and matched comparison group beneficiaries in all IAH practices that participated in demonstration Year 4. The data exclude three practices (Atlanta, Chicago, and Stuart) that withdrew from the demonstration before Year 4 and one practice (Louisville) terminated for cause.

[a] The number of hospital admissions includes observation stays.

[b] The number of potentially avoidable hospital admissions includes observation stays. A potentially avoidable hospital admission is one in which appropriate primary and specialty care might prevent or reduce the need for a hospital admission.

[c] Primary care clinicians are defined as primary care physicians, nurse practitioners, and physician assistants. Nonacute settings are defined as home, office, outpatient clinic, federally qualified health center, or rural health clinic.

[d] The probability of an unplanned readmission for a beneficiary is measured over the IAH-eligible months during each demonstration year. The probability equals zero for beneficiaries who did not have a qualifying hospital discharge or an unplanned readmission within 30 days of a qualifying hospital discharge during the measurement period.

ED = emergency department; HCC = Hierarchical Condition Category; IAH = Independence at Home; PBPM = per beneficiary per month.

B. Evaluation study design and overview of the report

1.   Study design

The legislation required an evaluation of the IAH demonstration to determine how it affects Medicare expenditures and other health-related outcomes. Ideally, we would have examined the effects of the entire demonstration, including the payment incentive and the home-based care delivery model, in a single analysis as a new health care and payment intervention. To do this, the patients in our sample would have had to be IAH-eligible and new to home-based primary care. Using those beneficiaries as the IAH group, we would have measured how outcomes changed for the IAH group relative to those who received home-based primary care from that practice before the demonstration, and we would have used a comparison group of beneficiaries who did not receive home-based primary care to control for other changes in the health care system over time. However, we could not evaluate the IAH demonstration using this approach

for two reasons. First, the number of new home-based primary care recipients in the IAH practices who met the demonstration eligibility requirements was too small to obtain estimates of the program's effect. Second, the legislation allows for those already receiving home-based primary care to enroll in the demonstration. This created two issues: First, many beneficiaries who started home-based primary care with an IAH practice before the demonstration could actually be enrolled in the demonstration at a later point in time, confounding the analysis; and second, the evaluation would have excluded a substantial group of the demonstration beneficiaries, whom Congress intended to include. Because of these limitations, we could not test the effect of the payment incentive and home-based primary care jointly as a new intervention; that is, we could not use a single analysis to examine the effects of IAH. Instead, we examined separately the effects of the demonstration payment incentive and home-based primary care.

As the next best alternative, we evaluated the effects of demonstration payment incentive separately from the effects of the home-based primary care delivery model using a different sample and methodology for each analysis. The estimated reduction in expenditures associated with the demonstration payment incentive suggests how much Medicare might save if it were to introduce financial incentives to home-based primary care practices. The costs (or savings) associated with home-based primary care provide an estimate of how much it might cost (or save) Medicare if more IAH-eligible beneficiaries were to receive home-based primary care. (Note that these costs are already being incurred in the Medicare program where home-based primary care is available.) For the IAH demonstration model to result in Medicare savings, the costs or savings associated with home-based primary care in expansion areas—plus any savings from the demonstration payment incentive—must net out to lower overall expenditures for Medicare, after accounting for the cost of incentive payments paid by CMS.

We conducted two studies:

1. The evaluation of the demonstration payment incentive, in which IAH practices may earn a payment if their patient's expenditures were below an established threshold and met required standards for a set of quality measures, addresses multiple questions:

- What was the effect of the demonstration on Medicare expenditures and health care use?

- How did the IAH practices change the way they delivered care during the demonstration, and did those changes affect the quality of care?

- How did IAH beneficiaries and their caregivers perceive the care they received?

2. The analysis of the receipt of home-based primary care answers the question: How did the receipt of home-based primary care for new patients of IAH and other home-based primary care clinicians affect Medicare expenditures and health care use?

To measure the effect of the demonstration payment incentive, we compared the change in outcomes of the IAH practices' eligible patients from before the introduction of the demonstration to after. We then compared this change with a comparison group who had similar demographic and health status characteristics and lived in the same geographic area.

To measure the effect of home-based primary care, we examined beneficiaries who (1) met the demonstration eligibility criteria, (2) were new to home-based primary care (that is, who had never previously received home-based primary care), and (3) lived in the same geographic target area of the IAH practices. In this analysis, the home-based primary care group consisted of beneficiaries receiving home-based primary care from non-IAH practices as well as beneficiaries receiving home-based primary care from IAH practices. This expanded sample was necessary to ensure a sufficient sample size. The comparison group consisted of beneficiaries residing in the IAH practices' geographic target area who had the same demographic and health care characteristics but who did not receive home-based primary care. We compared the change in outcomes before and after receipt of home-based primary care and used the comparison group to control for all other factors that were changing during that period.

To estimate expenditure reductions under each study, we used two estimation approaches: traditional frequentist and Bayesian. The Bayesian approach complemented the frequentist approach in that it enabled us to estimate a more precise measure of expenditure reductions and draw probabilistic estimates of the success of the program. However, Bayesian estimation is computationally intensive, so we provide Bayesian estimates of the effect on total Medicare expenditures only. We provide frequentist estimates for all measures of expenditures and other outcomes.

2.   Overview of the report

In the following chapters, we present the results for both studies: (1) the evaluation of the demonstration payment incentive and (2) the evaluation of home-based primary care.

a.   Evaluation of the demonstration payment incentive

In Chapter II, we present results from our study of the effect of the demonstration payment incentive on expenditures, health care use, and mortality. We began by assessing the effect of the demonstration payment incentive on Medicare expenditures. We then investigated the effect on components of Medicare expenditures and hospital use that contributed to total expenditures (Exhibit I.5) and calculated aggregate estimates from effects on expenditures and hospital use. Next, we examined the effects of the demonstration payment incentive on use of primary care, home health care, and other related services. We also wanted to study whether there were any unintended consequences for health and well-being, such as worsening mortality.

In Chapter III, we use data from interviews with staff from IAH practices, interviews with care partners of IAH practices, Medicare claims, and a survey of IAH beneficiaries and caregivers to assess how IAH practices and their beneficiaries changed during the demonstration. To identify changes that the IAH practices made to improve their performance on demonstration quality measures and overall quality of care, we collected and analyzed interview data from the IAH practices and claims data.[11] We also examined whether any identified improvements were consistent with changes in indicators of quality, such as potentially avoidable hospital admissions. When considering any new model of care, it is critical to understand how beneficiaries perceive the care they receive. We asked beneficiaries and their caregivers about

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[11] We cannot attribute any changes in outcomes to the changes described by IAH practices, as we do not have interview data from a comparison group of practices.

their views on receiving home-based primary care. We asked this of patients who were cared for by practices participating in the demonstration.

b.   Evaluation of home-based primary care

In the second analysis, we examined the effects of home-based primary care on expenditures and use of hospital care. To do this, we compared the change in expenditures before and after receipt of home-based primary care with the change in expenditures over a similar period for similar patients who did not receive home-based primary care. We also examined how hospital use changed after entry into home-based care. We repeated these analyses for the subset of beneficiaries who received care from IAH practices and also separately by the year in which beneficiaries began home-based primary care (from 2010 to 2014) to assess whether the effects changed over time. In addition, we conducted a descriptive analysis to determine whether expenditures in the last three months of life differed for home-based primary care recipients and comparison beneficiaries who died during the study period. Finally, it was important to understand how beneficiaries' attitudes toward health care affected their decision to receive primary care in their homes. Knowing more about why some chose to enter home-based primary care and why comparison beneficiaries chose not to enables us to disentangle the effect of selection into home-based primary care from the effect of home-based primary care on observed differences in expenditures and hospital use. We used data from our survey of both new entrants into home-based primary care and a group of matched comparison beneficiaries to conduct this analysis. We present these analyses in Chapter IV.

In Chapter V, we summarize the results of the studies of the demonstration payment incentive and home-based primary care and discuss implications of the results.

II. WHAT WERE THE EFFECTS OF THE DEMONSTRATION PAYMENT INCENTIVE ON EXPENDITURES AND HEALTH CARE USE?

The IAH demonstration provides a payment incentive to practices that meet a minimum savings requirement and meet or exceed performance requirements for specified quality measures. The demonstration seeks to determine whether the payment incentive can reduce beneficiaries' total Medicare expenditures without compromising the quality of care. In this chapter, we present results of the estimated effect of the demonstration on Medicare expenditures, service utilization, and mortality. In Chapter III, we examine changes that the practices made while participating in the demonstration and present results of the estimated effect of the demonstration on quality of care. We also describe how care partners of IAH practices perceive them, assess changes in IAH beneficiaries' characteristics, and examine how IAH beneficiaries and their caregivers view their care.

To measure the effects of the demonstration payment incentive, we conducted a difference-in-differences analysis of repeated cross-sections of beneficiaries who met IAH eligibility criteria. This analysis measured the demonstration effect as the change in the IAH practices' patient outcomes after netting out the change due to the other trends in the health care system, as observed from the comparison group. We refer to the beneficiaries who received care from an IAH practice as IAH beneficiaries or the IAH group. The matched comparison group consisted of beneficiaries who met the same IAH eligibility criteria and lived in the same geographic area as the IAH beneficiaries but did not receive home-based primary care. We constructed samples in each of the two pre-demonstration years and four post-demonstration years and compared outcomes over time.

Key takeaways of these analyses include the following:

- The estimated effect of IAH on total Medicare expenditures was an annual reduction in expenditures of $161 (3.7 percent) PBPM across the first four years (Figure II.2). This estimate was not statistically significant. However, because of the small size of the demonstration, we would have been unlikely to identify a reduction of 3.7 percent as statistically significant.

- The probability that the demonstration payment incentive decreased Medicare expenditures over the course of four years by any amount was 69 percent, there was a 31 percent probability that it increased expenditures. In addition, the probability that the demonstration payment incentive decreased expenditures by at least $100 PBPM—about 2 percent of the average—over the course of four years was just 29 percent.

- In Year 4, the estimated reduction in Medicare expenditures was $282 PBPM. This estimate was the largest reduction in expenditures in any of the four years but was not statistically significant.

- We found no strong evidence that the demonstration reduced the number of hospital admissions or the probability of having an unplanned readmission over the four-year demonstration period. However, the demonstration was associated with reductions in the probability of having an unplanned readmission and the number of ED visits in Years 3 and 4.

- The effects of the demonstration on expenditures and hospital care use were similar for beneficiaries with dementia and beneficiaries without dementia.

- We found some evidence that the independent practices (Austin, Brooklyn, Durham, and Portland) might have been more successful at reducing the use of hospital care than VPA or academic medical centers.

- The demonstration did not appear to affect the use of skilled nursing facilities (SNFs), hospice, or home health, nor did it affect the number of primary care or specialist visits.

- We found no evidence that the demonstration adversely affected mortality.

In Section A of this chapter, we describe our evaluation approach. We present results of the effect of the demonstration during the four-year demonstration period and each individual demonstration year in Section B (expenditures and hospital care use), Section C (use of other services), and Section D (mortality). In Section E, we discuss the limitations of our analysis and summarize the results.

A. Evaluation approach

To estimate the effect of the IAH demonstration payment incentive on Medicare expenditures and utilization, we compared outcomes for beneficiaries of IAH practices with outcomes for a comparison group of beneficiaries using a difference-in-differences model. Both IAH and comparison beneficiaries met the IAH eligibility requirements and had similar health status and demographic characteristics. However, beneficiaries in the comparison group did not receive home-based primary care. In this section, we describe how we selected IAH and comparison beneficiaries and the methods we used to estimate the effect of the demonstration.

1. Identifying IAH and comparison beneficiaries

We used a three-step process for identifying IAH and comparison beneficiaries. First, we identified beneficiaries who met the demonstration eligibility requirements. Second, we identified IAH beneficiaries by attributing beneficiaries to IAH practices. Third, we identified the comparison group. In each study year, we identified IAH and comparison beneficiaries without regard to whether they were in the IAH group, comparison group, or neither group in previous demonstration and pre-demonstration years. We describe each step below.

a. Identifying beneficiaries who met the demonstration eligibility requirements

In each pre-demonstration and demonstration year, we identified all Medicare FFS beneficiaries who met the demonstration eligibility criteria and lived in the same state as an IAH practice (Exhibit II.1). To answer questions related to the effect of the IAH demonstration payment incentive, we had to have the same approach to identifying the IAH beneficiaries and comparison group beneficiaries. To do this, we relied solely on administrative data, because we did not have clinical data for members of the comparison group. We used Medicare enrollment, claims, and assessment data to determine which beneficiaries were eligible for the demonstration in each pre-demonstration and demonstration year. We established the date of eligibility as the first day of the month in that year after the beneficiary met the hospital and rehabilitation service use criteria.

b. Identifying the IAH group

After we identified the larger sample of beneficiaries who met the demonstration eligibility criteria and lived in the same state as an IAH practice, we used claims that occurred between the date of eligibility for the demonstration and the end of the demonstration (or pre-demonstration) year to determine which beneficiaries were patients of an IAH practice. To attribute beneficiaries to IAH practices, we applied the following criteria:

- All beneficiaries must have at least one home visit from the IAH practice; *home* included private homes, assisted living facilities, group homes, and custodial care facilities.

- Beneficiaries eligible for the demonstration for more than three months must have at least one additional visit from the demonstration practice in the home or an office.

Exhibit II.1. Demonstration eligibility criteria for beneficiaries

- Enrollment in FFS Medicare
- Two or more ADLs that require human assistance
- Two or more chronic conditions
- Hospitalization and use of acute or subacute rehabilitation services in the previous 12 months
- Not in hospice or long-term care for the entire time they were eligible for the demonstration in a given year

To estimate the effect of the IAH demonstration, we had to use the same data to identify IAH and comparison beneficiaries. The IAH demonstration used a site-based enrollment process. The IAH sites used clinical assessments to identify beneficiaries they thought were eligible to participate in the demonstration, and the implementation contractor used administrative data to confirm whether those beneficiaries were eligible. In addition, the implementation contractor used administrative data to assist IAH sites with identifying potential beneficiaries for enrollment into the demonstration based on the eligibility criteria. We did not use clinical data from the IAH practices because we did not have such data for the comparison group or for IAH beneficiaries in the pre-demonstration period. Failing to select the IAH and comparison groups in the same way in each pre-demonstration and demonstration year could have introduced bias into the study results. Thus, to construct the evaluation sample (IAH group and comparison group) in the same way, we used only Medicare claims and other administrative data.

Because we used only Medicare claims and other administrative data to identify the evaluation sample, the IAH group included two types of beneficiaries: (1) beneficiaries who met the eligibility and attribution criteria outlined above and who were enrolled in the demonstration and (2) beneficiaries who met the eligibility and attribution criteria but were not enrolled in the demonstration. The IAH group did not include beneficiaries who were enrolled in the demonstration but who did not meet the eligibility and attribution criteria outlined above. Please see Appendix B, Section II for a detailed description of the differences in the Mathematica and site-based enrollment processes and reasons for the differences between the evaluation analysis and demonstration enrollment cohorts.

c. Identifying the comparison group

To select a comparison group, we sought to identify patients who had the same characteristics as the IAH beneficiaries and lived in the same area as the IAH beneficiaries but did not receive home-based primary care. First, from the group of Medicare beneficiaries in an IAH state who met the demonstration eligibility criteria (Exhibit II.1), we identified a set of potential comparison group members who met the following criteria:

- No visits from any demonstration practice in the study year

- No more than one home visit from any other practice in the study year

- Lived in the same zip code as an IAH beneficiary (For example, a potential comparison beneficiary for the Portland, Oregon, site in Year 4 had to live in a zip code where at least one Portland IAH beneficiary lived in Year 4.)

Next, we used propensity-score matching to select a comparison group of beneficiaries who were similar to IAH beneficiaries in ways we could measure. The goal of matching was to identify beneficiaries who were similar to IAH beneficiaries in health status, functional status, and demographic characteristics. We used a number of variables to select the comparison group, such as how recently the beneficiary was hospitalized, several measures of health status, ability to perform the six ADLs, race, age, gender, and whether the beneficiary was dually eligible for Medicare and Medicaid. We matched each site separately in each year. Please see Appendix B, Section III, for a complete list of matching variables and methods.

Based on characteristics we could measure, comparison group members were very similar to IAH beneficiaries in Year 4 and previous years. We assessed similarities between the IAH group and the final matched comparison group using standardized difference in means (Stuart 2010). The literature suggests that a standardized difference of less than 0.25 is an appropriate threshold for determining that the IAH and comparison groups are well matched on a particular characteristic (Rubin 2001). We applied a more stringent standard than 0.25. For most individual sites, the IAH and matched comparison group had standardized differences of less than 0.10 (absolute value) on most or all characteristics. When we combined data for all sites in demonstration Year 4, the absolute value of the standardized difference was less than 0.10 on all matching variables. In other words, the IAH and comparison groups had similar observable characteristics at the time they entered our study in Year 4. We had similar results when we selected the comparison groups for the other demonstration and pre-demonstration years. Please see Appendix B, Section III, for the balance statistics for the IAH and comparison groups.

For each demonstration year, we matched each IAH beneficiary to an average of four comparison beneficiaries (Table II.1). In Year 4, the 9,504 IAH beneficiaries were in the sample for an average of 9.4 months, and the 38,365 matched comparison beneficiaries were in the sample for an average of 8.7 months (Appendix B, Table II.2). This resulted in slightly more than 90,000 months of observations for the IAH beneficiaries, and more than 335,000 months for the comparison beneficiaries.

Table II.1. Analysis sample, by year

	Two years pre-demonstration	One year pre-demonstration	Year 1	Year 2	Year 3	Year 4
Number of IAH beneficiaries	6,837	7,367	8,216	7,266	7,564	9,504
Number of comparison beneficiaries	29,517	31,888	33,916	32,248	31,259	38,365

Source: Medicare claims and enrollment data for 2009–2016 obtained from the Virtual Research Data Center for IAH and matched comparison group beneficiaries in all IAH practices that participated in demonstration Year 4. The data exclude three practices (Atlanta, Chicago, and Stuart) that withdrew from the demonstration before Year 4 and one practice (Louisville) terminated for cause.

IAH = Independence at Home.

2.   Estimation approach

We estimated the average annual effect of the four-year demonstration period and the effect for each demonstration year. To determine the effect of the demonstration on expenditures (and other outcomes) in a given year, such as Year 4, we did the following:

1. Estimated the difference in regression-adjusted mean Medicare expenditures PBPM between the year before the demonstration (the baseline year) and Year 4 for IAH beneficiaries ($T_4 - T_0$ in Figure II.1). We restricted claims to those that occurred between the date of eligibility for the demonstration in a given year and the end of that year (and date of death). To obtain the regression-adjusted mean, we controlled for beneficiary characteristics such as time since most recent hospitalization, demographic characteristics, ADLs, and several measures of health status, including the CMS Hierarchical Condition Categories risk score. Please see Appendix B, Section VI.A, for a complete list of control variables and additional information about the regression.

2. Estimated the difference in Medicare expenditures during the same period for comparison beneficiaries ($C_4 - C_0$ in Figure II.1). As with the IAH group, we restricted claims to those that occurred between the date of eligibility and the end of the year, and we controlled for beneficiary characteristics.

3. Obtained the estimated effect of the demonstration by calculating the difference between the change in expenditures for IAH beneficiaries and the change in expenditures for comparison beneficiaries (i.e., $[T_4-T_0] - [C_4-C_0]$).

Figure II.1. Yearly trend in regression-adjusted total Medicare expenditures PBPM for IAH and comparison beneficiaries
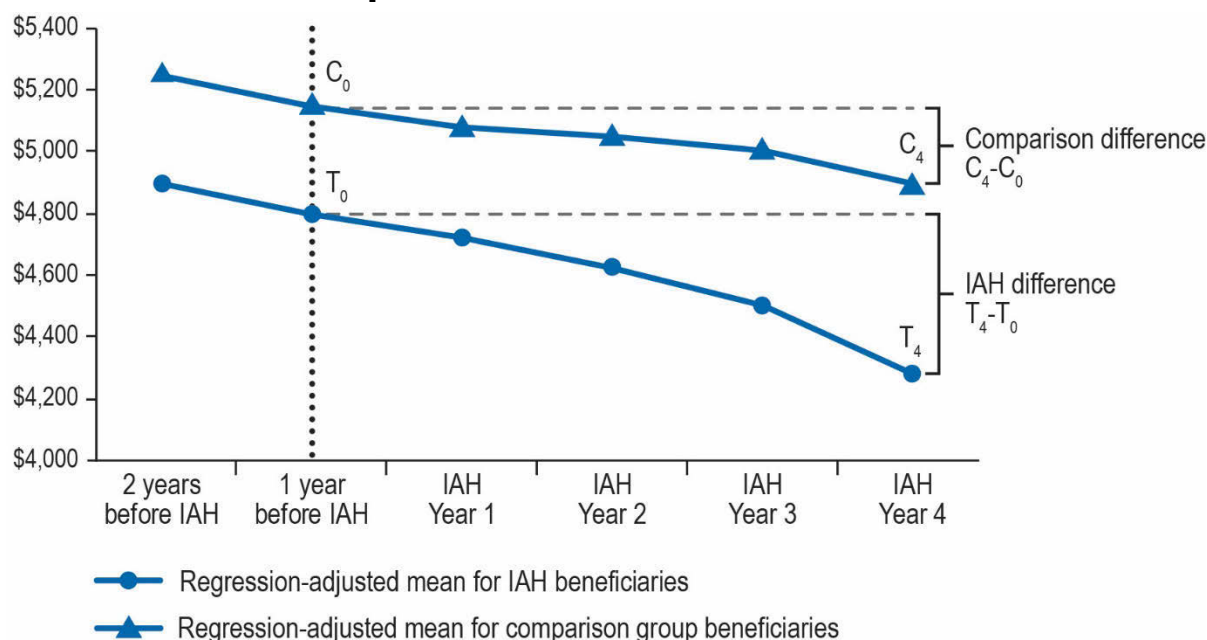
Notes: The figure shows hypothetical yearly trends in regression-adjusted total Medicare expenditures PBPM for IAH and comparison beneficiaries. T_0 and C_0 represent the regression-adjusted mean expenditures in the year before IAH (baseline year) for the IAH and comparison group, respectively. T_4 and C_4 represent the regression-adjusted mean expenditures in demonstration Year 4 for the IAH and comparison group, respectively. The difference-in-differences estimated effect for Year 4 equals the difference between the IAH difference (T_4-T_0) and comparison difference (C_4-C_0).

IAH = Independence at Home; PBPM = per beneficiary per month.

This method isolated the effect of the demonstration by accounting for changes in outcomes during the demonstration caused by factors unrelated to the demonstration that affected both IAH and comparison beneficiaries over time. We used a similar design to estimate the four-year average annual effect of the demonstration.

This before-and-after design was a strong assessment of the demonstration's effect if the difference in outcomes between IAH and comparison beneficiaries was stable before the demonstration. This design may not yield an accurate assessment of the demonstration's effect if the difference in a given outcome between the two groups changed significantly in years before the demonstration. A significant change in the difference between the two groups in the years before the demonstration is known as nonparallel pre-existing trends. We could not be confident about an estimate when the outcome had nonparallel pre-existing trends. This is because the difference-in-differences estimate for the demonstration years could reflect the continuation of a pattern—for example, narrowing or widening differences between the two groups—which started to emerge before the demonstration period. Section VI.A of Appendix B describes how we tested for the assumption of parallel pre-existing trends. For most outcomes, including expenditures and hospital care use, the difference in outcomes between IAH and comparison beneficiaries was stable before the demonstration.

We used two approaches to estimate the effect of the demonstration on total Medicare expenditures. Both approaches generated a difference-in-differences estimate. First, we used a frequentist model, which relies on a hypothesis-testing framework; this is the method that past CMS evaluations have used most often.[12] We used the frequentist model to estimate effects on all outcomes. Second, we used a Bayesian approach to estimate effects on total Medicare expenditures. The Bayesian approach had two main advantages. First, it allowed intuitive statements about the probability that the demonstration payment incentive saved money for Medicare. Second, Bayesian estimates were typically more precise (had less uncertainty) than frequentist estimates. However, the Bayesian approach was computationally intense, which was why we did not apply it to outcomes other than total Medicare expenditures.

We performed statistical significance testing to determine whether the effect of the demonstration payment incentive on a particular outcome was statistically significantly different from zero. Such testing accounted for sampling variability among the patients in both the IAH and comparison samples. As we discuss in Section E of this chapter, we could not draw conclusions about how the program would have affected other home-based primary care practices, because we did not know how similar IAH practices were to other home-based primary care practices.

Based on the sample sizes reported in Table II.1, we estimated that if the true effect of the demonstration was a reduction in expenditures of $306 PBPM, then we had an 80 percent chance to correctly identify the effect as statistically significant. A reduction in expenditures of $306 PBPM was 6.9 percent of the average Medicare expenditures for the IAH group in the year

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[12] In the frequentist framework, hypothesis testing relies on the *p*-value, defined as the probability of observing an effect of an intervention that is at least as large as the estimated effect, if the true effect of the intervention is zero. In contrast, the Bayesian framework directly estimates the probability that the intervention has an effect given the observed data (along with an assumed prior distribution of beliefs).

before the demonstration. Because of the small number of IAH practices and beneficiaries—due to the enrollment cap in the IAH legislation discussed in Chapter I—we did not have the statistical power to identify any reduction in expenditures smaller than $306 PBPM (minimum detectable effect). In other words, if the effect of the demonstration was a reduction in expenditures of less than $306, the confidence interval of the estimated effect would likely cover zero, and thus the estimated effect would not be statistically significant. In such case, we would not identify that estimated effect as being associated with the demonstration. For the Bayesian estimate, the smallest effect we could expect to identify was $244 PBPM, or 5.5 percent of the mean Medicare expenditures in the year before the demonstration. The Bayesian estimate had a smaller minimum detectable effect because it incorporated prior expectations about the effect of IAH on expenditures, which the frequentist model did not incorporate. We interpreted all findings in light of this and other limitations of the evaluation, which are presented in detail in Section E of this chapter.

In addition to estimating the effects of the demonstration across all IAH sites, we estimated effects for subgroups, to assess whether the demonstration payment incentive worked better for certain groups than for others. We hypothesized that there might be more value in the 48-hour follow-up visit and medication reconciliation, required by the IAH demonstration, for dementia patients than for other types of patients. To test this hypothesis, we performed subgroup analysis of beneficiaries with dementia versus those without dementia and assessed whether results differed between the two groups. In addition, to assess whether the demonstration worked better in certain types of practices than others, we performed the analysis separately for groups of practices based on whether they operated as (1) a unit of VPA, (2) an independent practice, or (3) part of an academic health center or health care system.

We also examined whether different ways of estimating the effects changed our findings on the effects of the demonstration across all IAH sites. For the majority of outcomes examined, different estimation techniques did not change our findings. In subsequent sections of this chapter, we discuss the results from alternative estimation techniques if they affected our interpretation of the demonstration effects. For details on the different estimation approaches and their results, please see Appendix B, Sections VI.A and X, respectively.

B. Did the demonstration payment incentive affect total Medicare expenditures and hospital care use?

As explained in Chapter I, we expected that the sites would respond to the demonstration payment incentive by changing how they provided care, and those changes would reduce Medicare expenditures by reducing hospital care use.

1. Total Medicare expenditures

a. Four-year average annual effect

The demonstration might have reduced total Medicare expenditures over the four years, but that result was not statistically significant. The average annual estimated effect from the frequentist model was a reduction in expenditures of $161 PBPM (Figure II.2 and Appendix B, Table B.17) over the four-year demonstration. That was a reduction of 3.7 percent of the IAH beneficiaries' mean expenditures in the year before the demonstration. The 90 percent

confidence interval was large, which means that we could not be confident that the demonstration actually saved $161 PBPM; the actual amount might be much higher or lower.

Figure II.2. Estimated effect of the IAH demonstration payment incentive on Medicare expenditures for the four demonstration years and by year

Source: Mathematica's analysis of data from the IAH implementation contractor and Medicare claims and enrollment data for 2009–2016 obtained from the Virtual Research Data Center for IAH and matched comparison group beneficiaries in all IAH practices that participated in demonstration Year 4.

Notes: The total unweighted number of observations across all years was 243,947. We computed coefficients and standard errors by using the weighted sample size, which considers both the matching and eligibility weights. The figure reports the four-year average annual effect and the estimated effect of each year. The horizontal lines represent 90 percent confidence intervals. If zero is within the confidence interval (denoted by horizontal lines), the estimated effect (denoted by a dot) was not statistically significantly different from zero at the 90 percent confidence level. In this case, the large confidence intervals suggest that the estimated reductions in expenditures were associated with great uncertainty. Details on the methods we used to produce these estimates are in Appendix B.

*/**/***The difference is statistically significant at the 0.10/0.05/0.01 level.

IAH = Independence at Home; PBPM = per beneficiary per month.

As described in Section B of this chapter, we also used a Bayesian model, which allows us to make intuitive statements about the probability that the demonstration payment incentive reduced Medicare expenditures. For the combined four years, there was a 69 percent probability that the demonstration payment incentive reduced Medicare expenditures and a 31 percent probability that it increased expenditures (Figure II.3). Because implementing a demonstration payment incentive requires incurring additional costs, we estimated the probability that the demonstration payment led to a reduction of $100 PBPM or more (2 percent of average Medicare expenditures). The probability that the demonstration payment incentive reduced expenditures by $100 PBPM or more over four years was just 29 percent.

Figure II.3. Probability of an effect of the IAH demonstration payment incentive on Medicare expenditures for the four demonstration years and by year
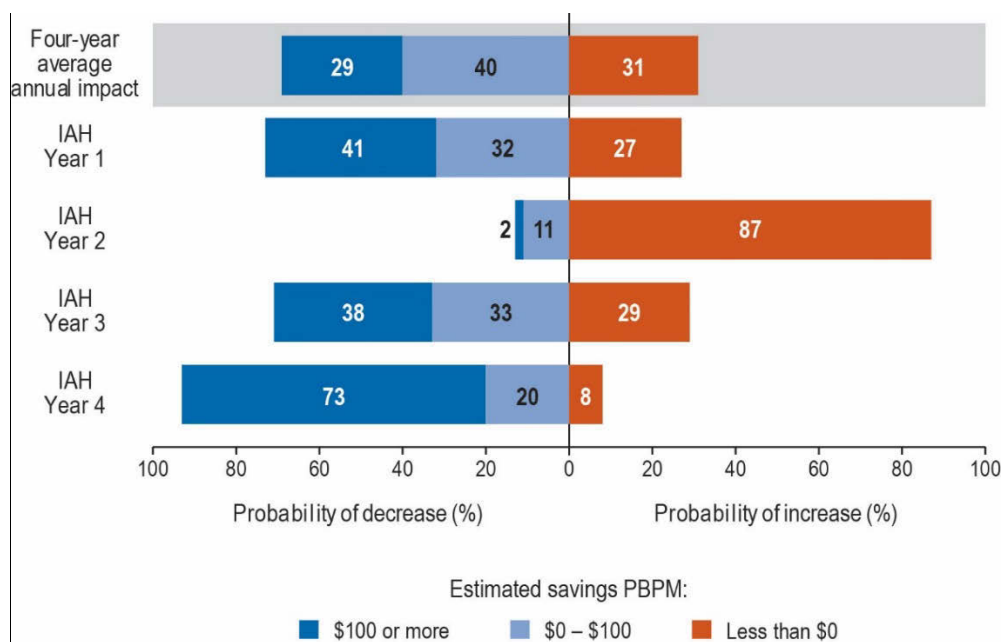
Source:　Mathematica's analysis of data from the IAH implementation contractor and Medicare claims and enrollment data for 2009–2016 obtained from the Virtual Research Data Center for IAH and matched comparison group beneficiaries in all IAH practices that participated in demonstration Year 4.

Notes:　The IAH group mean in the year before the demonstration was $4,397 PBPM, suggesting that an effect of $100 PBPM represented a reduction in expenditures of 2.3 percent. The total unweighted number of observations across all years was 243,947. Results are based on the Bayesian model, which is described in Appendix B.

IAH = Independence at Home; PBPM = per beneficiary per month.

b.　Yearly effect

Both models suggested that expenditure reductions associated with the demonstration might be increasing over time, but those results were again not statistically significant in any of the four years. In each year, average expenditures for IAH beneficiaries decreased slightly more than for the comparison group (Appendix B, Table B.17). As a result, the Year 4 frequentist estimated effect showed a decrease of $282 PBPM for IAH beneficiaries (Figure II.2). This estimated −$282 represented a 6.4 percent reduction from the IAH group baseline mean, and it was larger than the estimates for previous years (ranging from –$178 to –$32). However, while the trend is promising, it could also reflect natural variation in the estimates.

The Bayesian estimated effect was –$169 in Year 4 (or a 4 percent reduction, Appendix B, Table B.19). The Bayesian model indicated that there was a 73 percent chance that the demonstration saved $100 or more PBPM in Year 4 (Figure II.3). These predicted probabilities were much larger than in Year 3, which were in turn much larger than Year 2. In other words, the chance that the demonstration reduced total Medicare expenditures was higher in Year 4 than in previous years. However, for both models in all demonstration years, the 90 percent

confidence/credible intervals were large, and the demonstration may have actually increased expenditures.

It is not possible to say with certainty what factors contributed to the substantial variation in estimated expenditure reductions across the four years of the demonstration. For example, most IAH practices reported that they made relatively few changes in staffing and care delivery during Year 1 relative to the previous year, yet we estimated a 41 percent probability of the demonstration payment incentive reducing expenditures $100 PBPM or more in Year 1. Perhaps of more interest was the large increase in expenditure reduction from Year 3 to Year 4. That large increase may have been related to improvements in the care provided by IAH practices, possibly because practices had more time to improve care processes. However, it is also possible that the large difference between Years 3 and 4 was related to other factors. For example, the increased expenditure reduction in Year 4 coincided with several IAH practices' participating in accountable care organizations (ACOs). However, we have no strong evidence about whether such participation may have led to higher or lower expenditure reductions in Year 4 than would have occurred without participation in ACOs.

c.   Aggregate effects on expenditures

We estimated the aggregate effect of the IAH demonstration payment incentive on expenditures across all IAH beneficiaries in each year by multiplying the expenditure reductions PBPM by the number of beneficiaries. Our results suggested that the IAH demonstration might have reduced Medicare expenditures about $50.1 million over the four years before accounting for the distribution of incentive payments to the IAH practices (Table II.2). The 90 percent confidence intervals were large and included zero, suggesting that we could not be confident about that potential reduction in expenditures. In Year 1, we estimated that the demonstration may have lowered expenditures by nearly $10 million but that amount decreased to just $2 million in Year 2. In Year 3, we estimated that the demonstration may have lowered expenditures by nearly $13 million, which represented a sixfold increase over the aggregate amount of reductions in Year 2. The Year 4 estimated reduction of more than $25 million was a near doubling of the Year 3 result. The larger estimates of aggregate expenditure reductions in Years 3 and 4 resulted mainly from the larger PBPM estimated effect in these later years (estimated effect of –$178 and –$282, respectively) than in Year 2 (estimated effect of –$32), though the substantial growth in the number of beneficiaries participating in Year 4 also contributed to the larger estimates.

As of the writing of this report, we do not know how much the sites will be paid through Year 4, so we cannot yet determine whether the amounts shared with the practices will be more, or less, than the decrease in expenditures that may have been generated by the payment incentive. However, for the first three years of the demonstration, the incentive payments were close to the estimated expenditure reduction. Over the first three years, CMS paid $24,210,149 in incentive payments to IAH practices, while we estimated that the incentive reduced expenditures by $24,693,393;[13] the difference was $483,244. Again, since the actual reduction in expenditures could have been considerably higher or lower than $24,693,393; net savings could have been

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[13] https://innovation.cms.gov/initiatives/Independence-at-Home/

much larger than $483,244, or the demonstration payment incentive may have actually increased expenditures.

2.   Hospital care use

a.   Four-year average annual effect

As shown in Figure I.1, we expected that the payment incentive would lead to changes in the delivery of home-based primary care and that those changes would reduce Medicare expenditures by reducing hospital care use such as hospital admissions, readmissions, and ED use. As was the case for total Medicare expenditures, we found no strong evidence that the demonstration reduced the number of hospital admissions or the probability of having an unplanned readmission over the four-year demonstration period. The four-year average annual effects for number of hospital admissions and the probability of having an unplanned readmission were less than 7 percent and not statistically significant (Figure II.4 and Appendix B, Table B.21). In contrast with the results for hospital admissions and probability of readmission, the demonstration had a statistically significant effect on ED visits over the four-year demonstration period. The number of ED visits decreased by 0.1 visit per beneficiary per year, or 4 percent (Figure II.4).

The four-year average annual effect of the demonstration on potentially avoidable hospital admissions and outpatient ED visits differed from the results for total hospital admissions and ED visits. Potentially avoidable hospital use is hospital use for ambulatory care sensitive conditions (ACSCs). Hospital admissions and ED visits for ACSCs might be prevented if primary and specialty care is provided in a timely and effective manner; examples include hospitalizations for ACSCs such as hypertension and pneumonia. The demonstration was associated with a reduction in hospital admissions for ACSCs but not with a reduction in outpatient ED visits for ACSCs. Since hospital admissions and outpatient ED visits for ACSCs are measures of quality of care, we present those results in Chapter III.

b.   Yearly effect

The estimated effects of the demonstration on the use of hospital care grew more favorable from Year 2 to Year 4, and that growth followed the same trend that we saw for total Medicare expenditures. Evidence of an effect in the later years of the demonstration was stronger for the readmission and ED measures than for the total expenditure and hospital admission measures.

The demonstration had no statistically significant effect on hospital admissions in Year 4 or any previous year, but the trend was favorable. The gradual increase in the difference in the number of hospitalizations between IAH and comparison beneficiaries in Years 3 and 4 (Appendix B, Table B.21) suggested that practices might have made changes that reduced hospital admissions. The yearly results for hospital admissions for ACSCs provide additional evidence of improvements made by the practices, as we discuss in Chapter III.

The demonstration payment incentive led to a statistically significant reduction in the probability of having an unplanned readmission among IAH beneficiaries in Year 4 and Year 3 relative to beneficiaries in the comparison group. The result in Year 4 was 2.1 percentage points (10.8 percent), and the effect in Year 3 was 1.9 percentage points (9.5 percent). Both IAH and

comparison beneficiaries were less likely to have an unplanned readmission in Year 4 than in the baseline year, but the decrease was larger for IAH beneficiaries (Appendix B, Table B.21).

The demonstration payment incentive led to a statistically significant reduction of 0.21 (or 7 percent) ED visits per beneficiary per year among IAH beneficiaries in Year 4, relative to the comparison beneficiaries (Figure II.4 and Appendix B, Table B.21). This estimated effect was somewhat larger than in Year 3 (a statistically significant reduction of 0.16 ED visits, or 5 percent), which was in turn larger than the effect on ED visits in Years 1 and 2. The total number of ED visits reflects ED visits that were accompanied by a hospital admission and those that were not accompanied by a hospital admission, which we refer to as outpatient ED visits. The proportion of total ED visits that were accompanied by a hospital admission decreased for IAH and comparison beneficiaries from the year before the demonstration to Year 4, suggesting that hospitals may have been trying to reduce hospital admissions in favor of observation stays or community-based primary care.

These results, combined with results for hospitalizations and ED visits for ACSCs in Chapter III, suggest that the decrease in total ED visits may have been driven in part by a decrease in ED visits for ACSCs that were accompanied by a hospital admission. We could not measure ED visits for ACSCs that were accompanied by hospital admission, because there was no diagnosis from the ED visit on the claim record for the hospital admission. However, we know the following:

- The demonstration led to a statistically significant decrease in ED visits that were accompanied by a hospital admission (Appendix B, Table B.21). The demonstration also led to a statistically significant decrease in hospital admissions for ACSCs.

- There was no statistically significant change in outpatient ED visits or outpatient ED visits for ACSCs.

If we assume that hospital admissions for ACSCs are correlated with ED visits for ACSCs that led to a hospital admission, then these findings suggest that a decrease in ED visits for ACSCs that led to a hospital admission may have contributed to the decrease in total ED visits.

Figure II.4. Estimated effect of the IAH demonstration payment incentive on hospital use for the four demonstration years and by year

Source: Mathematica's analysis of data from the IAH implementation contractor and Medicare claims and enrollment data for 2009–2016 obtained from the Virtual Research Data Center for IAH and matched comparison group beneficiaries in all IAH practices that participated in demonstration Year 4.

Notes: The total unweighted number of observations across all years was 243,947. We computed coefficients and standard errors by using the weighted sample size, which considers both the matching and eligibility weights. The horizontal lines represent 90 percent confidence intervals. If zero is within the confidence interval (denoted by horizontal lines), the estimated effect (denoted by dots) was not statistically significantly different from zero at the 90 percent confidence level. For example, the estimated effect on the probability of unplanned readmission was statistically significant in Years 3 and 4, but not in previous years. The probability of unplanned readmission equals zero for beneficiaries who did not have a qualifying hospital discharge or an unplanned readmission within 30 days of a qualifying hospital discharge during the measurement period.

*/**/***The difference is statistically significant at the 0.10/0.05/0.01 level.

ED = emergency department; IAH = Independence at Home.

We examined expenditures by subtype. The estimated effects of the demonstration on inpatient and outpatient expenditures were generally consistent with utilization results. The decrease in inpatient expenditures over time was consistent with the decreases in total hospital admissions, hospital admissions for ACSCs, predicted probability of readmission, and ED visits that led to a hospital admission. The demonstration might have modestly reduced inpatient

expenditures in Year 4, contributing to $156 of the $282, or 55 percent of the estimated reduction in total Medicare expenditures (Figure II.5 and Appendix B, Table B.20). However, the effect of the demonstration on inpatient expenditures was not statistically significant on average over the four years or in any individual year; this was also the case with hospital admissions. Consistent with the results for outpatient ED visits and outpatient ED visits for ACSCs, outpatient expenditures decreased only slightly over time, and the decreases were not statistically significant.

Figure II.5. Estimated effect of the IAH demonstration payment incentive on categories of Medicare expenditures for the four demonstration years and by year
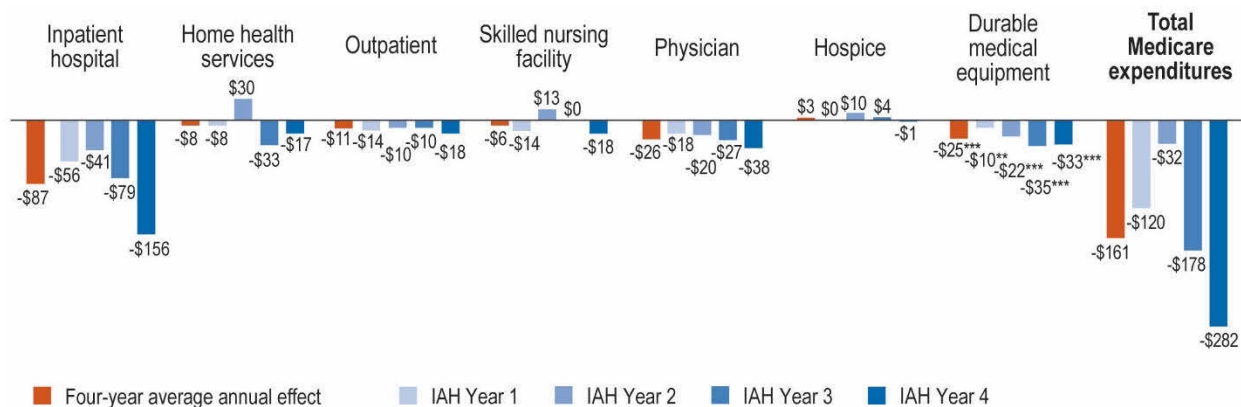
Source: Mathematica's analysis of data from the IAH implementation contractor and Medicare claims and enrollment data for 2009–2016 obtained from the Virtual Research Data Center for IAH and matched comparison group beneficiaries in all IAH practices that participated in demonstration Year 4.

Notes: The total unweighted number of observations across all years was 243,947. We computed coefficients and standard errors by using the weighted sample size, which considers both the matching and eligibility weights. The figure reports the estimated effect of each year and four years combined. Physician expenditures include expenditures from the Physician/Supplier Part B claims (known as the Carrier file). Claims are from noninstitutional clinicians (such as physicians, physician assistants, clinical social workers, and nurse practitioners) and from free-standing facilities. Outpatient expenditures include services furnished in hospital outpatient departments, federally qualified health centers, rural health clinics, renal dialysis facilities, outpatient rehabilitation facilities, comprehensive outpatient rehabilitation facilities, and community mental health centers.

*/**/***The difference is statistically significant at the 0.10/0.05/0.01 level.

IAH = Independence at Home

c.   Aggregate effects on hospital use

We used the same method to estimate the aggregate effects of the IAH demonstration on hospital use that we used to estimate the aggregate effect on total expenditures. Among the 32,550 IAH beneficiaries who became eligible over the four demonstration years, the demonstration may have led to 1,879 fewer hospital admissions, 3,462 fewer ED visits, and 411 fewer beneficiaries having an unplanned readmission. Except for ED visits, the 90 percent confidence intervals of the other two hospital care use estimates included zero, again suggesting substantial uncertainty surrounding them. In Year 4, the demonstration also led to a total of 827 fewer hospital admissions, 1,579 fewer ED visits, and 201 fewer IAH beneficiaries having an unplanned readmission. The aggregate estimated effects for ED visits and readmission were statistically significant at the 90 percent confidence level (that is, the upper limit of the

confidence interval was below zero). These estimates suggested an improvement over the aggregate effects in Years 2 and 3, which reflected the larger number of IAH beneficiaries in Year 4 as well as the larger reduction in those outcomes in Year 4. The large confidence intervals, or lack of precision, around the estimates for all outcomes in all years suggested that these estimates might have understated or overstated the demonstration's overall results.

Table II.2. Estimated effects of IAH demonstration on outcomes: Aggregate results

	Total Medicare expenditures		Number of hospital admissions		Number of ED visits		Number of beneficiaries having an unplanned readmission	
	Aggregate effect	90 percent CI	Aggregate effect	90 percent CI	Aggregate effect	90 percent CI	Aggregate effect	90 percent CI
Year 1	−$9,741,494	−$22,412,928; $2,929,941	−328	−719; 63	−728	-1,599; 143	3	-105; 111
Year 2	−$2,193,523	−$18,161,99; $13,774,946	−177	−751; 397	0	−669; 669	−74	−214; 66
Year 3	−$12,758,376	−$31,413,98; $5,897,234	−542	−1,235; 151	−963*	−1,854; −72	−140*	−254; −25
Year 4	−$25,470,413	−$55,862,945; $4,922,119	−827	−1,816; 162	−1,579*	−2,568; −589	−201*	−389; −14
Cumulative aggregate effect through Year 4	−$50,061,345	−$124,489,320; $24,366,631	−1,879	−4,226; 469	−3,462*	−5,940; −984	−411	−911; 89

Source: Mathematica's analysis of data from the IAH implementation contractor and Medicare claims and enrollment data from 2009–2016 obtained from the Virtual Research Data Center for IAH and matched comparison group beneficiaries in all IAH practices that participated in demonstration Year 4.

Notes: This table shows the aggregate difference-in-differences estimated effects for key outcomes for IAH-eligible beneficiaries, over all IAH practices during Years 1 through 4 of the demonstration. These calculations are based on the beneficiary-level estimates reported in Figures II.2 and II.4 and on the number of IAH beneficiaries and eligible beneficiary months in each year. The aggregate results for total expenditures, number of hospital admissions, and ED visits are calculated by multiplying the beneficiary-level estimated effect by the number of IAH beneficiary months (for expenditures) or by the number of IAH beneficiary months in each year divided by 12 (for admissions and ED visits that are measured yearly). The aggregate results for unplanned readmission are calculated by multiplying the beneficiary-level estimated effect by the number of IAH beneficiaries in each year. The numbers in this table might not correspond exactly to Figures II.2 and II.4 because of rounding. The total numbers of IAH beneficiaries in the annual analysis sample were 8,216 in Year 1; 7,266 in Year 2; 7,564 in Year 3; and 9,504 in Year 4. The numbers of eligible beneficiary months for the same numbers of IAH beneficiaries were 79,396 in Year 1; 69,768 in Year 2; 72,215 in Year 3; and 90,223 in Year 4.

*/**/***The difference is statistically significant at the 0.10/0.05/0.01 level.

CI = confidence interval; ED = emergency department; IAH = Independence at Home.

3. Findings on subgroups of patients and practices

We examined subgroups of patients and practices to understand whether the demonstration payment incentive had greater effects on certain groups than on others. Specifically, we compared effect estimation results for Medicare expenditures and hospital care use between beneficiaries with and without dementia, because our previous analysis suggested that there might be differences in how beneficiaries with dementia respond to home-based primary care. We also performed separate analyses for the three types of practices we described in Chapter I (VPA, academic medical centers, and independent practices) to assess the extent to which the demonstration had different effects on beneficiaries at different types of practices.

Overall, the results from the patient subgroup analysis suggested that the effects of the demonstration for patients with dementia and patients without dementia were similar in size and direction (increase or decrease). Whether the results were statistically significant at a conventional level sometimes varied between the two subgroups. However, results from both groups aligned with general findings from the analysis of all beneficiaries. For example, the demonstration seemed to have favorable effects on ED visits and the likelihood of readmission for beneficiaries with and without dementia in Years 3 and 4 (Appendix B, Tables B.26–B.29) relative to the comparison groups. Estimated decreases in ED visits were similar in magnitude for the two groups in Years 3 and 4, though the decreases were significant only for beneficiaries with dementia in Year 3 and beneficiaries without dementia in Year 4. The demonstration led to a decreased likelihood of an unplanned readmission by about 2 percentage points for both subgroups in Year 4, although the estimated effect in Year 3 was larger and statistically significant for beneficiaries without dementia. For both subgroups of beneficiaries, the estimated effects on total Medicare expenditures and hospital admissions were favorable, but not statistically significant in most cases.

In assessing the effects on different types of practices, we found some evidence that the independent practices (Austin, Brooklyn, Durham, and Portland) might have been more successful at reducing the use of hospital care than VPA or academic medical centers (Appendix B, Tables B.30–B.33). In Years 3 and 4, the number of ED visits declined significantly more for IAH beneficiaries in independent practices than for the comparison beneficiaries, by 0.40 to 0.52 annual visits (or 16 to 21 percent). In contrast with independent practices, there was no significant effect of the demonstration on ED visits for VPA or academic medical centers. The estimated reduction in the likelihood of readmission for IAH beneficiaries at independent practices was about 4 percentage points (or 23 percent) in Years 3 and 4, and the estimated reduction was statistically significant in Year 3 (but not Year 4). Compared with the estimates for independent practices, the estimated reductions in the likelihood of readmission for IAH beneficiaries at VPA and academic medical centers in Years 3 and 4 were somewhat smaller (1 to 3 percentage points) and none were statistically significant. The estimated decreases in total Medicare expenditures and hospital admissions for independent practices were larger than the estimated changes for the other two types of practices, although none of the yearly estimated effects for total expenditures or hospital admissions was statistically significant for any of the practice types.

4.   Alternative ways of estimating the effect

To see if changes in our assumptions or data led to meaningful changes in the estimated effect of the payment incentive from the frequentist model, we conducted four tests that we refer to as sensitivity analyses. We found that our results were robust. None of these alternative approaches changed the substantive findings; the estimated effect sign (positive or negative) and statistical significance of the yearly estimated effects on Medicare total expenditures remained the same (Appendix B, Tables B.34, B.40, B.41, and B.42).

The following are four tests we conducted:

- We examined whether our results were sensitive to the choice of baseline period by using two years before the demonstration as the baseline rather than one year.

- We assessed whether our results were sensitive to extremely large values by replacing outlier expenditure values with the largest value that was not considered an outlier.

- Since a few IAH practices began offering home-based primary care in new counties during the demonstration, we tested whether changes in the geographic composition of beneficiaries affected our estimated effects. To do this, we restricted the IAH group for each practice in each year to people who lived in one of the counties where IAH beneficiaries lived in the year before the demonstration.

- Some IAH practices accounted for a much larger share of the pooled sample in Year 4 than in the year before the demonstration, and other IAH practices accounted for a much smaller share of the pooled sample in Year 4 than in the year before the demonstration. To determine whether the results were affected by relative changes in sample size across IAH practices, we removed the effect of changes in practice size from the estimated effects. To do this, we adjusted the regression weights so that the weighted sum of beneficiaries within a single practice was equal across all sites for all years. For example, the weighted sum of beneficiaries in Durham (which was larger than most other IAH practices) equaled the weighted sum of beneficiaries in Portland (which was smaller than most other IAH practices), and those weighted sums were the same across all years.

Full details of these sensitivity analyses are in Appendix B, Section VI, with results in Appendix B, Section X (Appendix B, Tables B.34–B.42).[14]

C. Did the demonstration payment incentive affect use and expenditures of other types of services?

The IAH demonstration is based on the premise that providing home-based services will improve access to primary care, which will in turn decrease the need for inpatient acute care and possibly also post-acute care. However, whenever practices are given a financial incentive to reduce care, there is concern that clinicians might reduce care too much, potentially resulting in adverse health outcomes for beneficiaries. Thus, it is important to examine the demonstration effects on nonhospital care use, such as SNF, hospice, and home health use and physician visits by primary care clinicians or specialists, to identify consequences of the payment incentive. As with our analyses in Section C, we compared the changes in these outcomes over time for IAH beneficiaries and their matched comparison beneficiaries in the year before the demonstration and after the demonstration.

1. Skilled nursing facility, hospice, and home health use

The financial incentive for IAH practices to deliver more coordinated care might prompt practices to better understand patients' needs and preferences. An improved understanding of patients' preferences by practices could lead to more use of home health and hospice services

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[14] We performed the first sensitivity analysis (effect of using two years for baseline) on all outcomes reported in this chapter. For the second sensitivity analysis (effect of removing outliers), we examined total Medicare expenditures, the number of hospital admissions, and the number of ED visits. For the other two sensitivity analyses, we examined total Medicare expenditures, the number of hospital admissions, number of ED visits, and the probability of readmission within 30 days of hospital discharge.

and less SNF use among IAH beneficiaries than among beneficiaries who were treated by practices that did not participate in IAH.

a. Four-year average annual effect

Over the four demonstration years, the demonstration did not lead to statistically significant changes in the probability of SNF, hospice, or home health use among IAH beneficiaries (Table II.3 and Table II.4). Similarly, we found no evidence that the demonstration led to changes in the number of home health days or home health visits (Table II.4).

Table II.3. Estimated effect of IAH on SNF and hospice use

Period	Probability of SNF use in percentage points		Probability of hospice use in percentage points	
	Estimated effect (standard error)	Percentage effect[a]	Estimated effect (standard error)	Percentage effect[a]
Four-year average annual effect[b]	0.19 (0.82)	0.5	−0.83 (0.68)	−4.6
Year 4	−0.12 (1.22)	−0.3	−2.04** (0.90)	−11.4
Year 3	0.26 (0.89)	0.6	−0.46 (0.88)	−2.6
Year 2	1.29 (1.06)	3.1	0.03 (0.81)	0.2
Year 1	−0.48 (0.75)	−1.2	−0.56 (0.73)	−3.1
Two years before demonstration	1.07 (0.91)	2.6	−1.75** (0.76)	−9.8

Source: Mathematica's analysis of data from the IAH implementation contractor and Medicare claims and enrollment data for 2009–2016 obtained from the Virtual Research Data Center for IAH and matched comparison group beneficiaries in all IAH practices that participated in demonstration Year 4.

Notes: The total unweighted number of observations across all years was 243,947. We computed coefficients and standard errors by using the weighted sample size, which considers both the matching and eligibility weights. The table reports the estimated effect of each year and four years combined. Standard errors are reported in parentheses.

[a]We use the unadjusted IAH group mean in the year before the demonstration to calculate the percentage effect for each demonstration year. Appendix B, Table B.13 reports the baseline unadjusted IAH group means for all outcomes.

[b]We estimated a separate model using a single demonstration indicator (instead of separate indicators for each demonstration year) and used its interaction with IAH status to obtain an average annual estimated effect across four demonstration years.

*/**/***The difference is statistically significant at the 0.10/0.05/0.01 level.

IAH = Independence at Home; SNF = skilled nursing facility.

Table II.4. Estimated effect of IAH on home health use

Period	Probability of home health use in percentage points		Home health days per beneficiary per year		Number of home health visits per beneficiary per year	
	Estimated effect (standard error)	Percentage effect[a]	Estimated effect (standard error)	Percentage effect[a]	Estimated effect (standard error)	Percentage effect[a]
Four-year average annual effect[b]	−0.45 (0.70)	−0.5	−0.58 (5.67)	−0.4	0.14 (2.43)	0.2
Year 4	−0.17 (0.84)	−0.2	−3.31 (8.69)	−2.0	−1.02 (4.20)	−1.6
Year 3	−0.84 (0.83)	−0.9	−5.02 (7.74)	−3.0	−1.36 (3.47)	−2.2
Year 2	−0.26 (0.76)	−0.3	7.25 (6.99)	4.4	5.20** (2.32)	8.4
Year 1	−0.43 (0.55)	−0.5	−0.98 (3.39)	−0.6	−1.74 (1.83)	−2.8
Two years before demonstration	−1.26*** (0.47)	−1.4	−0.78 (4.29)	−0.5	1.17 (2.07)	1.9

Source: Mathematica's analysis of data from the IAH implementation contractor and Medicare claims and enrollment data for 2009–2016 obtained from the Virtual Research Data Center for IAH and matched comparison group beneficiaries in all IAH practices that participated in demonstration Year 4. The data exclude three practices (Atlanta, Chicago, and Stuart), which withdrew from the demonstration before Year 4, and one practice (Louisville) terminated for cause.

Notes: The total unweighted number of observations across all years was 243,947. We computed coefficients and standard errors by using the weighted sample size, which considers both the matching and eligibility weights. The table reports the estimated effect of each year and four years combined. Standard errors are reported in parentheses.

[a]We use the unadjusted IAH group mean in the year before the demonstration to calculate the percentage effect for each demonstration year. Appendix B, Table B.13, reports the baseline unadjusted IAH group mean for all outcomes.

[b]We estimated a separate model using a single demonstration indicator (instead of separate indicators for each demonstration year) and used its interaction with IAH status to obtain an average annual estimated effect across four demonstration years.

*/**/***The difference is statistically significant at the 0.10/0.05/0.01 level.

IAH = Independence at Home.

b.   Yearly effect

We examined whether the effect of the demonstration on use of SNF, hospice, and home health services varied by performance year.

The estimated effects of the demonstration on SNF use in the four individual demonstration years were small, not statistically significant, and varied in terms of whether the estimated change was an increase or decrease in SNF use. Taken together, these results suggest no effect of the demonstration on SNF use.

We found no convincing evidence that the demonstration affected hospice use. For the first three years, the results suggested little effect of the demonstration on the probability of hospice use. However, in Year 4, the probability of hospice use increased for beneficiaries in the comparison group and decreased for IAH beneficiaries (Appendix B, Table B.22). As a result, Year 4 showed a reduced probability of hospice use by 2.0 percentage points (or 11 percent) for IAH beneficiaries relative to beneficiaries in the comparison group. This is the opposite direction of the theorized effect of the model, since we anticipated an increase in hospice referrals. There are a few reasons why we think it is unlikely that the demonstration caused a reduction in hospice use in Year 4. First, we found that the probability of hospice use by the IAH group

increased significantly during the two years before the demonstration, relative to the matched comparison group. We refer to a statistically significant change during the pre-demonstration years for IAH beneficiaries relative to comparison beneficiaries as nonparallel pre-existing trends. This sign of nonparallel pre-existing trends between the two groups raised a concern about the validity of the estimated effects for hospice use. Furthermore, when we combined data from the two years before the demonstration instead of using a one-year baseline period, the estimated effect on hospice use in Year 4 was not statistically significant and was smaller than the estimated effect we reported in Table II.3 (Appendix B, Table B.38). The difference in the estimated effect in Year 4 when we used a one-year baseline compared to when we used a two-year baseline contributed to our conclusion that hospice care was not affected by the demonstration payment incentive.

The demonstration did not affect the use of home health services overall. The probability of receiving home health services did not change significantly in any demonstration year, and there were equally small estimates of the effect on the number of home health days. The estimated effect for the number of home health visits in Year 2 was positive and statistically significant (5.2 visits, or 8 percent), mainly due to the relatively larger increase in home health visits among the IAH beneficiaries, which did not persist into Years 3 and 4 (Appendix B, Table B.23).

Consistent with the nonsignificant utilization results, the estimated effects for SNF, hospice, and home health expenditures suggested no effect of IAH demonstration overall or in any year. However, we found a statistically significant reduction in DME expenditures, which persisted throughout the demonstration period (Figure II.3). Over the four years, the DME expenditures for IAH beneficiaries decreased more than for the comparison beneficiaries by an additional $25 (or 17 percent).

2. Number of visits to primary care and specialist clinicians

We expected to see more visits to primary care clinicians for the IAH beneficiaries relative to their matched comparison groups in both the pre- and post-demonstration periods because home-based primary care eliminated the travel barriers these patients faced. In addition, since earning an incentive payment required a practice to meet quality measures such as visiting patients within 48 hours of a hospital discharge or ED visit, IAH practices may have visited some of their patients more frequently in the post-demonstration period. We had no a priori assumption on how IAH would affect the number of specialist visits. Visits to specialists might increase or decrease, depending on whether home-based primary care visits led to more referrals to specialists or provided services that substituted for specialty care.

a. Four-year average annual effect

We found no strong evidence that the demonstration increased the number of primary care or specialist visits. Over the four demonstration years, the average number of primary care visits per beneficiary annually rose 0.6 visits more for IAH beneficiaries than for comparison beneficiaries (or 5 percent, Table II.5). The four-year average estimated effect was not statistically significant. On the other hand, the number of specialist visits declined faster among the IAH beneficiaries by about 0.4 specialist visits more per beneficiary per year (or 7 percent), but again the estimate was not statistically significant.

In addition to the fact that the estimated increase in primary care visits was not statistically significant, any difference in primary care visits during the post-demonstration period could be due to changes that began during the pre-demonstration period. Primary care visits for IAH beneficiaries increased significantly more quickly during the two years before the demonstration, relative to the comparison beneficiaries during the same time period (Figure II.6 and Table II.5). The increasing difference in primary care visits between IAH and comparison beneficiaries from two years before the demonstration to the year before the demonstration could have continued during the demonstration period.

b. Yearly effect

We did not find clear evidence that the small increases in primary care visits were related to the demonstration payment incentive. We found small, nonsignificant differences since the first demonstration year that resulted in possible increases in primary care visits for the IAH group relative to the comparison group in Years 2 through 4 (Figure II.6). However, as we discussed previously, the increasing difference in primary care visits between IAH and comparison beneficiaries from two years before the demonstration to the year before the demonstration could have continued during the demonstration period. On the other hand, the pre-demonstration trend did not persist into Year 1, suggesting that the increasing difference in primary care visits between IAH and comparison beneficiaries from two years before the demonstration to the year before the demonstration could be due to a random change in primary care visits in the baseline year. To check how the volatility of outcome trends in the pre-demonstration period influences our estimated effects, we performed a sensitivity test using both pre-demonstration years as the baseline. Again, we did not find clear evidence that the demonstration payment incentive led to a change in primary care visits (Appendix B, Table B.36).

Figure II.6. Mean annual primary care visits per beneficiary per year for IAH and comparison beneficiaries
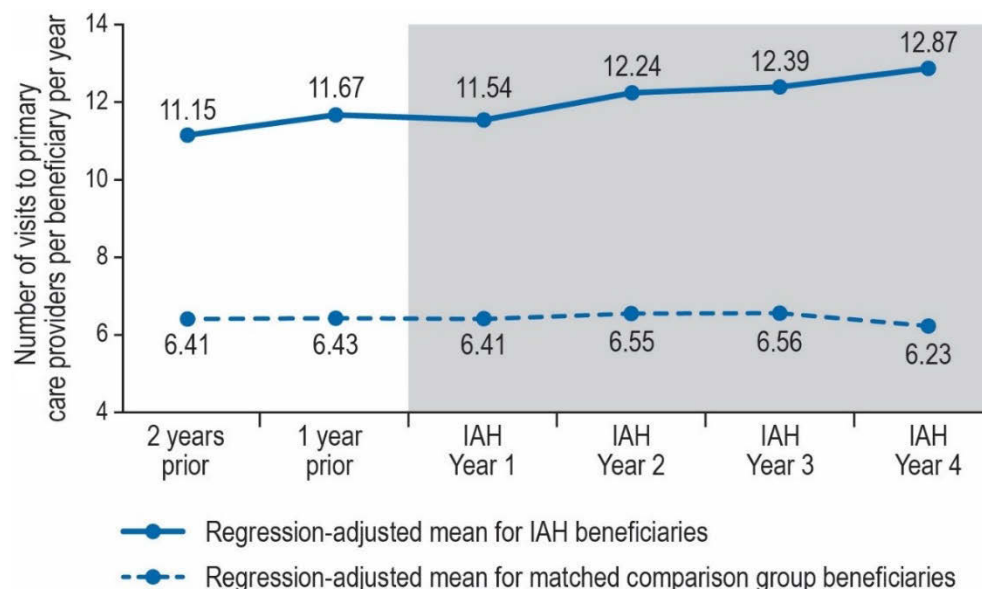
Source: Mathematica's analysis of data from the IAH implementation contractor and Medicare claims and enrollment data from 2009–2016 obtained from the Virtual Research Data Center for IAH and matched comparison group beneficiaries in all IAH practices that participated in demonstration Year 4. The data exclude three practices (Atlanta, Chicago, and Stuart) that withdrew from the demonstration before Year 4 and one practice (Louisville) terminated for cause.

Note: The figure reports regression-adjusted means, which we obtained by applying the estimated regression coefficients to the covariates of IAH beneficiaries in Year 4.

IAH = Independence at Home.

As with visits to primary care clinicians, there was weak evidence that the demonstration had a meaningful effect on specialist visits in a given year. Although the estimated effects were all in favorable directions, the size of the estimated effects varied somewhat in the four demonstration years, with only Year 2 having a statistically significant estimated effect. Finally, the demonstration payment incentive did not appear to affect physician or supplier expenditures in any demonstration year (Figure II.5).

Table II.5. Estimated effect of IAH on visits to primary care clinicians and specialists

Period	Visits in nonacute settings to primary care clinicians per beneficiary per year		Visits in nonacute settings to specialists per beneficiary per year	
	Estimated effect (standard error)	Percentage effect[a]	Estimated effect (standard error)	Percentage effect[a]
Four-year average annual effect[b]	0.59 (0.57)	5.3	−0.39 (0.32)	−6.9
Year 4	1.40 (1.02)	12.4	−0.30 (0.41)	−5.2
Year 3	0.58 (0.63)	5.2	−0.52 (0.35)	−9.2
Year 2	0.45 (0.55)	4.0	−0.55* (0.32)	−9.8
Year 1	−0.12 (0.31)	−1.1	−0.29 (0.32)	−5.0
Two years before demonstration	−0.50*** (0.17)	−4.4	−0.07 (0.19)	−1.2

Source: Mathematica's analysis of data from the IAH implementation contractor and Medicare claims and enrollment data for 2009–2016 obtained from the Virtual Research Data Center for IAH and matched comparison group beneficiaries in all IAH practices that participated in demonstration Year 4.

Notes: The total unweighted number of observations across all years was 243,947. We computed coefficients and standard errors by using the weighted sample size, which considers both the matching and eligibility weights. The table reports the estimated effect of each year and four years combined. Standard errors are reported in parentheses.

[a]We use the unadjusted IAH group mean in the year before the demonstration to calculate the percentage effect for each demonstration year. Appendix B, Table B.13, reports the baseline unadjusted IAH group mean for all outcomes.

[b]We estimated a separate model using a single demonstration indicator (instead of separate indicators for each demonstration year) and used its interaction with IAH status to obtain an average annual estimated effect across four demonstration years.

*/**/***The difference is statistically significant at the 0.10/0.05/0.01 level.

IAH = Independence at Home.

D.   Did the demonstration payment incentive affect mortality?

In addition to examining the effect of the demonstration on expenditures and utilization, we examined whether the demonstration was associated with increased mortality among IAH beneficiaries.[15] Better access to high-quality primary care under the demonstration may allow IAH beneficiaries to make more informed choices about managing their care. Since the demonstration targets a population that has multiple chronic conditions and significant functional limitations, some beneficiaries may make choices that lead to an earlier death while at the same time are consistent with their values and preferences. Therefore, we did not expect the

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[15] We also examined the effect of the demonstration on the probability of beneficiaries' entering institutional long-term care, since entry into long-term care could be a potential unintended consequence. However, we are working with CMS to resolve potential issues with the measure of entering institutional long-term care.

demonstration to reduce mortality. However, we wanted to ensure that the demonstration payment incentive did not result in an unintended consequence of more deaths. To do that, we examined changes in mortality for the IAH group relative to changes for the comparison group.

We found no evidence that the demonstration adversely affected mortality across the four demonstration years. The difference between the two groups remained stable in Years 1 through 3, indicating no significant effect of the demonstration on mortality (Figure II.7 and Table II.6). The mortality difference between the two groups widened in Year 4, suggesting an effect of 1.4 percentage points (or 8 percent) reduction in mortality for IAH beneficiaries relative to the comparison group. This estimated effect was statistically significant, driven by both a decrease in mortality for the IAH group and an increase for the comparison group from Year 3 to Year 4. However, given the lack of consistent trends in mortality for the IAH and comparison groups before and during the demonstration, we did not have sufficient evidence to conclude that the reduced mortality for IAH beneficiaries in Year 4 was due to the demonstration. As a part of testing our ability to be confident in the conclusions being drawn, we examined trends in mortality before the demonstration. Mortality among the IAH beneficiaries increased significantly faster than among the comparison group in the two years before the demonstration. The significant difference in mortality between IAH and comparison beneficiaries in the pre-demonstration period was a concern, because our ability to attribute changes during the demonstration to the payment incentive relied on an assumption that outcomes like mortality changed at the same rate for both groups in the two-year pre-demonstration period. Our sensitivity analysis that combined two years of pre-demonstration data as the baseline period also suggested unstable yearly estimated effects—the demonstration led to a 1.8 percentage point *increase* in mortality in Year 3, and a 0.5 percentage point decrease in mortality in Year 4 (Table B.39). Taken together, our analyses of mortality suggested that the mortality trends were inconsistent for the IAH and comparison groups and that the estimated effects were sensitive to small changes in the estimation model such as using a two-year baseline period. It is possible that there were unmeasured differences between the IAH and comparison groups that contributed to mortality changes over time (we discuss this limitation in section E).

Figure II.7. Regression-adjusted probability of dying within twelve months for IAH and comparison beneficiaries
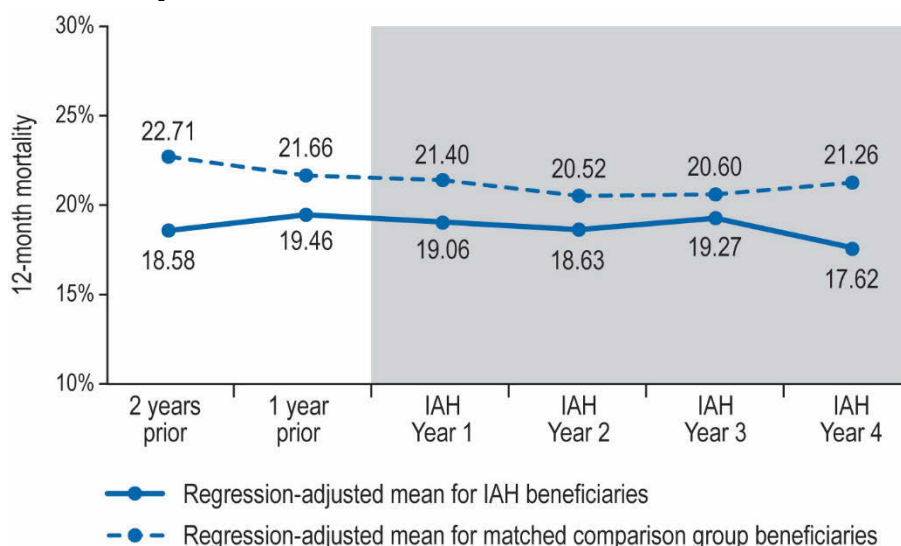
Figure II.7 (*continued*)

Source: Mathematica's analysis of data from the IAH implementation contractor and Medicare claims and enrollment data for 2009–2016 obtained from the Virtual Research Data Center for IAH and matched comparison group beneficiaries in all IAH practices that participated in demonstration Year 4.

Note: The figure reports regression-adjusted means, which are obtained by applying the estimated regression coefficients to the covariates of IAH beneficiaries in Year 4.

IAH = Independence at Home.

Table II.6. Estimated effect of IAH on 12-month mortality

Period	Estimated effect in percentage points (standard error)	Percentage effect[a]
Four-year average annual effect[b]	−0.2 (0.5)	−1.0
Year 4	−1.43*** (0.54)	−7.9
Year 3	0.87 (0.60)	4.8
Year 2	0.32 (0.65)	1.7
Year 1	−0.13 (0.55)	−0.7
Two years before demonstration	−1.93*** (0.68)	−10.7

Source: Mathematica's analysis of data from the IAH implementation contractor and Medicare claims and enrollment data for 2009–2016 obtained from the Virtual Research Data Center for IAH and matched comparison group beneficiaries in all IAH practices that participated in demonstration Year 4.

Notes: The total unweighted number of observations across all years was 243,947. We computed coefficients and standard errors by using the weighted sample size, which considers both the matching and eligibility weights. The table reports the estimated effect of each year and four years combined. Standard errors are reported in parentheses.

[a]We use the unadjusted IAH group mean in the year before the demonstration to calculate the percentage effect for each demonstration year. Appendix B, Table B.13, reports the baseline unadjusted IAH group mean for all outcomes.

[b]We estimated a separate model using a single demonstration indicator (instead of separate indicators for each demonstration year) and used its interaction with IAH status to obtain an average annual estimated effect across four demonstration years.

*/**/***The difference is statistically significant at the 0.10/0.05/0.01 level.

IAH = Independence at Home.

E. Limitations and conclusion

1. Limitations

This study was subject to several important limitations. In this section, we discuss these limitations and the implications for interpreting the results. Additional discussion of these and other limitations are in Appendix B.

First, this examination was not designed to draw conclusions about how the IAH demonstration might affect outcomes for Medicare FFS beneficiaries who receive home-based primary care from practices other than those in the demonstration. The IAH practices were not selected to represent the national population of practices providing home-based primary care. In addition, because of the small size of the demonstration, we lacked the statistical power to identify small effects of the demonstration across all demonstration sites. For example, before the demonstration, we calculated that the smallest effect on total Medicare expenditures we would likely identify as statistically significant was $306 PBPM, or 7 percent of the average monthly expenditures for the IAH group in the year before the demonstration. Therefore, it was unlikely that we would have identified a reduction in expenditures of $282 (the estimated effect in Year 4) as statistically significant.

Second, to have a consistent comparison group across time, we limited the analysis to beneficiaries who we deemed eligible for the demonstration in each year using administrative data. If a beneficiary was eligible for and enrolled in the demonstration in one year and continued to be enrolled in the demonstration the next year, that beneficiary was in our sample in the next year only if he or she met all of the demonstration eligibility criteria again. This meant that we excluded beneficiaries who avoided recent hospital stays or use of rehabilitation services (two of the demonstration eligibility criteria). The value of the demonstration for beneficiaries with chronic conditions who recently avoided hospital stays or use of rehabilitation services is not known and might differ from what we measured in the study.

Third, inaccurate estimates of the effect of the IAH demonstration could also arise from changes in unmeasured characteristics in the patient population over time. If an unmeasured characteristic changes differently for IAH and comparison beneficiaries, and if that characteristic affects a particular outcome, then the estimated effect of IAH on that outcome would be biased. For example, we do not know how the proportion of IAH and comparison beneficiaries who reside in an assisted living facility changed over time, because we cannot use administrative data to determine whether a beneficiary resides in an assisted living facility. We learned during visits to IAH practices that some assisted living facilities have policies that require staff to call 911 any time a resident falls, even if the resident appeared unharmed. If that was the case for most assisted living facilities, being in an assisted living facility could be associated with higher ED visits not resulting in a hospitalization.[16] Under these conditions, we would underestimate the effect of the demonstration on outpatient ED visits because we could not control for type of residence.

Another factor that may have caused unmeasured changes in the IAH and comparison groups over time was the participation of several IAH practices in ACOs in Year 4. Our sample includes IAH-eligible patients of IAH practices who were treated by other providers in an ACO. ACO patients treated by the IAH sites might have been healthier (or sicker) on average than other non-ACO IAH beneficiaries. If ACO and non-ACO IAH beneficiaries had differences in health status that affected Medicare expenditures but which we could not measure in administrative data, and if the comparison group did not experience a similar change in health status, then participation in ACOs would cause bias in our results in Year 4 and the average annual effect of the demonstration.

Fourth, our estimated effects are based on a difference-in-differences analytic approach that looks for changes in trends before and after the intervention. This method assumed that the outcomes of IAH and matched comparison groups followed the same trend before the demonstration. That is, we assumed that outcomes changed at the same rate for both groups in the two-year pre-demonstration period, so any difference in outcomes between the two groups would remain the same during the demonstration period unless the demonstration caused a

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[16] The alternative could also occur. Beneficiaries residing in an assisted living facility may be less likely to go to the ED because they interact regularly with staff in the facility, unlike beneficiaries living in private homes who may be alone for days at a time. If that were the case, and if there was an increase in the proportion of beneficiaries residing in assisted living facilities in the IAH group relative to the comparison group, then outpatient ED use might be lower for IAH beneficiaries for a reason unrelated to the IAH demonstration.

change. We examined this assumption by testing whether the outcomes changed differentially in the pre-demonstration period, and most outcomes did not change differentially.[17] However, for the a few outcomes with a differential trend before the demonstration, our results could be biased.

Finally, data constraints could limit which effects we were able to measure. Our measures of primary care and specialty care visits came from the physician/supplier claims, which enabled us to identify whether the clinician was a primary care clinician (including NP or PA) or a specialty physician. We excluded care from institutional settings because we were attempting to assess primary care and wanted to exclude care that occurred during acute care episodes like a hospitalization. However, this methodology also excluded care from institutional providers that operated in settings other than acute and post-acute care, such as clinicians in rural health clinics and federally qualified health centers. Also, the data sources available to us did not allow us to report the effect of the demonstration on entry into a nursing home or other institutional long-term care. Entry into long-term care is an outcome that matters to patients and their caregivers, and it affects Medicaid expenditures. We continue to explore the best way to measure long-term care use.

2.   Conclusion

Our findings suggest that the IAH demonstration may have reduced expenditures and some types of hospital care use during the IAH demonstration. As we discuss in Chapter III, qualitative information we gathered annually from the practices suggested that IAH practices made changes in how they provided care during the demonstration. When interpreting the effects of the demonstration on expenditures and hospital care use, we took into account changes reported by IAH practices, the consistency of the direction (increase or decrease) of the effects of the demonstration, and the possibility that the effects increased over time. We also considered the fact that because of the small size of the demonstration, we would have been unlikely to identify a reduction in expenditures of 3.7 percent—which is the average annual estimated effect of IAH on expenditures across the four years—as statistically significant. Taken together, this information suggested that IAH might have decreased expenditures and hospital care use, particularly in later years of the demonstration. However, there may have also been differential changes over time in unobserved patient characteristics of IAH and comparison beneficiaries, especially in Year 4, which could have caused bias in the estimated effects of the demonstration. The possibility of differential changes over time in unobserved patient characteristics made it more challenging to interpret the effect of the demonstration payment incentive in the later years.

a.   Effects on Medicare expenditures and hospital use

The sites reported that they responded to the demonstration payment incentive, but we could not be confident that their efforts reduced Medicare expenditures. Estimates of the overall annual change in expenditures (that is, average annual estimated effects across four demonstration years) showed reductions in total Medicare expenditures relative to the pre-demonstration year,

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[17] Outcomes for which the parallel-trend assumption did not hold included mortality, probability of hospice use, probability of home health use, and number of visits to primary care clinicians. We discuss the implications earlier in Chapter II when we interpret the results for these outcomes.

but these reductions were not statistically significant. The overall reduction was $161 PBPM—3.7 percent of the IAH beneficiaries' group mean spending in the pre-demonstration year.

Although the probability that the demonstration payment incentive decreased Medicare expenditures over the course of four years by any amount was 69 percent, there was a 31 percent probability that it increased expenditures. In addition, the probability that it decreased expenditures by at least $100 PBPM—about 2 percent of the average—over the course of four years was just 29 percent.

The reduction in PBPM and total dollar expenditures observed could have been achieved by the sites as a result of the demonstration payment incentive. However, because of the limited number of sites and beneficiaries served—a design feature driven by the congressionally imposed beneficiary cap—we had only a low probability of detecting an effect this small as statistically significant. Thus, we could not conclude whether the measured reduction in expenditures were attributable to the demonstration payment incentive.

Although we observed no statistically significant reductions in overall average annual expenditures, the estimated effect of the demonstration on expenditures and hospital use appeared to be increasing over time, with Year 4 showing the largest effects. The estimated reduction in PBPM expenditures increased from less than $120 in the first two demonstration years to $178 in Year 3, and grew further to $282 in Year 4. None of these reductions in expenditures were statistically significant. The probability that the demonstration saved $100 PBPM or more in Year 2 was only 3 percent, and this probability increased to 38 percent in Year 3 and 73 percent in Year 4. However, we were more concerned about the possibility of unmeasured differences in beneficiary characteristics causing bias in the estimated effects in later years of the demonstration, because more time elapsed since the baseline year (year before the demonstration).

Consistent with the findings on total Medicare expenditures, we found no strong evidence that the demonstration reduced overall use of hospital care over the four-year demonstration period. We found a statistically significant reduction in total ED visits over the four-year demonstration period. The number of hospital admissions and probability of unplanned readmission also decreased during the same period, although the effects were not statistically significant. In addition, the estimated effects of the demonstration on the use of hospital care grew more favorable from Year 2 to Year 4, which followed the same trend that we saw for total Medicare expenditures. In Years 3 and 4, the demonstration was associated with a reduction in the number of ED visits and in the probability of having at least one unplanned readmission.

Cumulatively over the first four demonstration years, the demonstration might have saved an estimated $50.1 million in Medicare expenditures before accounting for the incentive payments disbursed or to be disbursed to the sites. These gross savings did not reach a level that we could confidently attribute to the demonstration. The actual amount might be much higher or lower, including the possibility that the demonstration *increased* expenditures. The aggregate effect on expenditures in Year 4 suggested an improvement over the aggregate effects in Years 2 and 3, which reflected the larger number of IAH beneficiaries as well as the larger potential reduction in expenditures in Year 4. Underlying the $50.1 million in savings across the four demonstration years were an estimated 1,879 fewer hospital admissions and 3,462 fewer ED visits resulting in a

hospital admission for the 32,550 beneficiaries. However, like the aggregate expenditure results, the wide confidence intervals, or lack of precision, around the aggregate estimates of changes in hospital care use suggested that both the cumulative and underlying annual estimates for the effect of the demonstration could be considerably higher or lower.

Over the first three years of the demonstration, we estimated that the demonstration payment incentive saved $24,693,393, while CMS paid $24,210,149 in incentive payments, for a savings of $483,244 from the program. Again, we note that the actual expenditure reduction could have been considerably higher or lower than $24,693,393, and thus net savings could have been much larger than $483,244, or the program may have actually increased expenditures.

Over the course of the demonstration, IAH practices reported developing more systematic approaches to improving care. Although we could not attribute the potential reductions in Medicare expenditures to these factors or to any of the other changes they made, the reductions were consistent with progress toward improved care and increased savings. The increased savings could be related to improvements in care, with Year 4 showing the largest effects, possibly because practices have had more time to improve care processes. However, it is also possible that these large differences between Years 3 and 4 were related to unmeasured changes among IAH beneficiaries relative to comparison beneficiaries during this time period. This was a particular concern in Year 4, when several IAH practices participated in ACOs as part of a network of providers. However, we have no strong evidence about whether such participation may have led to higher or lower expenditure reductions in Year 4 than would have occurred without participation in ACOs.

b.   Effects on use of other types of services

Because one goal of home-based primary care is to improve access to appropriate and necessary care, it is important to understand how the demonstration payment incentive affected non–hospital service use. We found no strong evidence that the demonstration increased the number of primary care or specialist visits. Similarly, the demonstration did not affect home health use, SNF care, or hospice care.

c.   Effect on mortality

We found no compelling evidence that the demonstration payment incentive had an unanticipated adverse effect on mortality across the demonstration years.

III. HOW DID IAH PRACTICES DELIVER CARE AND CHANGE DURING THE DEMONSTRATION?

The legislation that established the IAH demonstration provided a payment incentive to reward IAH practices that reduced unnecessary Medicare expenditures. At the same time, CMS monitored performance on quality measures to discourage potentially harmful reductions in expenditures. In Chapter I, we described characteristics of the IAH practices. In Chapter II, we examined whether the IAH demonstration affected Medicare expenditures, service utilization, and mortality. To understand why and how the payment incentive may have affected outcomes, we needed to understand changes that the participating IAH practices made during the demonstration. In particular, because the amount of the incentive payment depended on performance regarding hospital admissions and ED visits for ACSCs and readmissions, we expected practices to implement changes designed to reduce those outcomes. Finally, to better understand how the payment incentives affected clinician behavior and the care beneficiaries received, we also examined whether the IAH beneficiaries' characteristics and the location of IAH clinicians' visits changed over time and how IAH beneficiaries and their caregivers viewed their care.

We begin by presenting the evaluation approach in Section A. In Section B, we use data from interviews with IAH practices to identify changes practices made to try to improve their performance on demonstration quality measures. We also use claims data to determine whether those efforts were consistent with improved outcomes. In Section C, we use data from interviews with IAH practices and interviews with care partners of IAH practices to describe changes made by IAH practices. We also use claims data to examine changes in the types of clinicians working for IAH practices. Then, in Section D, we measure changes in IAH beneficiaries' characteristics, geographic area, and location of visits. In Section E, we explore how IAH beneficiaries and their caregivers viewed the care the beneficiaries received from the IAH practice. In Section F, we discuss limitations and summarize the information we provide in this chapter.

Key takeaways of these analyses include the following:

- To provide follow-up contacts within 48 hours of hospital and ED use, as required by the demonstration, many practices added staff to their care teams such as nurse case managers. Some practices expanded their use of electronic medical records or electronic health information exchanges.

- Some practices tried to reduce admissions, readmissions, and ED visits by making care more comprehensive and responsive to patients' needs, for example, by increasing follow-up for patients with high rates of hospital use.

- In Years 3 and 4, the demonstration decreased potentially avoidable hospital admissions and the probability of a beneficiary's having at least one unplanned readmission. However, the demonstration did not decrease potentially avoidable ED visits that did not lead to a hospital admission.

- Many practices reported improvement over the course of the IAH demonstration in their relationships with outside providers. Care partners of IAH practices generally reported strong working relationships with IAH practices.

- Practices reported a variety of efforts to improve overall quality of care, for example, conducting chart audits to identify areas for improvement and meetings to discuss solutions for managing patients. Also, some IAH practices focused on improving communication and coordination of round-the-clock coverage for care.

- We found some evidence of increased use of NPs relative to other primary care clinicians; nine practices increased their use of NPs in Year 4 compared with Year 2.

- Across all sites combined, there were few substantive changes in IAH beneficiaries' characteristics, geographic service area, or location of visits.

- A large majority of patients and their caregivers reported high levels of satisfaction with home-based primary care, found it accessible, and reported that clinicians take their opinions into account.

A. Evaluation approach

To identify changes that the IAH practices made to improve their performance on demonstration quality measures and improve overall quality of care, we collected and analyzed interview data from the IAH practices and claims data. We collected interview data from IAH practices during site visits and telephone calls beginning in February 2013 (halfway through the first year of the demonstration) and concluding in in February 2017 (halfway through the fifth year of the demonstration). During site visits, we spoke with administrators, clinicians, and staff at each IAH practice. For more details on this analysis, see Appendix B, Section VII. In addition to using interview data, we used the IAH practices' claims data to examine the types of clinicians who made visits in Years 2 and 4. We focused on those years because the decrease in expenditures due to the demonstration might have increased in that period. For more details on the measures we used in these analyses, please see Appendix B, Section V.

To assess whether the changes we observed were associated with better quality of care, we examined whether IAH beneficiaries had a larger decrease (or smaller increase) in hospital admissions and outpatient ED visits for ACSCs over time, relative to a comparison group. As we described in Chapter I, ACSCs are conditions for which primary or specialty care may prevent or reduce the need for a hospital admission or ED visit; therefore, we sometimes refer to hospital admissions and ED visits for ACSCs as potentially avoidable. Improved access to primary care can reduce the need for such admissions. For example, if caregivers call an IAH practice to report an exacerbation of a condition, and the IAH practice is able to address the problem, this could reduce the need for a hospital visit. We conducted this analysis for the first four years of the demonstration. The sample and methods we used to analyze the effect of the demonstration on hospital use for ACSCs were the same as those we used to analyze the effect of the demonstration on Medicare expenditures and other outcomes. An important limitation is that we could not be certain that observed effects on hospital care use for ACSCs were caused by the changes made by IAH practices that we discuss in this chapter, as we could not rule out the possibility that IAH practices would have made some of the changes even without the demonstration. For more details on the methods we used in this analysis, including its limitations, see Chapter II. For more information on our measures of ACSCs, see Appendix B, Section V.

To understand how the care partners of IAH practices perceived them, we interviewed care partners. Care partners are organizations external to the IAH practice's care team with which the practice has an established working relationship to coordinate care for patients. Each IAH site identified its care partners (including home health agencies, hospices, specialists, pharmacists, DME suppliers, assisted living facilities, and social service organizations). During interviews conducted in 2016 and 2017, we talked with 48 care partners across all participating IAH practices except Brooklyn. For more details on this analysis, see Appendix B, Section VII.

We used claims data to examine changes among IAH beneficiaries (patients of IAH practices who were eligible for the demonstration). Using Medicare claims and enrollment data, we measured demographic characteristics, health status, functional status, geographic area, and types of locations where IAH beneficiaries received care from IAH clinicians. For more details on the data we used for this analysis, see Appendix B, Section V.

Finally, we surveyed IAH beneficiaries and their caregivers to understand how they perceived their care. In this chapter, we present survey data on beneficiaries' satisfaction with the care they received from IAH practices, preference to receive primary care at home, and willingness to contact the IAH practice if they were feeling unwell and unsure whether they should go to the ED. For more details on the survey, see Appendix B, Section VIII. Additional survey results are in Appendix C.

B. How did sites change their delivery of care to improve their performance on the quality measures, and did performance improve?

In this section, we examine changes that IAH practices made to improve their performance on the quality measures used to calculate the payment incentive effect. Also, we determine whether performance on quality measures used to calculate the payment incentive improved.

1. How did sites change their delivery of care to improve their performance on the quality measures?

The IAH demonstration offered a payment incentive to home-based primary care practices to make changes that would improve their ability to provide effective, efficient, and timely care. To prevent IAH practices from reducing necessary expenditures, IAH practices had to meet certain quality performance standards to be eligible for incentive payments. The six quality measures included follow-up contact and in-home medication reconciliation within 48 hours of hospital or ED use, three measures of hospital care use (hospital admissions and ED visits for ACSCs and all-cause hospital readmissions), and annual documentation of patient preferences (see Exhibit I.2).[18] Incentive payments were proportional to the number of quality performance requirements met and the difference between a practice's estimated spending target and the

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[18] The three conditions used for identifying ACSCs in the demonstration quality measures were diabetes, congestive heart failure, and chronic obstructive pulmonary disease. In contrast, for the evaluation, we based our definition of ACSCs on the Agency for Healthcare Research and Quality Prevention Quality Indicator 90, which includes the following conditions: diabetes short-term complications, diabetes long-term complications, uncontrolled diabetes, lower-extremity amputation among diabetics, chronic obstructive pulmonary disease or asthma in older adults, hypertension, heart failure, angina without procedure, dehydration, bacterial pneumonia, and urinary tract infection. For more information on our measures of hospital use for ACSCs, please see Appendix B, Section V.

practice's actual expenditures. We interviewed administrators, staff, and clinicians at the IAH practices and analyzed their responses to examine their approaches to meeting the thresholds required for the six quality measures.

a. Follow-up contacts within 48 hours of hospital admission, hospital discharge, and ED visits

Throughout the demonstration, most practices worked to track and provide timely follow-up for hospital admissions and ED visits. Some practices reported new strategies to improve notification of hospital admissions and ED visits and conduct 48-hour post-discharge visits. Reported changes include expanded use of EMRs and health information exchanges to track hospital admissions and ED visits and modified organization and staffing to facilitate post-hospital follow-up.

Three practices expanded their use of EMRs to track patients' use of acute care so they could provide timely assistance with transitions in care. Although these three practices have used their EMRs throughout the entire demonstration, later in the demonstration (Year 5), respondents described more formalized processes and functionality enhancements. Examples included a flag on the patient's chart to follow up daily during a hospital stay to monitor discharge plans and alerts of hospital admissions and ED visits. One practice gained access to more EMRs of other hospitals, which enables a practice to track in real time when patients are admitted. These improvements have helped practices receive information about hospitalizations and ED visits more quickly and initiate follow-up planning. The text box provides an example of how one of these sites changed its process.

> "It's more than just a flag—what the flag triggers is a conversation with [the practice provider] … [the practice provider] is in close touch with the hospital admitting physician to make sure that they know what the patient's needs are, what the home situation is, what they can do to help them get back soon. And sometimes, frankly, from the ER [emergency room], we avoid admissions altogether because they know it's an IAH patient. They call IAH, and they say, "Hey, listen, you guys can probably get us ABC resource to get this patient back home," such as VNA [Visiting Nurse Association] or whatever it takes, and they find IAH to be very responsive, and obviously, everyone wants to get the patient home. So as far as I can see it, it's a win/win for everyone. Whether you're an ER person, a hospital person, or IAH person, you're really in constant touch to ensure the best care for the patient."
>
> *Provider*

Four practices increased efforts to use electronic health information exchanges to track hospital admissions and readmissions. A health information exchange enables doctors, nurses, pharmacists, and other health care providers to electronically access and share a patient's medical information. Access to health information exchange data enables IAH practices to identify admissions and ED visits they might not otherwise have known about or would have learned about some time after discharge. With prompt notification, practices can contact patients earlier to assess their needs and plan post-discharge care. In addition, some practices used the exchange data to identify patients with high rates of hospital and ED use so that the practice could review their cases and assess care needs.

Many practices added new staff to their care teams to expand capacity for managing patient care transitions. Most of these practices added nurse case managers to monitor hospital admissions and provide timely post-discharge follow-up in coordination with home visits from

clinicians to help prevent readmissions. A few practices encountered some adjustment challenges as clinicians shifted responsibilities to new staff and hospitals developed relationships with nurse care managers. However, most practices reported that their visiting clinicians valued the additional support and saw improvement in continuity and comprehensiveness of care for patients.

Some practices noted continued concerns among clinicians about making follow-up visits within 48 hours after discharge, especially on the weekends. One practice developed a pod system in which two or three physicians share responsibility for a panel of patients. Although clinicians initially resisted the new approach, they found that the reorganized team approach enabled them to provide better care and offered back-up support to help address urgent patient needs from clinicians who know their patients well. Although a couple of practices added staff to conduct weekend visits, one practice stopped conducting 48-hour follow-up visits on weekends in response to staff complaints about burnout. With only one or two visits in a typical weekend, the practice determined this change would not significantly affect achievement of IAH performance goals. Finally, some practices began using new scheduling software that accounts for geographic coverage of clinicians. With this software, the schedulers can find the closest clinician with time available to accommodate urgent visits.

b.   In-home medication reconciliation within 48 hours of hospital discharges and ED visits

Across the IAH practices, clinicians generally reviewed medications during each visit with a patient and fully reconciled medications during the 48 hours after a hospital discharge or ED visit. Clinicians reported using the medication reconciliation process to verify the appropriateness of medications, increase patients' adherence, and discuss treatment options with patients.

Practices faced challenges reconciling medications because of external factors, including patients' ability to understand and adhere to complex regimens and inadequate information exchange. Practices relied on discharge data from local hospitals to begin the medication reconciliation process, and that process was delayed when practices did not receive timely discharge notifications. Practices also encountered challenges with patients' understanding, remembering, and adhering to their medication regimens. Clinicians reported using these medication reconciliation visits to educate patients and their caregivers on medications, encourage them to contact the practice when they went to a hospital, and help them keep medications organized.

c.   Reducing admissions, readmissions, and ED visits

Aside from improving tracking and post-hospital follow-up, some practices tried to reduce admissions, readmissions, and ED visits by making care more comprehensive and responsive to patients' needs. They did so by adding staff or modifying staff locations to broaden and support their team-based care approach and increasing follow-up for patients with high rates of acute care use.

Several practices added staff or modified staff locations to support team-based care. Some practices serving patients in assisted living facilities added professional staff from dentistry, audiology, podiatry, social work, and psychology to provide more comprehensive care and reduce unnecessary hospital use.

The VPA practices introduced a centralized care protocol system in the early years of the demonstration. Later, they returned patient care coordinators to local practice sites after clinicians and patients expressed dissatisfaction with the centralized system. According to one respondent, locating at the practice enables patient care coordinators to have more in-person contact with clinicians and to build relationships with patients. This change promoted strong working relationships among teams of clinicians, medical assistants, and care coordinators. Those strong working relationships help to address patients' needs and avoid unnecessary readmissions and hospital and ED visits. Another practice changed where the physicians and other staff on the care team sat in the office. This practice clustered the care team together so they could discuss patients' concerns and care delivery more easily.

> "Nobody's really taking care of the needs of our assisted living residents in terms of audiology, optometry, and dentistry. And so we believe there's a meaningful relationship between oral health and, you know, general health and so we're developing a dental division and we've hired a doctor of audiology, and we've hired an optometrist. So we're mainly offering these services to our own patients, again trying to meet the broad range of health care needs that they have. And of course, we've always done podiatry, which is a very important part of primary care…. We do these things because we want to provide the most comprehensive service possible and with the idea that at least some of it may very well translate into reduction in unnecessary trips to the ER and to the doctors' offices."
>
> *Practice administrator*

Some practices reported making changes to help reduce patients' frequent hospital and ED visits. To help manage patients who frequently used hospital services, these practices applied various strategies, including (1) case management by nurses or NPs who provided telephone follow-up between their in-home visits to patients with high needs, (2) adjusting a patient's visit frequencies according to their level of acuity, (3) telemedicine visits to facilitate more frequent patient contacts, and (4) enhanced outreach to assisted living facility staff to improve awareness and notification of the needs of patients with a history of high hospital use.

d. Documenting patients' preferences

Practices were required to discuss treatment preferences with patients and document these preferences in the medical record at least once each demonstration year. Practices used their own systems for collecting these preferences. Practices reported an increased focus on documenting patients' preferences for care, with some assigning staff to review notes and remind clinicians about patient documentation. Some practices instituted clinician bonuses to ensure that they documented preferences. A few practices reported that IAH prompted them to focus on documenting patients' preferences in a consistent, easily accessible location on a patient's chart. Two other practices assigned specific staff members to review patients' charts to ensure the preferences had been documented. These staff members also reminded the nurses and doctors to discuss and document patients' preferences if they were not noted in the chart. In addition, staff reviewed a list of patients the clinician would see the next day to check whether the patient had completed preferences and screenings. Clinicians in one practice reportedly received a bonus for each IAH patient with preferences and screenings completed and documented in the chart.

Practice staff reported challenges in documenting patients' preferences, including regarding the functionality of their EMRs, confusion about the requirements for this documentation, and other clinician priorities. First, some practices reported that their EMR system was not designed to enable staff to easily extract information on patients' preferences and note whether preferences had been documented. For example, in one practice, staff had to search through a patient's records to find a specific encounter in which the patient discussed his or her preferences, then record the date the preferences were documented in a separate database. In another practice, staff reported that because the EMR did not notify or remind clinicians to fill out this field annually, clinicians often forgot to update preferences. Second, some clinicians felt this requirement should have focused on advance care planning; more specifically, they chose to implement practitioner or medical orders for life-sustaining treatment forms rather than do-not-resuscitate orders. Last, some practices mentioned that during patients' appointments for acute care needs, clinicians typically focused more on stabilizing the patient than on having a lengthy discussion on the patient's preferences. In these cases, clinicians delayed these discussions until the next appointment. Other practices scheduled social worker counseling regarding advance directives during separate appointment visits.

2. Did performance improve on the quality measures used in the incentive calculation?

During the course of the demonstration, we observed how IAH practices changed the care they provided. If those changes improved care, then outcomes associated with better primary care may improve. Hospital admissions and ED visits for ACSCs were two of the six quality measures whose performance influenced the size of the incentive payment. Another quality measure used to determine the size of the incentive payment was all-cause hospital readmissions. Because the amount of the incentive payment depended on performance on those three measures, we expected practices to focus on reducing hospital admissions and ED visits for ACSCs and readmissions. We examined hospital admissions and outpatient ED visits for ACSCs using the same methods we used for total admissions and ED visits. Specifically, we examined whether the change over time in a particular outcome for IAH beneficiaries differed from the change over time for comparison beneficiaries; the comparison beneficiaries lived in the same geographic areas and had similar demographic characteristics and health status as the IAH beneficiaries but did not receive home-based primary care. (For more details on this analysis, including its limitations, see Chapter II, Sections B and E, and Appendix B.)

The demonstration payment incentive was associated with a decrease in hospital admissions for ACSCs, and the effect increased (larger reduction) over time. Before the demonstration, hospital admissions for ACSCs decreased faster among comparison beneficiaries than IAH beneficiaries (Figure III.1). That trend reversed during the demonstration; hospital admissions for ACSCs decreased faster among IAH beneficiaries than comparison beneficiaries. Across the four years, IAH beneficiaries had an average of 0.03 (6.7 percent) fewer hospital admissions for ACSCs per beneficiary per year (Table III.1 and Appendix B, Table B.45). That decrease was statistically significant. Further, the favorable effect of the demonstration on hospital admissions for ACSCs increased over time. The reduction in hospital admissions for ACSCs was larger in Year 4 (−0.07 admissions per beneficiary per year) than in Year 3 (–0.04) or Year 2 (–0.01). In contrast to the decrease in hospital admissions for ACSCs, we reported in Chapter II that there was no observed effect on total hospital admissions. This may imply that IAH practices were

successful in their focused efforts on reducing hospital admissions for ACSCs but that success was not large enough to reduce total hospital admissions for this particularly frail population.

We found no evidence that the demonstration reduced outpatient ED visits for ACSCs (that is, ED visits for an ACSC that were not accompanied by hospital admission). The average number of outpatient ED visits for ACSCs per year was slightly lower for all beneficiaries in the post-demonstration period (Table III.1 and Appendix B, Table B.45). Because the slight decrease was about the same for both IAH and comparison beneficiaries, we did not measure the demonstration as having an effect on outpatient ED visits for ACSCs based on the average annual effect. Further, for each of the four demonstration years, the estimated effect of the demonstration on outpatient ED visits for ACSCs was small and not statistically significantly different from zero. The lack of effect on outpatient ED visits for ACSCs differed from the statistically significant decrease in total ED visits (see Chapter II for details). As we discussed in Chapter II, our results suggest that a decrease in ED visits for ACSCs that lead to a hospital admission may have contributed to the decrease in total ED visits.

Survey responses from some IAH beneficiaries and caregivers regarding their desire to visit the ED rather than contact the IAH practice indicate that the IAH practices had not yet changed existing preferences and patterns for ED utilization. As we discuss in Section E of this chapter, a sizable minority of beneficiaries and caregivers would prefer to visit the ED—instead of contacting the IAH practice—if they were unsure whether symptoms required emergency care. A preference among some beneficiaries and caregivers to visit the ED rather than contact the IAH practice was consistent with the observed inability to reduce outpatient ED visits for ACSCs and total outpatient ED visits during the demonstration.

All-cause hospital readmission was another quality measure that CMS used to determine the size of the incentive payment. As we discussed in Chapter II, the probability of a beneficiary's having an unplanned readmission did not decrease on average across the four demonstration years, but it was statistically significantly lower for IAH beneficiaries than comparison beneficiaries in Years 3 and 4. In conjunction with the statistically significant effect on hospital admissions for ACSCs in those years, the results suggest that changes made by the IAH practices may have improved quality of care.

Figure III.1. Mean annual hospital admissions for ACSCs per beneficiary per year for IAH and comparison beneficiaries
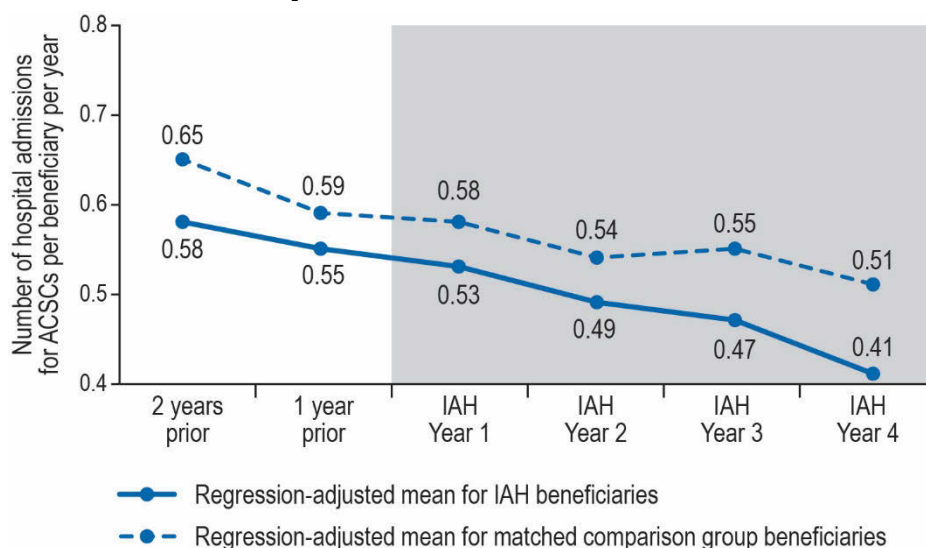
Source: Mathematica's analysis of data from IAH implementation contractor and Medicare claims and enrollment data for 2009–2016 obtained from the Virtual Research Data Center for treatment and matched comparison group beneficiaries in all IAH practices that participated in Year 4.

Notes: An admission for an ACSC is one in which appropriate primary and specialty care may prevent or reduce the need for a hospital admission. The total unweighted number of observations across all years was 243,947. We computed coefficients and standard errors by using the weighted sample size, which considers both the matching and eligibility weights.

ACSC = ambulatory care–sensitive condition; IAH = Independence at Home.

Table III.1. Estimated effect of IAH on hospital use for ACSCs

Period	Hospital admissions for ACSCs per beneficiary per year		Outpatient ED visits for ACSCs per beneficiary per year[c]	
	Estimated effect (standard error)	Percentage effect[a]	Estimated effect (standard error)	Percentage effect[a]
Four-year average annual effect[b]	−0.03** (0.02)	−6.7	0.00 (0.01)	0.4
Year 4	−0.07** (0.03)	−14.3	−0.02 (0.01)	−9.5
Year 3	−0.04* (0.02)	−8.8	0.01 (0.02)	3.5
Year 2	−0.01 (0.02)	−1.4	0.02 (0.01)	10.8
Year 1	−0.01 (0.01)	−2.8	0.01 (0.01)	3.0
Two years before demonstration	−0.03* (0.02)	−6.8	0.01 (0.01)	4.6

Source: Mathematica's analysis of data from IAH implementation contractor and Medicare claims and enrollment data for 2009–2016 obtained from the Virtual Research Data Center for IAH and matched comparison group beneficiaries in all IAH practices that participated in Year 4.

Notes: An admission (or ED visit) for an ACSC is one in which appropriate primary and specialty care may prevent or reduce the need for a hospital admission (or ED visit). The total unweighted number of observations across all years was 243,947. We computed coefficients and standard errors by using the weighted sample size, which considers both the matching and eligibility weights. The table reports the estimated effect of each year and four years combined. Standard errors are reported in parentheses.

[a]We used the unadjusted IAH group mean in the year before the demonstration to calculate the percentage effect for each demonstration year. Appendix B, Table B.13, reports the baseline unadjusted IAH group mean for all outcomes.

[b]We estimated a separate model using a single demonstration indicator (instead of separate indicators for each demonstration year) and used its interaction with IAH status to obtain an average annual estimated effect across four demonstration years.

Table III.1 (continued)

^cThe number of outpatient ED visits measures ED visits not resulting in hospital admission, including those resulting in an observation stay. The measure excluded ED visits that led to an inpatient admission, because there was no diagnosis from the ED visit in a claim record when an ED visit led to an inpatient admission.

*/**/***The difference is statistically significant at the 0.10/0.05/0.01 level.

ACSC = ambulatory care–sensitive condition; ED = emergency department; IAH = Independence at Home.

C. What other changes did the IAH practices make during the demonstration?

In this section, we examine (1) how IAH practices work with other providers, (2) efforts to track metrics, conduct care team meetings, and other approaches to quality improvement, (3) improvements in round-the-clock access to care, and (4) changes in the type of clinicians used by IAH practices.

1. Increased collaboration with outside providers

To understand how IAH practices work with other providers in the field, we interviewed administrators, clinicians, and staff at IAH practices, and we interviewed care partners of IAH practices. We asked the IAH administrators, clinicians, and staff about changes they made during the demonstration. We asked the care partners how they worked with home-based rather than office-based primary care clinicians and what changes occurred during the demonstration.

a. Changes reported by IAH practices

Many practices reported improvement over the course of the IAH demonstration in their relationships with outside providers such as those providing home health, hospice, pharmacy, and transportation services. To establish relationships with outside providers, a few practices reported their NPs' or PAs' meeting with home health and hospice agencies in person. Some practices have developed strategies for referring patients to a limited number of preferred home health agencies to improve care coordination.

> "I think [we] recognize that those community collaborations … with the visiting nursing association … with … pharmacies, some of the home care agencies, is that … they add to our success in terms of being able to manage these patients positively and with high quality."
>
> *Social worker*

Although IAH practices reported working to improve care with outside providers, including hospice, home health, and other community agencies, each of these collaborative relationships presented challenges. Some practices noted that communicating and coordinating with hospice providers have been challenging, as hospice typically takes over primary care for the patient. Several practices reported hiring new staff over the course of the demonstration to better coordinate care with community providers and IAH clinicians' own medical system. Some practices have hired nurses to work exclusively on coordinating care.

b. Care partners' perceptions of working relationships with IAH practices and changes during the demonstration

Generally, care partners reported very strong working relationships with IAH practices. Partners described three key differences working with IAH practices compared with office-based primary care practices. First, they described having strong working relationships with IAH practices. The care partners can access home-based primary care clinicians directly or through a single point of contact with staff who know the beneficiaries firsthand. The IAH practices' staff provide timely response to inquiries and requests—typically the same day, and often within an hour or two. Second, several care partners collaborate closely with home-based primary care practices. They consult with clinicians via telephone or meet face to face regarding efforts to deliver comprehensive post-acute care, keep beneficiaries in their homes, and avoid unnecessary hospital use or duplicate services. Third, several care partners reported a strong emphasis on patient-centered care in their work with home-based practices. For example, they described IAH clinicians' detailed knowledge of beneficiaries' needs and resources as informing care plans.

> "[With the home-based practice] I feel like the communication is more effective than most of the other practices. Again, I think a lot of it has to do with the relationship—[the practice staff] knows and trusts our judgment. We know they are quick to respond to us and that we can typically get help when we call…. In one particular situation, there was a caregiver that was just very concerning, and the home-based provider had a good rapport, a good relationship with the caregiver. We were able to all meet together, and obviously, that's not something that would ever happen in a clinic setting. And it allowed our nurse to begin to build that relationship with the caregiver. The patient was able and the caregiver was able to see, we're on the same team, so you can trust us."
>
> *Home health agency care partner*

In contrast to their description of working with IAH practices, most care partners described challenges in their work with office-based practices. These challenges included communication with some clinicians—having to leave messages rather than speak directly with a person knowledgeable about a particular beneficiary and delays in response to their calls. In addition, several care partners noted variation among office-based clinicians in their openness to developing strong collaborative working relationships. As one hospice care partner described, "They'll give me a referral, and I'll ask them, 'Do you want weekly updates or not?' Some doctors do want that, and some doctors say 'No, that's fine. Just have your medical director take over. I just want to know when the patient passes.' So, some docs are more hands off, whereas [the IAH practice] is very much involved." However, a few care partners said their communication and collaboration did not differ between IAH and office-based clinicians.

Most care partners had established strong working relationships with IAH practices before the demonstration and maintained them throughout. Some care partners reported small changes in their work with practices during the demonstration. These changes included increased awareness of one another's roles and needs and ongoing improvements in timely communication and access to clinicians after hours. A few care partners reported challenges during the demonstration, such as changes in a practice's referral and order processes that added data entry and administrative burden on care partner staff. However, the care partners did not perceive those challenges to be the result of participating in the demonstration.

2.   Tracking metrics, care team meetings, and other approaches to quality improvement

Practices reported a variety of efforts to improve overall quality of care, such as (1) tracking their own quality metrics (those not used as part of the demonstration quality measures) and conducting chart audits to identify areas for improvement; (2) conducting meetings with clinicians, administrators, and staff to discuss performance and brainstorm solutions for managing patients; and (3) implementing quality improvement initiatives targeting specific patient care issues. While these efforts were intended to improve overall quality of care, they may also have improved practices' performance on quality measures required to earn an incentive payment. In this section, we discuss those efforts to improve quality of care. In addition, we explore sites' plans to sustain demonstration activities that they believed led to improved care quality.

First, many practices reported tracking a variety of metrics to monitor care delivery and beneficiaries' outcomes and to identify areas for improvement. Process metrics varied across practices and included measures related to falls, medical orders for life-sustaining treatment, advance directives, and influenza and pneumonia vaccinations.

In addition to tracking metrics, most practices reported conducting care team meetings. Care team meetings provided a forum for clinical teams and staff to review quality metrics and progress toward performance goals, discuss an individual beneficiary's case, and receive information on clinical topics. Clinicians valued receiving performance feedback and appreciated the opportunity to discuss cases with other clinicians and share ideas to improve care. VPA corporate medical directors conducted weekly company-wide, web-based meetings with all clinicians, and regional managers conducted individual meetings with IAH practices, to review clinicians' performance on IAH quality metrics and outcomes and consider broader implications for all of their patients.

> "[Care team meetings] give us an opportunity to look back upon our encounter with the patient and really be able to gauge, 'Was there a reason why the hospitalization happened, could it have been prevented, is there something that I missed?' … It can be a little bit unnerving … but it [has] actually … strengthened my practice quite a bit. Because you learn a lot from that feedback."
>
> *Physician*

Reported quality improvement efforts often extended beyond care and management of IAH beneficiaries to practice-wide change. Most practices reported plans to sustain demonstration activities that they believed led to improved care quality. Multiple practices stated that visits to reconcile medications after transitions in care will continue after the demonstration because of their importance to patients' health. Most practices reported they will sustain patient follow-up after hospitalizations and ED visits because it is key to planning care, reconciling medications, and addressing health and other issues. However, some practices reported that conducting follow-up within 48 hours for every patient was burdensome and not always clinically necessary. Thus, half of the practices that reported planning to sustain these follow-up efforts stated that the time frame will likely expand or become more flexible, with patients at higher risk contacted sooner than those at lower risk.

3. Improvements in round-the-clock access to care

One of the conditions of participating in the demonstration was that the practices would be available 24 hours per day, 7 days a week, which we refer to as round-the-clock access. A number of practices had approaches to providing round-the-clock access before the demonstration, through on-call services or telephone triage systems. Some practices introduced round-the-clock access to meet the demonstration requirement. There was variation in the degree of coverage and the level of coordination and communication practices arranged for round-the-clock access. Of the practices that reported making changes in the provision of round-the-clock access to care, some had systems in place previously and others established new systems because of the demonstration requirement.

Some IAH practices focused on improving communication and coordination of round-the-clock coverage. VPA practices' adoption of a method called SBAR (Situation, Background, Assessment, Recommendation) was one example of a new strategy for improving communication outside of traditional office hours. SBAR aims to facilitate and standardize communication between clinicians and other staff in a way that supports clinical decision making. Before implementing SBAR, if a patient called during the night, the VPA practice did not consistently collect information about the patient's concerns to share with clinicians. After implementing SBAR, there was a clearly documented system for collecting information in a standardized way and disseminating patients' information to the entire care team to facilitate decision making and follow-up. Another practice (Wilmington) changed its cell phone tree system to enable staff members to see who was on call at any given time for a patient. The practice also added call waiting and caller identification functionality that enabled the triage nurses and schedulers to return patients' calls more reliably. One practice (Durham) added more doctors for on-call weekend coverage.

4. Changes in types of clinicians used by IAH practices

To receive an incentive payment during the demonstration, Congress required IAH sites to achieve a level of expenditures for their beneficiaries that were lower than the relevant spending target (see Appendix A). To gain insights into whether IAH sites may have attempted to change to less costly modes of care, we examined whether practices made visits with less expensive practitioners. We examined changes in these measures using claims data from Year 2 and Year 4. We focused on those years because results of the estimated effect of the demonstration suggested that expenditures might have increased in that period (Figure II.2). In Year 4, the probability that the demonstration payment incentive reduced expenditures by at least $100 PBPM reached more than 70 percent (Figure II.3). (For more information on the estimated effect of the demonstration on Medicare expenditures, see Section II.B.)

One way sites could have reduced Medicare expenditures was to use less expensive practitioners to provide care. That is, instead of sending physicians to provide care, a practice could send an NP or PA when they felt it was appropriate. We found some evidence of increased use of NPs relative to other primary care clinicians. Nine practices increased their use of NPs in Year 4 compared with Year 2. Three of these were VPA practices (Dallas, Flint, and Jacksonville), two were independent practices (Durham and Brooklyn), and four were academic medical centers (Cleveland, Long Island, Philadelphia, and Wilmington) (Table III.2). However, despite increased reliance on NPs in these nine practices, the average beneficiary in seven of the

nine practices received more than half of his or her visits from primary care physicians, not NPs, in Year 4. Philadelphia and Wilmington were the exceptions; in those practices, NPs provided about 75 percent of visits to the average beneficiary. One or more factors may have played a role in the increased use of NPs, such as differences in the local supply of clinicians or differences in salaries between types of clinicians.

Table III.2. Mean percentage of visits per IAH beneficiary, by clinician type in nonacute settings, demonstration Years 2 and 4

	Year 2				Year 4			
	Primary care physician	NP	PA	Other	Primary care physician	NP	PA	Other
VPA								
Dallas, TX	69.5	30.5	0	0	64.3	35.7	0.0	0.0
Flint, MI	98.0	1.8	0	0.2	75.7	20.9	3.4	0.0
Jacksonville, FL	92.2	7.4	0	0.4	68.0	32.0	0.0	0.0
Lansing, MI	91.1	8.9	0	0	95.5	4.5	0.0	0.0
Milwaukee, WI	87.8	12.2	0	0	98.2	1.8	0.0	0.0
Academic medical centers								
Boston, MA	100.0	0	0	0	99.7	0.3	0.0	0.0
Cleveland, OH	66.4	30.6	3.0	0	65.1	34.1	0.8	0.0
Long Island, NY	80.7	19.3	0	0	63.9	36.1	0.0	0.0
Philadelphia, PA	38.3	61.7	0	0	24.5	75.5	0.0	0.0
Richmond, VA	28.7	71.3	0	0	24.1	75.9	0.0	0.0
Washington, DC	31.4	68.6	0	0	31.1	68.9	0.0	0.0
Wilmington, DE	40.1	43.6	16.3	0	39.1	55.2	5.7	0.0
Independent practices								
Austin, TX	21.3	47.7	25.3	5.8	21.0	39.8	39.1	0.0
Brooklyn, NY	94.1	5.9	0	0	77.0	17.1	5.9	0.0
Durham, NC	64.0	0	28.0	8.0	53.2	13.7	27.6	5.5
Portland, OR	5.8	87.1	7.0	0	17.4	76.1	6.5	0.0
Mean per practice	59.4	35.1	4.7	0.8	57.4	36.7	5.3	0.3

Source: Medicare claims and enrollment data for 2013–2016 obtained from the Virtual Research Data Center.

Notes: All figures are the mean percentage of evaluation and management visits by all IAH clinicians per eligible IAH beneficiary enrolled in the demonstration in Years 2 and 4. We focused on those years because the reduction in expenditures due to the demonstration might have increased in that period. *Primary care physician* includes family medicine, internal medicine, general practice, geriatrics, and preventative medicine. *Other* includes specialists, social workers, and other clinicians.

IAH = Independence at Home; NP = nurse practitioner; PA = physician assistant; VPA = Visiting Physicians Association.

D. Were there changes in IAH beneficiaries' characteristics, geographic area, or location of visits?

In this section, we address whether other factors that could have affected Medicare expenditures and health care use changed over time. We used claims data to examine whether there were changes in IAH beneficiaries' characteristics, geographic service area, or location of visits. For the most part, there were few changes across all sites. However, some individual sites had substantial changes.

1. Did the characteristics of IAH beneficiaries change during the demonstration?

Across all sites combined, there were few changes in the demographic characteristics of IAH beneficiaries from the year before the demonstration to Year 4. In both years, about half of IAH beneficiaries were age 80 or older, and about 40 percent were dually eligible (Appendix B, Table B.46). There were no systematic changes in the demographic characteristics of IAH beneficiaries within the three practice groups, although there were changes for some individual sites.

Relative to IAH beneficiaries in the year before the demonstration, IAH beneficiaries in Year 4 had slightly poorer functional status; the share of IAH beneficiaries who needed human assistance with at least five ADLs (rather than two to four ADLs) increased by 4 percentage points, or about 7.8 percent (Appendix B, Table B.47). Assessing changes in health status over time is more difficult than assessing changes in functional status. To calculate Hierarchical Condition Category (HCC) scores, we used the HCC model that CMS has used for the Program of All-Inclusive Care for the Elderly (PACE) population since 2012. Changes in coding and population characteristics may increase the average risk score over time.[19] Therefore, despite the fact that the average HCC score for IAH beneficiaries increased by 11.6 percent from the year before the demonstration to Year 4, it is likely that the average IAH beneficiary was not substantially sicker in Year 4. As with demographic characteristics, there were no systematic changes in the functional status and HCC score of IAH beneficiaries within the three practice groups.

2. Did the geographic area where IAH beneficiaries lived change during the demonstration?

Changes in the geographic areas where IAH practices provide home-based primary care could cause bias in the estimated effects if those changes in geographic areas were accompanied by changes in patient characteristics that we were unable to measure in administrative data. For example, if a practice began providing care in a rural area in the middle of the demonstration, that practice might begin treating patients who may not have had the same access to care over the years, and thus have different illness severity than the patients that the practice treated before the demonstration.

Few IAH practices expanded to new geographic areas over the course of the demonstration. To assess changes in geographic area, we calculated the proportion of IAH beneficiaries in Year 4 who lived in a county that had zero IAH beneficiaries in the year before the demonstration. In most practices (13 of the 16 practices), no more than 6 percent of the Year 4 IAH beneficiaries lived in counties that had zero IAH beneficiaries in the year before the demonstration (Appendix B, Table B.48). There were a few exceptions, most notably Long Island and Washington, DC. About one-fifth of the IAH beneficiaries at Long Island in Year 4 lived in a county that had zero IAH beneficiaries in the year before the demonstration. The same was true of 8.2 percent of Washington, DC, IAH beneficiaries in Year 4. The change for the Washington, DC, practice was caused by the practice initiating home-based primary care in Baltimore, MD, during Year 4.

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[19] CMS uses a normalization factor to account for the trend in risk scores. For more information, see
https://www.cms.gov/medicare/health-plans/medicareadvtgspecratestats/downloads/advance2018.pdf.

3. Did the location of visits made by IAH clinicians change during the demonstration?

The places where clinicians give primary care affect the number of visits a clinician can complete each day and opportunities for care coordination. We did not see evidence of changes in site of care by IAH clinicians between Years 2 and 4. As in Year 2, three practices focused largely on beneficiaries in assisted living and other congregate living facilities in Year 4, and all other practices focused largely on private homes (Appendix B, Table B.49). In Durham and Portland, the average beneficiary had more than 80 percent of his or her visits in an assisted living or other facility. For Milwaukee, the figure was 71.5 percent. Clinicians who see patients in assisted living facilities can complete more visits per day because they spend less time in transit between patients, thus reducing practices' costs of providing care. In some cases, staff in those facilities serve as informal members of the primary care team by alerting clinicians to recent hospital discharges and contacting the practice before sending patients to the ED. In other cases, assisted living facilities can have policies that require staff to transfer patients to EDs regardless of the severity of the incident, such as with falls not involving serious injury.

In both years, IAH clinicians at some academic medical center practices provided care to IAH beneficiaries in inpatient settings. In the Boston and Washington sites, the average beneficiary had 8.4 percent (Boston) and 12.0 percent (Washington) of his or her visits by IAH practitioners in inpatient settings in Year 4. Three of the academic medical center practices (Boston, Philadelphia, and Richmond) reported that they also provided coverage to serve IAH beneficiaries in SNFs. This care pattern is in contrast to what occurs for most Medicare FFS beneficiaries who do not commonly receive care from their own primary care clinician when they are in the hospital or a SNF; most often, a clinician at the institution provides that care. Practices whose clinicians visit patients in the hospital or an SNF might gather more information about their patients' health status than practices that do not visit patients in the hospital or SNF. In addition, the primary care clinician may be aware of health, social, and other factors that affect the beneficiary's treatment and recovery that other hospital and SNF clinicians would not be aware of. The result may be a shorter length of stay or a lower risk of readmission, and thereby lower expenditures.

E. How did the beneficiaries and their caregivers perceive their care?

Because the IAH demonstration provides an incentive for the practices to reduce spending, it is important to examine beneficiaries' and caregivers' experiences during the demonstration to fully understand whether the model meets the beneficiaries' needs. To address this issue, we surveyed IAH beneficiaries and their caregivers. In this section, we present the survey data on their satisfaction with the quality of care from IAH practices, preference to receive primary care at home, and willingness to contact the IAH practice if they were not feeling well and were unsure whether they should go to the ED. Additional survey results are in Appendix C.

Patients and their caregivers reported high levels of satisfaction with home-based primary care, found it accessible, and reported that clinicians take their opinions into account. About 93 percent of beneficiaries and caregivers reported being "satisfied" or "very satisfied" with the overall quality of care they had received from the IAH practice in the past six months (Appendix C, Tables C.10 and C.11). Close to three-quarters (73 percent) of beneficiaries preferred receiving primary care in their home "a lot more" than receiving care in an office or clinic, and a similarly large share of caregivers (82 percent) expressed a preference for the beneficiary to

receive primary care at home. Only 5 percent of beneficiaries preferred receiving primary care in their home "a lot less" or "somewhat less" than receiving care in an office or clinic.

In addition to being satisfied with care, the large majority of IAH beneficiaries (87 percent) and their caregivers (89 percent) reported having no trouble obtaining in-home care; also, beneficiaries reported that the clinicians involved them in their decisions about their health care and considered the beneficiary's opinions. Many (86 percent of beneficiaries and 83 percent of caregivers) also reported that the primary care team explained to the beneficiary or caregiver what to do if problems or symptoms continued, worsened, or returned.[20]

One challenge for the demonstration was that a sizable minority of beneficiaries and caregivers would prefer to visit the ED—instead of contacting the IAH practice—if they were unsure whether symptoms required emergency care (Table III.3). Beneficiaries provided a number of reasons for preferring to go to the ED, including that they or their caregivers thought it was the best place to receive care. Even though three-quarters of beneficiaries reported that the IAH practice visited about as often as the patient wanted them to visit (Appendix C, Table C.8), some beneficiaries' preference for the ED in uncertain situations might contribute to the demonstration's lack of an effect on outpatient ED visits.

F. Limitations and conclusion

1. Limitations

The analyses we present in this chapter were subject to several important limitations. First, since we did not collect qualitative data from IAH practices before the demonstration, our ability to measure changes in the delivery of care relies on respondents' recall of changes their practices made. In addition, we could not rule out the possibility that IAH practices would have made some of the changes described here even without the demonstration. Therefore, we could not be certain that observed effects on hospital admissions for ACSCs and probability of readmission were caused by the changes made by IAH practices that we discuss in this chapter. Second, IAH practices identified the care partners that we interviewed. It is possible that some IAH practices purposefully identified care partners that they believed would speak favorably about coordination of care with the IAH practice. Finally, our patient and caregiver survey did not collect information from a comparison group, nor did it collect information from IAH patients and caregivers before the demonstration began. Therefore, we could not assess whether the demonstration payment incentive improved patient or caregiver satisfaction or increased patients' and caregivers' willingness to contact the IAH practice when the patient is unsure if he or she needs emergency care. As result, we interpreted the survey data in a descriptive fashion only.

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[20] The caregiver percentage refers to those whose beneficiary has the ability to express preferences.

Table III.3. Beneficiaries' willingness to contact the IAH practice if they were not feeling well and unsure whether they should go to the ED

	Percentage of all nonmissing, valid responses[a]	Percentage of nonmissing, valid responses from respondents who would not contact primary care team
Whether beneficiary knows how to contact primary care team during a *weeknight or weekend*		
Yes	77.9	-
No	22.0	-
Response missing or invalid	(4.3)	-
Whether beneficiary would contact primary care team during a *weeknight or weekend*		
Yes	70.5	-
No	29.5	-
Response missing or invalid	(7.8)	-
Reasons a beneficiary would not contact primary care team during a *weeknight or weekend*[b,c]		
I don't want to bother primary care team	6.1	22.4
It takes too long to get help	11.9	44.5
When I call, I cannot talk to someone I know	10.9	41.2
It is hard to remember to call primary care team when I am not feeling well	6.4	23.7
The ED is the best place for me when I am unsure whether my problem is serious	14.5	53.7
Caregiver, family member, or friend prefers that I go to the ED	15.3	56.3
I get better care in the ED	12.1	44.6
The ED is more convenient	12.5	46.0
Whether beneficiary would contact primary care team during a *weekday*		
Yes	80.0	-
No	20.0	-
Response missing or invalid	(6.8)	-
Reasons why beneficiary would not contact primary care team during a *weekday*[d,e]		
I don't want to bother primary care team	3.0	15.2
It takes too long to get help	7.6	40.1
When I call, I cannot talk to someone I know	6.4	33.9
It is hard to remember to call primary care team when I am not feeling well	5.4	28.5
The ED is the best place for me when I am unsure whether my problem is serious	8.7	45.8
Caregiver, family member, or friend prefers that I go to the ED	11.1	57.3
I get better care in the ED	8.4	44.4
The ED is more convenient	8.4	44.2

Source: IAH beneficiary surveys conducted from 2013 to 2015.

Notes: Data are weighted for overall nonresponse. Mathematica sent the survey to all IAH enrollees who were still alive at the time of the survey and who Mathematica could locate, regardless of their eligibility for the demonstration according to Mathematica's criteria. Beneficiaries could provide multiple reasons for why they would not contact the IAH primary care team.

[a]Percentages are shown as a share of nonmissing values for each variable. The row labeled "Response missing or invalid" includes the percentage of invalid responses for each variable and cases in which the response was missing, the beneficiary provided multiple responses, or the beneficiary wrote "not applicable" when there was no such answer choice. Missing or invalid responses are shown as a percentage of all surveys received (n = 3,870).

[b]The subset of respondents to whom this question applied is the 29.5 percent who answered "no" when asked whether the beneficiary would contact his or her primary care team during a weeknight or weekend if the beneficiary was not feeling well and was unsure whether he or she needed to go to the ED.

Table III.3 (continued)

[c]The percentage of all respondents (n = 3,870) who missed a given question or gave an invalid response ranged from 10.7 to 11.5 percent. The percentage of respondents who answered that they would not contact a primary care team during a weeknight or weekend and missed a follow-up question or gave an invalid response ranged from 10.6 to 13.5 percent. The percentage of responses missing differs because we asked respondents separately about each item.

[d]The subset of respondents to whom this question applied is the 20.0 percent who answered "no" when asked whether the beneficiary would contact his or her primary care team during a weekday if the beneficiary was not feeling well and was unsure whether he or she needed to go to the ED.

[e]The percentage of all respondents (n = 3,870) who missed a given question or gave an invalid response ranged from 7.5 to 8.0 percent. The percentage of respondents who answered that they would not contact a primary care team during a weekday and missed a follow-up question or gave an invalid response ranged from 11.3 to 13.3 percent. The percentage of responses missing differs because we asked respondents separately about each item.

ED = emergency department; IAH = Independence at Home.

2. Conclusion

IAH practices made many changes to improve their performance overall and in the quality measures used to calculate the incentive payment. To provide follow-up contacts within 48 hours of hospital and ED use, many practices added new staff to their care teams, such as nurse case managers. Some practices expanded their use of EMRs or electronic health information exchanges. However, some practices noted continued concerns among clinicians about making follow-up visits within 48 hours after discharge, especially on weekends. Some practices tried to reduce admissions, readmissions, and ED visits by making care more comprehensive and responsive to patients' needs, employing such strategies as increasing follow-up for patients with high rates of acute care use. In Years 3 and 4, the demonstration was associated with decreases in hospital admissions for ACSCs and in probability of unplanned readmission, but the demonstration did not affect ED visits for ACSCs that did not lead to a hospital admission.

Many practices reported other changes during the demonstration, such as how they work with other providers, efforts to improve identification, tracking and improvement of care quality areas of concern, improvements in round-the-clock access to care, and changes in the types of clinicians used by IAH practices. Many practices reported improvement over the course of the IAH demonstration in their relationships with outside providers such as home health, hospice, pharmacy, and transportation services. Care partners of IAH practices generally reported strong working relationships with IAH practices. Practices reported a variety of efforts to improve overall quality of care, such as tracking their own quality measures and conducting chart audits to identify areas for improvement and conducting meetings to discuss performance and brainstorm solutions for managing patients. In addition to improving overall quality of care, some IAH practices focused on improving communication and coordination of round-the-clock coverage. We found some evidence of increased use of NPs relative to other primary care clinicians; nine practices increased their use of NPs in Year 4 compared with Year 2.

Across all sites combined, there were few substantive changes in IAH beneficiaries' characteristics, geographic service area, or location of visits.

Patients and their caregivers reported high levels of satisfaction with home-based primary care, found it accessible, and reported that clinicians take their opinions into account. A sizable minority of beneficiaries and caregivers would prefer to visit the ED—instead of contacting the IAH practice—if they were unsure whether symptoms required emergency care.

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IV. DID HOME-BASED PRIMARY CARE REDUCE MEDICARE EXPENDITURES AND HOSPITAL USE?

Chronically ill disabled Medicare beneficiaries can have a difficult time accessing office-based primary care. As a result, they might not receive timely and appropriate primary care, especially when coping with an acute condition such as the flu, recovering at home from a medical or surgical procedure, or returning home after a hospitalization. These beneficiaries are particularly vulnerable during the time following hospital stays because of problems such as untreated infections, unsafe conditions or inadequate support in the home, and confusing discharge and medication orders. Providing primary care in the home is theorized to reduce these access barriers and to provide care in a more holistic approach. These hypothesized improvements in care might, in turn, improve the health status of vulnerable patients if medical problems and unsafe conditions in the home can be identified and resolved at an early stage.

Home-based primary care aims to reduce ED visits, hospitalizations, and SNF stays and improve overall health status and well-being for beneficiaries. In addition to experiencing an increase in primary care utilization, home-based primary care recipients may also experience an increase in referrals to home health agencies for nursing care or therapies that home health workers provide. The extent to which changes in total Medicare expenditures are realized will depend in part on the relative costs of the potential reductions in hospital and ED care and the anticipated increases in primary care and home health services.

The intention of the IAH legislation is to test the effect of both the delivery of team-led home-based primary care and the demonstration payment incentive. However, the demonstration's design—allowing practices to enroll existing patients into the demonstration, some of whom have received home-based primary care for years—did not allow us to measure the effects of home-based primary care and the demonstration with the same sample of beneficiaries. To examine the effects of home-based primary care, we needed a large sample of beneficiaries who could be observed prior to and after starting home-based primary care. There were too few patients at the IAH practices who were new to home-based primary care and eligible for the demonstration to conduct this analysis. Because of this limitation, we designed a separate study that allowed us to examine outcomes for home-based primary care recipients who met the IAH eligibility criteria prior to and after starting home-based primary care. To ensure sufficient sample size, we included beneficiaries who received home care from all local home-based primary care clinicians in the same market as an IAH clinician, not just the IAH clinician. In the sample examined, approximately one-fourth of cases were treated by a practice that, beginning in 2012, was IAH affiliated. Others were patients of non-IAH practices who provide but do not necessarily specialize in home-based primary care. These practices may not necessarily meet the infrastructure and experience standards required of IAH practices. Additionally, the analysis examined beneficiaries entering home-based primary care both during and prior to the period of time when IAH was active.

The following are key takeaways of the effects of home-based primary care on Medicare expenditures and hospital use:

- Home-based primary care, as delivered in the Medicare program to chronically ill and disabled patients, did not lower Medicare expenditures. Instead, we found that home-based

primary care led to expenditures higher in total than those for comparison beneficiaries. These higher expenditures were in part the result of higher expenditures for Medicare services provided in the home, but also for hospital care.

- IAH practices had similarly higher levels of total Medicare expenditures for their new patients as for those in the full sample. Note that this analysis included beneficiaries who received care at an IAH practice before the IAH demonstration as well as those who received care during the demonstration.

- Home-based primary care did not have a statistically significant effect on total Medicare expenditures during the first six months after the initial home visit. However, the probability that home-based primary care led to relatively higher expenditures was 77 percent in the second quarter (months 4 through 6). In addition, home-based primary care recipients had significantly higher expenditures relative to the comparison group during the remaining 18 months in the study period.

- In the first year after starting home-based primary care, the increase in PBPM expenditures on home health ($310), DME ($41), and physician or supplier services ($86)—a total of $437—was not offset by reduced expenditures on services from SNFs (−$365) and outpatient services (–$8). Home-based care recipients also had higher spending on hospice ($91 in the first year).

- Home-based primary care recipients had more potentially avoidable hospital admissions and ED visits during the first year after starting than they would have otherwise. We were not able to assess any differences in measures such as quality of life or patient satisfaction.

- Descriptive analysis suggests that among people who died during the 24 months of the post-period, those in the home-based primary care group had lower Medicare expenditures in the last three months of life than beneficiaries in the comparison group. This difference was driven by lower inpatient and SNF expenditures.

- The costs associated with home-based primary care might be decreasing. Patients who entered home-based primary care in later years (2013 and 2014) had a smaller increase in costs relative to the comparison group than those who entered in earlier years (2010 and 2011).

The finding that chronically ill and functionally limited Medicare beneficiaries who received home-based primary care experienced higher expenditures for ED and inpatient services than their comparison beneficiaries is contrary to expectations. We examined whether this unexpected effect of home-based primary care provided by IAH practices was the same as that for the full sample. The results from restricting the sample to IAH practices were similar. It is possible that this unanticipated rise in expenditures occurred because the increased access to care resulting from home-based primary care led to the discovery of new health problems that could benefit from hospital care. It is also possible that family members of home-based beneficiaries are more proactive in seeking care, including in advocating for hospital services. However, we have no evidence to support either of these potential explanations.

As in any observational study, we cannot rule out the possibility that other, unobserved differences in clinicians and beneficiaries account for the higher spending of home-based primary care. In addition, beneficiaries could switch into or out of home-based primary care after

the initial six months. For example, among all home-based primary care recipients, approximately 15 percent stopped having the majority of their evaluation and management (E&M) visits performed by a primary care clinician in the home during months 7 through 12 after starting home-based primary care. However, around 4 percent of these beneficiaries returned to home-based primary care in the following six-month period. And approximately 3 percent of the comparison beneficiaries started home-based primary care during months 7 through 12 after their index date. Similar rates of entering and exiting home-based primary care occurred during the second year (Appendix D, Table D.13). Given the relatively small number of beneficiaries who switched between the two types of primary care, it likely that the overall result of higher expenditures would remain even if there were no switchers.

There was also a high mortality rate among this population. On average, 16 percent of the beneficiaries died during the first six-month period; another 11 percent died during the second six-month period. The attrition due to mortality as well as the potentially nonrandom cross-overs between home-based and office-based primary care presented challenges to this analysis.

In this chapter, we describe the overall approach to evaluating the effects of home-based primary care and the robustness checks and additional analyses that were conducted, with additional detail provided in Appendix D. We also present the results and discuss limitations.

A. Evaluation approach

To estimate the effect of home-based primary care, we designed a difference-in-differences analysis that compares outcomes over time of beneficiaries who were new to home-based primary care to those of beneficiaries in a matched comparison group who did not receive home-based primary care.[21] The difference-in-differences design allows for differences in average outcomes between home-based primary care recipients and comparison beneficiaries as long as those differences would have persisted over time in the absence of home-based primary care. The difference-in-differences design also controls for the effect of other factors (unrelated to home-based primary care) that affect expenditures and use over the study period for all Medicare FFS beneficiaries.

As discussed above, the demonstration allowed IAH practices to enroll eligible beneficiaries who were existing patients already receiving home-based primary care. Thus, even though the program required a minimum of 200 beneficiaries per site, only a small numbers of the IAH beneficiaries were new to home-based primary care in any given year. In this analysis we limited the sample to those beneficiaries eligible for the IAH demonstration who were new to home-based primary care. We expanded the sample to include all IAH-eligible beneficiaries who were living in the same catchment area as the IAH patients and received home-based primary care (by either IAH or non IAH clinicians) for the majority of their care for at least six months after their first home visit. We also expanded the sample by including additional years of observation, adding beneficiaries who began home-based primary care before the demonstration began. This approach yields a sample large enough for robust estimates of the effect of home-based primary care and provides insight into the benefits of home-based primary care for a group of Medicare

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[21] We define "not receiving home-based primary care" as those who did not receive care for the six months after the index date.

FFS beneficiaries who were similar to IAH enrollees. In the following paragraphs we describe how we constructed our sample and our estimation methods for measuring the effect of home-based primary care on key outcomes. More details on these topics are available in Appendix D.

1.   Home-based primary care analysis sample construction

We constructed five panels, one for each calendar year from 2010 to 2014. Each panel consists of a group of beneficiaries that began home-based primary care in that year (for example, in 2012 for the 2012 panel) and a matched set of comparison beneficiaries who did not receive home-based primary care. Consequently, we had one panel of home-based primary care recipients who began home-based primary care in each of the two calendar years (2010 and 2011) before the start of the IAH demonstration (mid 2012) and we had three panels (2012–2014) that overlap with the demonstration.

For home-based primary care recipients, we defined the *index date* as the date of the first home-based primary care visit. The index date for comparison beneficiaries was the reference date used when constructing matching variables (the specification of the index date is described in more detail in Appendix D). Each panel consisted of home-based care recipients and comparison beneficiaries who met the IAH eligibility criteria as of the index date—that is, those who (1) had two or more activities of daily living (ADLs) that require human assistance,[22] (2) had two or more chronic conditions, and (3) received inpatient hospital and acute or subacute rehabilitation services in the previous 12 months.

Home-based primary care group. To be retained in the home-based primary care group, beneficiaries must have had at least two E&M visits from a primary care clinician (physicians engaged in general practice, family practice, internal medicine, geriatric medicine, or preventive medicine; nurse practitioner; or physician assistant) in the home or an assisted living facility during the six-month period starting with the first home visit (the index date). In addition, the majority of E&M visits from a primary care clinician during that same period must have taken place in the home or assisted living facility. These restrictions ensured that the dominant mode of primary care for home-based care recipients was home-based for at least a six month window of time. We provide detailed descriptions of how we defined and implemented these and other eligibility criteria in Appendix D.

We first identified the subset of home-based primary care beneficiaries who received the plurality of their care from a practice [using their Tax Identification Number (TIN)] that joined the IAH demonstration; we considered these beneficiaries patients of an "IAH practice," either before the practice joined the demonstration or while it was participating in the demonstration. The sets of zip codes in which IAH-attributed beneficiaries resided defined the IAH catchment areas. We then retained all home-based primary care beneficiaries, including those not attributed to an IAH practice, who resided in an IAH catchment area. Home-based care beneficiaries

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[22] Although information on ADL dependence from the most recent post-acute care assessment can be used, assessment data were missing for some patients and were outdated for others, so the data might be insufficient to capture levels of dependence as of the index date. To determine more consistently Medicare FFS beneficiaries with two or more chronic conditions who met the ADL eligibility criteria, we used a claims-based algorithm to predict the likelihood of having two or more ADLs needing human assistance, following the process tested in Faurot et al. (2015). Appendix D provides a full explanation of this approach.

attributed to IAH practices accounted for, on average across panels, 26 to 28 percent of the home-based primary care sample.

Comparison group. We used propensity score matching to construct a comparison group with the same demographics, prior utilization, and health status as the home-based primary care group, with one exception. Beneficiaries in the comparison group did not receive primary care in the home during the six months after their index date. The goal of matching was to produce patients in the home-based primary care and comparison groups that were similar in clinical characteristics, demographics, and health characteristics. Thus, key characteristics for matching included those that determine eligibility for the demonstration and other measures of frailty (for example, the HCC risk score and the presence of specific conditions) at the time of the index date that were observable in claims data and demographic characteristics (for example, age and gender) observable in administrative data (Appendix D, Table D.5). We also included various health care expenditure and use measures. Some of these measures reflected health status immediately before the index date, others were based on the 12- and 24-month periods before the index date. We used variables from the months leading up to the index date in order to match not just on a snapshot of beneficiary characteristics at one moment in time but also on the trajectory leading up to the index date. Health status can change rapidly or slowly and we believe that the length of time that a beneficiary has been in poor health, for example, was an important variable for matching. The matching process allowed for a ratio of up to 5:1 of comparison beneficiaries to home-based primary care recipients ratio (Appendix D, Table D.6).

Comparison group members were well matched on observed characteristics. A standard statistic used to assess similarities between the home-based primary care group and the final matched comparison group is the standardized difference in means (Stuart 2010). The literature suggests that a standardized difference of less than 0.25 is an appropriate threshold for determining that the two groups match well on a particular variable (Rubin 2001). We applied a more stringent standard for our matching: For most catchment areas, the home-based primary care and matched comparison groups had standardized differences less than 0.10 (absolute value) on most or all matching variables. Our final matched sample consisted of 30,324 home-based primary care beneficiaries and 150,677 matched comparison beneficiaries. All beneficiaries were observed for two years prior to the index date and for two years afterwards. Our study design was well-powered to detect the effects of home-based primary care. We fully describe our matching process, the variables included, and the results in Appendix D. Table D.5 shows characteristics of the potential comparison group, the matched comparison group, and the home-based primary care group for the 2010 panel (the characteristics of the two groups were similar for the other four panels).

2. Home-based primary care impact analysis

To answer the key question—What was the effect of providing home-based primary care to Medicare FFS beneficiaries eligible for the demonstration?—we first used a similar difference-in-differences approach as described in Chapter II of this report. Our baseline period was the 12 months before the first home-based primary care visit and we measured outcomes in two 12-month periods after the start of home-based primary care. We used three key pieces of information to determine the effect of home-based primary care on expenditures (and other outcomes) in each of two post-intervention years:

1. The difference in expenditures (and other outcomes) between the year prior to starting home-based primary care (the baseline year) and in the first year and in the second year after the first home visit for the home-based primary care recipients

2. The difference between the same periods for comparison beneficiaries

3. The difference between the first two amounts, which is the difference-in-differences estimate of the effect of home-based primary care

The strength of this design was that it enabled us to net out time-invariant, observed or unobserved, pre-initiation of home-based primary care differences between the home-based primary care and comparison groups. The difference-in-differences design also netted out the effect of other external factors affecting both the home-based primary care and comparison groups that caused changes in outcomes between the pre and post periods (see Exhibit IV.1. for key outcomes). This approach rested on the assumption that in the absence of home-based primary care, outcomes for the home-based primary care beneficiaries would have changed in the same way that outcomes change for the comparison group (referred to as "parallel trends" and discussed in more detail in Appendix D).

In addition to the frequentist approach described above, we used a Bayesian approach[23] to estimate the difference-in-differences impact estimates for total Medicare expenditures.[24] The Bayesian approach enabled us to report intuitive statements about the probability that receiving home-based primary care was associated with a reduction in total Medicare expenditures. We estimated the Bayesian model using both yearly and quarterly data. Further details on our estimation approaches are available in Appendix D.

Robustness checks. In addition to estimating our main regressions using the modeling approach described earlier, we examined whether outliers affected our analysis. We also used a modeling approach developed by Deb (2016) to account for differences in mortality, or survival probability, between home-based primary care beneficiaries and their matched comparison beneficiaries in estimating Medicare cost differences. Appendix D describes these robustness checks and our findings in more detail.

> **Exhibit IV.1. Key evaluation outcomes**
>
> - Medicare expenditures, total and by type of service
> - Number of hospitalizations and ED visits
> - Number of hospitalizations and ED visits for ambulatory care sensitive conditions (ACSCs)
> - Probability of having an unplanned readmission
>
> Note: See Table D.2. in Appendix D for measures of Medicare expenditures and service utilization analyzed. ACSCs are conditions for which ambulatory care may prevent or reduce the need for a hospital admission or ED visit, such as hypertension, heart failure, and dehydration.

Subgroup analyses. We conducted analyses of several subgroups to test whether the results varied across subgroups. For example, we examined whether the estimated effect of home-based

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[23] In the frequentist framework, hypothesis-testing relies on the p-value, defined as the probability of observing an impact of an intervention that is at least as large as the estimated impact, if the true impact of the intervention is zero. In contrast, the Bayesian framework directly estimates the probability that the intervention truly has an impact given the observed data (along with an assumed prior distribution of beliefs).

[24] The Bayesian approach is computationally intense, so we did not apply it to other outcomes.

primary care provided by IAH practices, who were providing services consistent with the demonstration requirements, was the same as the effect estimated for care provided by all home-based primary care clinicians in IAH practice markets. We also tested whether the estimated effect changed over the time period studied by analyzing each of the five panels separately (each panel includes beneficiaries who started home-based primary care in one of five calendar years—2010 through 2014—and their comparison group).

One reason some Medicare FFS beneficiaries might choose to receive home-based primary care is a preference for a particular style of medical care during the last months of their lives. We conducted a descriptive analysis of whether end-of-life expenditures differed between home-based primary care recipients and comparison beneficiaries for the subgroup of beneficiaries who died during the two-year period after the index date. To get a better idea of possible attitudes and preferences that influence why some people do or do not chose home-based primary care, we surveyed home-based primary care recipients in the IAH practice markets whose first home visits took place from January 2015 to June 2016 and their matched comparison beneficiaries. We used the survey responses to analyze how home-based primary care recipients differ from comparison beneficiaries as well as whether the estimated effect of home-based primary care changes after we account for the differences revealed in the survey.

The key results of these subgroup analyses are included below. Appendix D provides additional information about the analyses and the results.

B. What was the effect of home-based primary care on Medicare expenditures?

One of the key questions for this analysis was whether providing primary care in the home can reduce Medicare expenditures by reducing the use of expensive acute care services, such as inpatient hospitalizations and ED visits. We estimated the effect of home-based primary care on Medicare expenditures using both frequentist and Bayesian statistical frameworks.[25] We also used a variant of the frequentist model that accounted for any differences between the home-based primary care recipients and the matched comparison group in expected survival at baseline. The evidence from all analyses suggest that home-based primary care increased total Medicare expenditures. While home-based primary care reduced expenditures at SNFs, those reductions were more than offset by increased expenditures in other service categories, especially home health, hospice, and inpatient care. We also found that those in home-based primary care had lower total end-of-life Medicare expenditures than the comparison beneficiaries. As noted above, these analyses are subject to limitations, including potential nonrandom self-selection into home-based primary care and nonrandom switching between home-based and office-based primary care after the initial six-month attribution period.

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[25] In the frequentist framework, hypothesis-testing relies on the p-value, defined as the probability of observing an impact of an intervention that is at least as large as the estimated impact, if the true impact of the intervention is zero. In contrast, the Bayesian framework directly estimates the probability that the intervention truly has an impact given the observed data (along with an assumed prior distribution of beliefs). Because the Bayesian approach is computationally intense we only used it to analyze total Medicare expenditures.

1. Total Medicare expenditures

Although total Medicare expenditures decreased for both home-based primary care recipients and comparison beneficiaries in both the first and second year after the index date, the decrease was smaller for those receiving primary care in their homes. Our estimated impact using the frequentist model suggest that home-based primary care increased total Medicare PBPM expenditures by $256 in the first year and $367 in the second year above what they would have been otherwise (Figure IV.1).[26]

Figure IV.1. Estimated effect of home-based primary care on total PBPM Medicare expenditures.
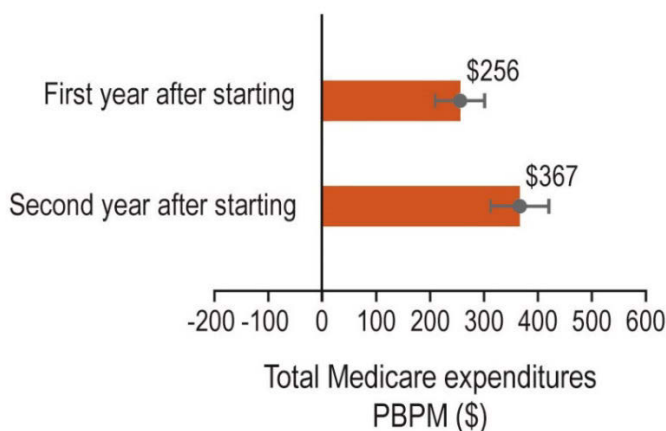
Source: Medicare claims and enrollment data for 2010–2016 obtained from the Virtual Research Data Center for home-based primary care recipients and matched comparison group beneficiaries

Note: Expenditures were measured PBPM. The difference-in-differences estimate for each year was calculated as the difference in means between home-based primary care recipients and comparison beneficiaries in that year minus the difference in the means in the year before the index date. The bars represent 90 percent confidence intervals. If the confidence interval includes zero then the estimated impact is not statistically significantly different from zero.

PBPM = per beneficiary per month.

We estimated a version of the Bayesian model using quarterly instead of annual outcomes (Figure IV.2). Using quarterly data not only increased the precision of our estimates by borrowing strength over time, it also allowed the effect of home-based primary care on total Medicare expenditures to vary across smaller time intervals, providing insight into whether the impact changed after the first 6-month period when some of the home-based primary care beneficiaries stopped receiving primary care home visits. In the first quarter after starting home-based primary care, the credible interval was centered near zero, which means that based on the observed data it was equally probable that home-based primary care increased or decreased expenditures. However, the probability of a positive impact (increased expenditures) increased in each subsequent quarter of the first year, including during the second quarter when there was no switching. In the second year the estimates were relatively stable and indicated a high probability that the effect of home-based primary care on total expenditures was greater than $100 PBPM (Table IV.1).

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[26] The results were robust to trimming expenditures at the 99th percentile. This was true whether we used annual or monthly expenditures as our dependent variable.

Despite the close match on observable characteristics at baseline, there were differences in mortality rates between the home-based primary care and comparison groups (Appendix D, Table D.14). These differences may signal unobserved, and therefore uncaptured, differences in health status between the two matched groups at baseline. To address this possibility, we extended the frequentist analysis to account for whether some of the observed differences in regression-adjusted expenditures between home-based primary care recipients and their matched comparisons were attributable to differences in expected mortality, or survival probability (see Appendix D for more details). After controlling for the probability of survival, the estimated effects decreased somewhat but remained positive and significant, increasing from $256 to $236 in the first year and from $367 to $336 in the second year (Appendix D, Table D.20).

Figure IV.2. Estimated quarterly effects of home-based primary care on total PBPM Medicare expenditures (Bayesian quarterly model)
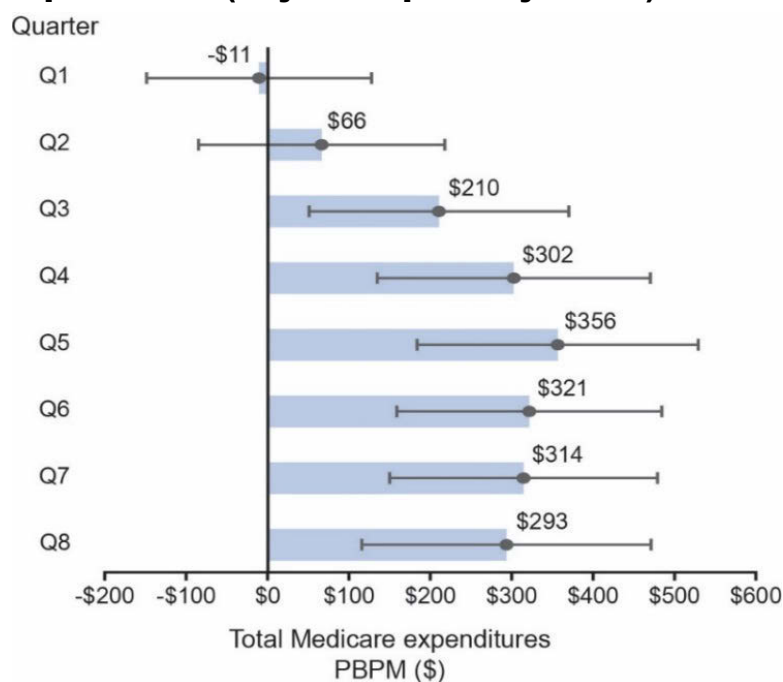
Source: Medicare claims and enrollment data for 2010–2016 obtained from the Virtual Research Data Center for home-based primary care recipients and matched comparison group beneficiaries.

Note: Results are based on the Bayesian model, which is described in Appendix D. The error bars represent 90 percent credible intervals. In the Bayesian framework, the credible interval shows the range in which the true effect lies with 90 percent probability.

PBPM = per beneficiary per month.

Table IV.1. Probability of an effect of home-based primary care on total PBPM Medicare expenditures

	Difference-in-differences estimate (standard error)	Probability of effect < $0	Probability of effect > $100	Probability of effect > $200	Probability of effect > $300
Quarter after start					
1	−$11 ($84)	53%	8%	0%	0%
2	$66 ($92)	23%	36%	7%	1%
3	$210 ($97)	1%	88%	53%	18%
4	$302 ($102)	0%	98%	85%	49%
5	$356 ($105)	0%	99%	94%	70%
6	$321 ($99)	0%	99%	89%	58%
7	$314 ($100)	0%	98%	88%	56%
8	$293 ($108)	0%	96%	81%	47%
Total number of observations across the four years: 671,257					

Source: Medicare claims and enrollment data for 2010–2016 obtained from the Virtual Research Data Center for home-based primary care recipients and matched comparison group beneficiaries.

Note: Results are based on the Bayesian model, which is described in Appendix D.

PBPM = per beneficiary per month.

2.   Categories of expenditures

Home-based primary care recipients had higher expenditures for home-based services (home health services, DME, and hospice), whereas the matched comparison beneficiaries spent more on non-hospital services received outside of the home: SNFs and outpatient care (Table IV.2). In the first year after starting home-based primary care, the increase in PBPM expenditures on home health ($310), DME ($41), and physician or supplier services ($86)—a total of $437—was not offset by reduced expenditures on services from SNFs (−$365) and outpatient services (−$8). Home-based care recipients also had higher spending on hospice ($91 in the first year).[27]

In the first year after starting home-based primary care, the change in PBPM inpatient expenditures for home-based primary care recipients was $100 higher than for their matched comparisons; in the second year, it was $144 higher (Table IV.2). Although it is not surprising to see that home-based primary care led to increased use of home-based services, higher expenditures on inpatient services were unexpected given that one of the goals of home-based primary care is to reduce the use of potentially avoidable inpatient hospital admissions. As we describe in section D, we did not find such a reduction. In fact, our results indicate that home-based primary care recipients experienced more inpatient hospital admissions than their matched comparisons. The expenditure results were consistent with increased utilization of inpatient services: the estimated effect of home-based primary care on inpatient services was an increase of $100 PBPM during the first year and $144 in the second year.

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[27] About 24 percent of home-based primary care recipients had hospice expenditures in the first year after starting home-based primary care versus only 18 percent of the matched comparisons. We cannot observe in claims data whether this difference in utilization is caused by differences in preferences for noninstitutional care that existed before receiving home-based care. We conducted a survey in order to get a better understanding of whether home-based primary care recipients have different preferences and attitudes towards care (and whether any such difference might affect our impact estimates). This analysis is presented in Section C of this chapter.

Table IV.2. Estimated effect of home-based primary care on PBPM Medicare expenditures, by service category (frequentist model)

Service type and period	Difference-in-differences estimate (standard error)	90% CI LL	90% CI UL	Percentage effect (relative to home-based primary care group mean in the year before starting home-based primary care)
Inpatient services				
First year after starting home-based primary care	$100*** ($21)	65.5	134.5	4.8%
Second year after starting home-based primary care	$144*** ($23)	106.2	181.8	6.9%
SNFs				
First year after starting home-based primary care	−$365*** ($9)	−379.8	−350.2	−32.1%
Second year after starting home-based primary care	−$135*** ($10)	−151.5	−118.6	−11.9%
Home health services (Parts A and B)				
First year after starting home-based primary care	$310*** ($4)	303.4	316.6	73.3%
Second year after starting home-based primary care	$120*** ($4)	113.4	126.6	28.4%
Hospice services				
First year after starting home-based primary care	$91*** ($5)	82.8	99.2	303.3%
Second year after starting home-based primary care	$169*** ($8)	155.8	182.2	563.3%
Outpatient services				
First year after starting home-based primary care	−$8*** ($3)	−12.9	−3.1	−4.0%
Second year after starting home-based primary care	−$6 ($4)	−12.6	0.6	−3.0%
Physician or supplier services				
First year after starting home-based primary care	$86*** ($4)	79.4	92.6	14.0%
Second year after starting home-based primary care	−$6 ($4)	−12.6	0.6	−3.0%
DME				
First year after starting home-based primary care	$41*** ($2)	37.7	44.3	67.2%
Second year after starting home-based primary care	$17*** ($2)	13.7	20.3	27.9%
Total number of observations across all years: 671,257				

Source: Medicare claims and enrollment data for 2010–2016 obtained from the Virtual Research Data Center for home-based primary care recipients and matched comparison group beneficiaries.

Note: Expenditures were measured PBPM. The difference-in-differences estimate for each year was calculated as the difference in means between home-based primary care recipients and comparison beneficiaries in that year minus the difference in the means in the year before the index date.

*/**/*** The difference is statistically significant at the 0.10/0.05/0.01 level.

CI = confidence interval; DME = durable medical equipment; LL = lower limit; PBPM = per beneficiary per month; SNF = skilled nursing facility; UL = upper limit.
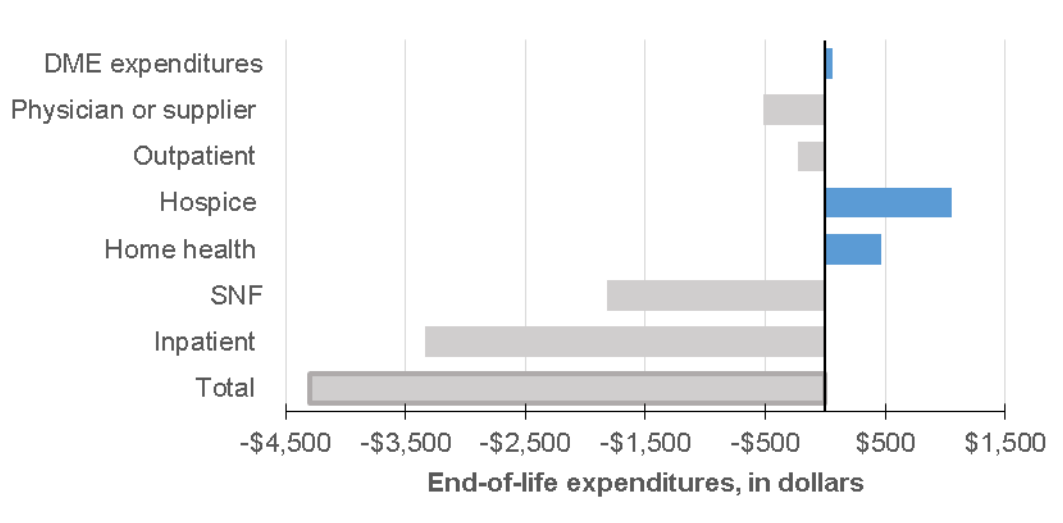
3. End-of-life expenditures

One reason some Medicare FFS beneficiaries might choose to receive home-based primary care is a preference for a particular style of medical care during the last months of their lives, specifically, one that deemphasizes institutional care, specialty care, and complex treatment plans and emphasizes in-home primary care and, when appropriate, palliative care. The results presented thus far show that home-based primary care led to higher expenditures measured on a PBPM basis. However, averaging expenditures over the course of a 12-month period may obscure the effect of home-based primary care on end-of-life costs.

When we compared unadjusted end-of-life expenditures for home-based primary care recipients and comparison beneficiaries who died during the 24 months of the post-period, we found that those receiving home-based primary care had lower expenditures in the last months of life. In addition, the types of expenditures in the month of death and the two months before differed between home-based care beneficiaries and the comparison group. Beneficiaries who died within two years after beginning home-based primary care experienced significantly lower inpatient, outpatient, physician or supplier, and SNF end-of-life expenditures than did comparison beneficiaries who also died during that period (Figure IV.3). The home-based primary care recipients also had significantly higher DME, home health, and hospice expenditures during this end-of-life period. However, the size of the difference in inpatient expenditures alone ($3,336 lower) dwarfed the higher expenditures for those other services, resulting in significantly lower total expenditures for home-based care group decedents ($23,238 versus $27,541), a difference of about 16 percent.

These results suggest that some combination of clinician and patient preferences led to a different approach to health care in the final months of life for those beneficiaries receiving home-based primary care. It is possible that a subset of beneficiaries who opted for home-based primary care did so in part to receive alternatives to institutional and aggressive care, at least during their last months of life. It is also possible that home-based primary care recipients' attitudes towards palliative and hospice care changed, reflecting the style of care received.

Figure IV.3. Difference in average end-of-life expenditures between home-based primary care recipients and comparison beneficiaries, pooled across panels.

Source: Medicare claims and enrollment data for 2010–2016 obtained from the Virtual Research Data Center for home-based primary care recipients and matched comparison group beneficiaries.

Note: End-of-life expenditures were calculated as the sum of expenditures incurred in the month of death and in the two months preceding death.

SNF = skilled nursing facility; DME = durable medical equipment.

C. Did attitudes and preferences explain any of the differences in home-based primary care expenditures?

One of the key limitations of the home-based primary care impact study was the possibility that unobserved differences between home-based primary care recipients and comparison beneficiaries influenced both the decision to start home-based primary care and health care utilization and expenditure patterns. This could include differences in health status and environment that were not captured in Medicare claims or administrative data, as well as differences in attitudes and preferences regarding health care. To understand these issues, we surveyed 1,820 home-based primary care recipients whose first home visits took place from January 2015 to June 2016 and 3,640 matched comparison beneficiaries. We had to use a more recent sample of beneficiaries (rather than our original panel) to maximize the number of respondents who would be living at the time of the interview. We asked them about their health status (overall, functional, and frailty), living situation, access to health care, knowledge of and attitudes toward home-based primary care, and preferences for treatment under several scenarios. See Appendix D for a detailed description of the survey sample, instrument, data collection, and analysis.

We included a definition of home-based primary care in the survey (Exhibit IV.2). However, cross-checking respondents' answers to Question A1, which asked whether the respondent had received home-based primary care in the past year, revealed that some survey respondents were either confused by the definition or were using a different definition. Nine percent of comparison respondents reported having had home-based primary care in the past year even though the

claims indicated that they had no home care visits; 14 percent of home-based primary care respondents reported not having had home-based primary care when claims indicated that they had.

Some questions were asked of all respondents (for example, health status assessment and how they would handle an episode of dizziness; see Tables D.33 through D.37 in Appendix D for more examples). Other questions were targeted to either those who identified as home-based care recipients or those who did not (for example, we asked those who identified as home-based care recipients why they started home-based primary care whereas we asked those who said they were not receiving home-based primary care why not; see Tables D.31 and D.32 in Appendix D for more examples). To align claims-based data with survey responses, we included in our analysis (1) respondents designated (based on their claims) as home-based primary care recipients who also self-identified as home-based care recipients in the survey and therefore answered the questions specific to home-based primary care , and (2) respondents designated as comparison respondents during the claims-based sample construction who did not self-identify as home-based primary care recipients in the survey and therefore answered the questions geared to those who do not receive primary care in the home.

> **Exhibit IV.2. Definition of home-based primary care used in survey**
>
> Home-based primary care is routine preventive care delivered in your home or medical treatment a patient receives in his or her home from a doctor, physician assistant, or nurse practitioner. Home-based primary care does not include care from a home health aide sent by a home health agency. Home health aides may help with activities such as dressing or bathing. Home-based primary care also does not include care from a visiting nurse sent by a home health agency or public health department.

We examined two key questions using these data:

1. Did home-based primary care recipients differ from comparison beneficiaries in ways that influenced their decision to receive home-based primary care?

2. Did the estimated effect of home-based primary care change after we account for the differences revealed in the survey?

There were systematic differences between the home-based primary care recipients and comparison beneficiaries who responded to the survey. However, controlling for these differences did not alter the estimated effect of home-based primary care on total Medicare expenditures. We present selected results from the survey analysis below.

1. Did home-based primary care recipients differ from comparison beneficiaries in ways that might cause selection bias into home-based primary care?

Home-based primary care recipients reported more functional limitations and poorer health. Although home-based care recipients in the survey sample were well matched to comparison beneficiaries according to ADL measures obtained through assessment data, home-based primary care recipient respondents were more likely than comparison respondents to report receiving help or having difficulty, by a minimum of 9.5 percentage points across functional activities (Table IV.3). In addition, the share of home-based primary care recipient respondents reporting very good or good health was about 9 percentage points lower than the share of

comparison respondents, and the proportion reporting poor health was 10 percentage points higher (Table IV.3). However, home-based primary care recipients and comparison beneficiaries receiving the survey matched well on a long list of claims-based health status measures (Appendix D, Table D.18).

Home-based primary care recipients and the comparison beneficiaries had similar attitudes about home- versus office-based care (Appendix D, Table D.35). Although home-based primary care recipients were more likely to express positive feelings about care in the home, the majority of both groups felt that receiving care in the home would be easier on friends and family and more comfortable than in a doctor's office. The majority of both groups also responded that primary care received in the home would be just as good as in a doctor's office. Most home-based primary care recipient and comparison respondents said they would feel safe receiving care at home but the majority of comparison respondents said they would feel *safer* receiving health care at a doctor's office.

Convenience, access to care, and awareness of home-based primary care were the main reasons that Medicare beneficiaries start home-based primary care. The most common reason given was convenience (79 percent); 76 percent said it was easier on the people who look after them, and 75 percent said it had become too difficult to travel (Appendix D, Table D.31).[28] Comparison respondents who expressed interest in home-based primary care gave the same top three reasons for their interest (that is, convenience, easier for those looking after them, and difficulties travelling) (Appendix D, Table D.32). A lack of awareness might be an important reason some beneficiaries did not start home-based primary care. Only 44 percent of comparison respondents had heard of home-based primary care and only 16 percent had received a recommendation from a clinician or someone else that they start home-based primary care.

The survey responses did not indicate that differences in attitude and preferences drove the decision to start home-based primary care, but they did reveal systematic differences in self-reported health status and functional limitations that we did not observe in claims data. Therefore, there is the potential for selection bias in the home-based primary care impact estimates if self-reported health status or functional limitations were correlated with expenditures.

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[28] Respondents could choose more than one reason.

Table IV.3. Functional limitations and health status

	Percentage of home-based primary care recipient respondents	Percentage of comparison respondents	Difference between home-based primary care recipient and comparison respondents, percentage points
"Due to a health or physical problem, do you receive help from another person with the following everyday activities?"			
Bathing or showering	73.2	56.0	17.2*** (1.7)
Dressing	63.2	45.2	18.0*** (1.8)
Eating	32.6	23.1	9.5*** (1.6)
Getting in or out of bed or chairs	53.5	37.5	16.0*** (1.8)
Walking	52.7	42.3	10.4*** (1.8)
Using the toilet	46.7	31.8	14.9*** (1.7)
Doing errands, such as shopping or visiting a doctor's office or clinic	81.7	70.8	10.9*** (1.5)
Taking your prescribed medications in your home	67.8	53.0	14.8*** (1.7)
Using medical equipment (for example, dialysis equipment, wheelchair, respirator, or inhaler)	60.6	43.0	17.6*** (1.8)
"Due to a health or physical problem, do you have difficulty doing any of the following activities on your own?"			
Doing errands, such as shopping or visiting a doctor's office	83.5	71.4	12.1*** (1.5)
Feeding yourself	29.7	19.3	10.4*** (1.5)
Using the toilet	49.1	31.0	18.1*** (1.7)
"In general, compared to other people your age, how would you rate your health?"			
Excellent	4.3	4.5	−0.2 (0.7)
Very good	10.9	15.1	−4.2*** (1.2)
Good	22.9	27.6	−4.7*** (1.6)
Fair	30.6	31.0	−0.4 (1.6)
Poor	29.7	19.9	9.8*** (1.5)
Don't know, missing, refused, multiple response	1.6	1.9	−0.3 (0.5)
Number of respondents	**651**	**1,316**	

Sources: Mathematica's analysis of 2013–2016 Medicare claims and enrollment data on the Virtual Research Data Center and survey data.

Note: The percentages reported were weighted using nonresponse and matching weights.

*/**/*** The difference is statistically significant at the 0.10/0.05/0.01 level.

2.   Did the estimated effect of home-based primary care change after we account for the differences revealed in the survey?

We found no evidence that our estimates in the home-based primary care analysis were influenced by selection bias. In coming to this conclusion we tested for a possible bias by identifying the set of survey responses that we found to differ systematically between the home-based primary care recipients and the comparison group, for example, self-reported health status (see Appendix D, Table D.19 for a complete list). We then estimated the effect of home-based primary care on expenditures with and without controlling for these survey responses. A marked change in the impact estimates, after controlling for self-reported health status, would suggest that previous estimates that did not control for this selection on health status into home-based primary care were biased.

We repeated the impact estimates three times using three different sets of control variables. The "base set" of control variables consisted of the same variables as those used in the main home-based primary care analysis.[29] The second set of controls included the base set plus the subset of survey variables that we found to be statistically significant differentiators between home-based care recipients and comparison respondents (shown in Appendix D, Table D.19). The final set of controls included the base set of controls plus *all* survey response variables (described in Appendix D, Table D.30), regardless of whether responses were systematically different for home-based care recipients versus comparison respondents. The impact estimates shown in Table IV.4 were not sensitive to including the two successive sets of additional control variables.[30]

Table IV.4. Estimated effects of home-based primary care with survey control variables, by expenditures category

Expenditures category	Impact estimate (standard error)		
	Base control variables	Base and differentiator survey variables	Base and all survey variables
Total expenditures	−$33 ($213)	−$37 ($214)	−$36 ($215)
Inpatient services	$26 ($149)	$21 ($150)	$20 ($150)
SNFs	−$315*** ($73)	−$314*** ($74)	−$312*** ($74)
Home health services (Parts A and B)	$216*** ($26)	$216*** ($26)	$216*** ($27)
Hospice services	$49* ($30)	$49 ($30)	$49 ($30)
Outpatient services	−$107*** ($29)	−$108*** ($29)	−$107*** ($29)
Physician or supplier services	$77** ($33)	$77** ($33)	$76** ($33)
DME	$21** ($11)	$21** ($11)	$21** ($11)
Total number of observations across two years: 3,934			

Source: Mathematica's analysis of 2013–2016 Medicare claims and enrollment data on the Virtual Research Data Center and survey data.

Notes: Expenditures were measured PBPM. The difference-in-differences estimate was calculated as the differences in means between the home-based primary care recipient and comparison respondents in the first year after the index date minus the difference in means in the year before the index date. "Base control variables" are shown in Appendix D, Table D.11. "Differentiator survey variables" are variables derived from the survey that were statistically significant predictors of home-based primary care status (Appendix, Table D.19). The full set of survey variables is shown in Appendix D, Table D.30.

*/**/*** The difference is statistically significant at the 0.10/0.05/0.01 level.

DME = durable medical equipment; PBPM = per beneficiary per month; SNF = skilled nursing facility.

Although we did find systematic differences between the home-based primary care recipient and comparison respondents to the survey, these differences either did not correlate with total Medicare expenditures or the standard set of controls is sufficient to effectively proxy for the

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[29] There was one difference—the survey used assessment data for information on ADLs instead of the ADL prediction model used in the main home-based primary care analysis. Table D.11 in Appendix D lists the base control variables.

[30] The impact estimates were similar to the earlier results (Table IV.2): Home-based primary care increased expenditures on DME and home health, physician, and hospice services, and reduced expenditures on SNF and outpatient services. However, in this analysis, the effect on total expenditures was not statistically significantly different from zero. The survey sample differed from the earlier analysis sample in two important regards: (1) All home-based primary care recipient respondents were attributed to an IAH practice and (2) the sample frame, with index dates in 2015 and the first six months of 2016, was later than the latest panel, with index dates in 2014.

differences. We did find differences in self-reported health status and functional limitations, which might be expected to be correlated with expenditures. If there is such a correlation, the results of our analysis suggest that the controls used in the home-based primary care analysis captured these differences.

3. Limitations to survey analysis

Some patients changed the type of care they receive over time. Between sample extraction and survey response, certain beneficiaries identified as home-based primary care recipients had stopped this mode of care and some comparison beneficiaries had started primary care visits in the home. Our analysis of Medicare claims in the period following the start of home-based primary care through the survey response date revealed that 104 (16 percent) of the 651 home-based primary care recipients who responded to the survey did not have any home-based primary care visits in the 12 months before their survey response. Of the 1,316 comparison respondents, 61 (5 percent) had at least one home-based primary visit in the 12 months before their survey response.[31]

As in the earlier analysis, we did not drop respondents from the home-based primary care group if they were found to have exited home-based primary care, nor did we drop comparison respondents who started having primary care visits in the home. However, we did test for selection bias using only home-based primary care respondents who remained in home-based primary care and comparison respondents who did not start. Our results were qualitatively the same as for the full sample.

D. How did home-based primary care affect hospital use?

One of the key questions for this analysis is whether, by providing more timely and appropriate primary care in the home, home-based primary care reduced the use of expensive acute care services such as inpatient hospitalizations and ED visits. We know that home-based primary care resulted in higher inpatient expenditures, relative to changes for matched comparison beneficiaries. We estimated the effect of home-based primary care on five outcomes related to hospital use: the number of all inpatient hospital admissions and those for ACSCs; the number of all ED outpatient visits and those for ACSCs; and the probability of having a qualifying hospital discharge and an unplanned readmission within 30 days of discharge.[32]

Home-based primary care recipients experienced, on average, 0.17 more inpatient hospital admissions in the first year than they would have otherwise and 0.11 more in the second year (Table IV.5). Home-based primary care recipients also had a small but statistically larger number of hospital admissions for ACSCs than they would have otherwise: 0.06 more in the first year and 0.02 more in the second. For both groups, the average number of hospital admissions in the post-baseline period was three to four times the average for all Medicare beneficiaries nationally.

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[31] The observed rate of switching was similar to that found in the main home-based primary care analysis.

[32] The regression for readmission includes all beneficiaries; it was not conditional on having a qualifying index discharge. Impact estimates of home-based primary care on this outcome provide an estimate of the combined effect of that care on whether a patient had an eligible index discharge and, if so, whether the patient had an unplanned readmission within 30 days. We excluded planned readmissions from this measure.

Home-based primary care recipients were more likely to have ED visits, both total ED visits (an increase of 0.21 visits, relative to the comparison group) and ED visits for ACSCs (an increase of 0.03) in the first year after starting home-based primary care (Table IV.5). In the second year, the effect on total ED visits was smaller (an increase of 0.05) and there was not a statistically significant effect for preventable ED visits.

In both post-intervention years, the effect of home-based primary care was to increase the probability of having a qualifying hospital discharge and an unplanned readmission within 30 days of discharge, by 1.8 percentage points in the first year and 1.4 percentage points in the second (Table IV.5).

Table IV.5. Estimated effect of home-based primary care on ED visits and hospital inpatient care

Service type and period	Difference-in-differences impact estimate (standard error)	90% CI LL	90% CI UL	Percentage effect (relative to the group mean of home-based primary care recipients in the year before starting home-based primary care)
Number of hospital admissions per beneficiary per year				
First year after starting home-based primary care	0.17*** (0.01)	0.15	0.19	8.7%
Second year after starting home-based primary care	0.11*** (0.01)	0.09	0.13	5.5%
Number of hospital admissions for ACSCs per beneficiary per year				
First year after starting home-based primary care	0.06*** (0.01)	0.05	0.07	13.2%
Second year after starting home-based primary care	0.02*** (0.01)	0.01	0.03	4.3%
Number of ED visits per beneficiary per year				
First year after starting home-based primary care	0.21*** (0.01)	0.19	0.23	19.4%
Second year after starting home-based primary care	0.05*** (0.01)	0.02	0.07	4.4%
Number of ED visits for ACSCs per beneficiary per year				
First year after starting home-based primary care	0.03*** (0.00)	0.02	0.03	20.0%
Second year after starting home-based primary care	0.01 (0.00)	0.00	0.01	4.0%
Probability of having a qualifying hospital discharge and an unplanned readmission within 30 days of discharge				
First year after starting home-based primary care	1.8%*** (0.3%)	1.2%	2.3%	8.3%
Second year after starting home-based primary care	1.4%*** (0.4%)	0.8%	2.0%	6.7%
Total number of observations across all years: 671,257				

Source: Medicare claims and enrollment data for 2010–2016 obtained from the Virtual Research Data Center for home-based primary care recipients and matched comparison group beneficiaries.

Notes: The difference-in-differences estimate for each year was calculated as the difference in means between home-based primary care recipients and comparison beneficiaries in that year minus the difference in the means in the year before the index date. Because of rounding, the percentage impact might exceed zero when the difference-in-differences estimate is zero.

*/**/*** The difference is statistically significant at the 0.10/0.05/0.01 level.

ACSC = ambulatory care-sensitive condition; CI = confidence interval; ED = emergency department; LL = lower limit; UL = upper limit.

E.   Impact estimates across panels

Our full sample included beneficiaries who started home-based primary care in one of five calendar years: 2010 through 2014. We separated the full sample into five panels, according to the year in which beneficiaries started home-based primary care and estimated the effects separately by panel. The results for each of the panels were qualitatively similar to the results described earlier for all panels combined: home-based primary care led to higher total Medicare

expenditures and increases in most utilization measures. However, comparing the results from the later panel to those of the earlier panels suggests that the effect of home-based primary care may be changing over time.

The effect of home-based primary care on inpatient admissions—relative increases—steadily declined across the five panels (Appendix D, Table D.26). For example, when estimated on the 2010 panel, the effect in the first year after starting home-based primary care was 0.20 more hospital admissions per beneficiary (a 10.5 percent impact) compared with 0.14 more admissions (a 7.2 percent impact) when estimated on the 2014 panel. The estimated effect of home-based primary care on the average number of ED visits, especially in the second year after starting home-based primary care, showed a similar pattern: The estimated effect was statistically significant only for the 2010 and 2011 panels (0.11 and 0.12 respectively). There was no statistically significant effect for any of the three later panels.

There was a statistically significant positive effect of home-based primary care on total expenditures across all panels; however, the effect declined for later panels, from $355 for the 2010 panel to $154 for the 2014 panel (Appendix D, Table D.25). The decrease in total Medicare expenditures over time was due to smaller increases in expenditures on home health services, physician or supplier services, and DME for home-based primary care recipients along with larger decreases in expenditures on SNF and outpatient services (Appendix D, Figure D.3).

These results could be due to improvements in the delivery of home-based primary care; reflecting an increasing ability of home-based primary care clinicians to keep their patients out of the hospital and ED. It is also possible, however, that unobserved characteristics of those who entered home-based primary care (and/or of the comparison beneficiaries) changed over these five years, leading to changes in the estimated effect.[33]

F.   Did IAH practices have the same results?

The IAH demonstration was designed to test a particular type of home-based primary care, for example, team-based primary care led by a physician, NP, or PA using EMRs. In this analysis, we focused on the effects of home-based primary care as provided by all clinicians in the IAH practice markets. We do not know whether, or how, the IAH care delivery approach may have differed from other local clinicians, nor whether it would make a difference. We examined whether the IAH practices, who we know were providing services consistent with the demonstration requirements, had the same effect as the effect measured across all home-based primary care clinicians.

On average, across all 5 panels of beneficiaries studied, approximately 27 percent of the home-based primary care recipients included in our sample received care from an IAH practice, either before it joined the demonstration (for the earlier panels) or while it was participating in the demonstration. We repeated the analyses described above including only the subset of home-based primary care recipients who received care from an IAH practice (and their matched comparisons). The IAH patients were more likely—by one or two percentage points—to be

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[33] The number of Medicare FFS beneficiaries new to home-based primary care increased over time, from 5,282 in 2010 to 6,513 in 2014.

younger than 65, to be black or African-American, have dual-eligibility status, and have disability as the original reason for Medicare eligibility than were home-based primary care recipients who received care from other practices. However, there were no large or systematic differences in other baseline characteristics, including health care use (such as number of hospitalizations in the previous year), expenditures in the baseline period, HCC scores, number of chronic conditions, or specific chronic conditions.

We found that the expenditures results were qualitatively the same as those estimated using the full sample (Tables D.27 and D.28 in Appendix D show results for total Medicare expenditures and categories of expenditures respectively). These results suggest that receiving home-based primary care from the IAH practices did not have a different effect on expenditures. The hospital use results for the IAH patients were generally similar to the results for the full sample (see Appendix D, Table D.29). However, because of the smaller sample size we were unable to measure the effect with the same level of precision as for the full sample. As a result, the bulk of the utilization impact estimates for the IAH patients were not statistically significant.

The same limitations that applied to our main analysis apply here, including concerns about nonrandom selection of Medicare FFS beneficiaries into and out of home-based primary care and the implications for our estimates. In general, home-based primary care beneficiaries attributed to IAH practices—or, for those in the earlier panels, attributed to practices that later entered the demonstration—were less likely to leave home-based primary care after the first six months. Their exit rate was approximately 5 percentage points lower; however, those IAH-attributed patients who did leave home-based primary care were less likely to return in the following six-month period than were home-based care recipients receiving care from a non-IAH clinician. The IAH-attributed sample was not large enough to support separate analyses for each panel, for testing whether the estimated effect of home-based primary care changed over time.

G. Limitations and conclusion

1. Limitations

The panel design was a strong assessment of the effect of home-based primary care. However, there are several limitations that affect the interpretation and implications of our findings. Some of these limitations are due to the inability of available data to capture potentially important but unobservable characteristics of the beneficiaries and the clinicians; others reflect limitations of the study design.

First, as in all observational studies, bias is a concern if unmeasured factors could affect both selection into home-based primary care and outcomes under consideration. Many factors can play a role in determining whether high-need Medicare FFS beneficiaries enter into home-based primary care (for example, history with the health care system, difficulty with transportation, family support, restrictions on Medicare supplemental coverage, and preferences for a style of medical care). Suppose that beneficiaries who start home-based primary care have more severe functional limitations, and assume that claims do not capture the extent of these limitations. If so, then beneficiaries receiving home-based primary care might have higher expenditures and increased utilization even in the absence of home-based primary care—hence, the potential for bias in impact estimates.

To look for evidence of selection bias, we surveyed new entrants into home-based primary care and a set of matched comparison beneficiaries who did not receive primary care in the home. The survey focused in particular on access barriers, attitudes toward and preferences for health care delivery, and self-perceived health status. Section C of this chapter describes our analysis of the survey results. Although we did find certain differences between the home-based primary care recipients and comparison respondents to the survey, we did not find that these differences introduced bias into our impact estimates. Regardless, it is not possible to completely rule out the possibility that unobserved differences between the two groups of beneficiaries could affect the results.

Second, our analysis design rests on the assumption that the home-based primary care recipients in our sample would have followed a similar health status trajectory as the comparison group if they had not started home-based primary care. It is a limitation of this design that the assumption of "parallel trends" was not testable. It is possible to assess whether both groups had similar trajectories over the two years prior to starting home-based primary care (see Appendix D), however, there are reasons to believe that trends from the baseline year backward may not be a reliable proxy for trends from the baseline moving forward. The reason is that all sample beneficiaries experienced a major health event during the baseline (one that resulted in an inpatient stay and post-acute care). The nature of this health shock in the baseline year could put two individuals who looked quite different in the year before the baseline into a very similar health state. That said, in an effort to match on the trajectory of health status, our matching process took into account a range of factors from the year prior to the baseline in addition to baseline year factors (see Appendix D for details).

We also included a wide array of recent health status measures in our matching—for example, whether the beneficiary had a hospital admission in the month before beginning home-based primary care (Appendix D, Table D.5.). Even so, we may be missing more nuanced information about their health care needs at the time of entry that differ systematically between those who start home-based primary care and those who do not. It is possible that those who enter home-based primary care have a more severe or advanced case of the same chronic condition, or are more susceptible to complications from the same set of conditions, than those who do not, resulting in increased ED and inpatient use. Ultimately we relied on our matching process to identify a comparison group whose utilization and Medicare expenditures provided an accurate account of how expenditures and utilization would have evolved for home-based primary care recipients had they not started home-based primary care.

Third, we monitored home-based primary care recipients and comparison beneficiaries for use of home-based primary care in the first six months after the index date, as described previously. The intent-to-treat design retained beneficiaries in the home-based primary care sample even if they eventually stopped using home-based primary care after the first six months; similarly, those in the comparison group remained in the comparison group even if they began to receive primary care in their home after the first six months. If a large proportion of beneficiaries switched from home-based primary care to office based care or vice versa during those periods, our analysis will yield a diluted measure of the effect of receiving primary care in the home in those months.

We did observe some home-based primary care recipients who stopped receiving the majority of E&M visits in their home after the first six months and we also observed some of the comparison beneficiaries who started to receive home-based primary care after the first six months (see Appendix D, Table D.13 for more discussion and exit rates for these and later time periods). We do not know why these beneficiaries switched. For example, some of these home care recipients may have been temporarily homebound after hip surgery, or while undergoing an intensive course of treatment for cancer, and switched back to seeing their primary care physician in the office once their health status improved. In addition, even if receiving primary care in the home altered a person's use of health care services while a patient (for example, reducing ED visits in favor of care in the home), there might have been few utilization changes that remained once a patient stopped being a home care recipient. In our intent-to-treat model, those patients may have exited home-based primary care, but they remained in the sample of home-based primary care recipients, again potentially leading to an inaccurate measure of the effect. During the initial six month period, Medicare expenditures were similar for both the home-based primary care and comparison beneficiaries. However, after that initial period, expenditures were higher for the home-based primary care beneficiaries and, after two years, the difference had increased to $367 PBPM. Given the relatively small number of beneficiaries who switched between the two types of primary care, it likely that the overall result of higher expenditures would remain even if there were no switchers.

Fourth, to have enough home-based primary care recipients to draw conclusions, we selected all qualified beneficiaries in the service area, regardless of who provided their home-based care. The demonstration practices, however, had to meet specific requirements, including supplying team-based primary care (see Exhibit I.1). We had very little information about the other, non-IAH clinicians and therefore cannot speculate about what aspects of home-based primary care led to our results. We estimated the effect of home-based primary care on the subset of new home-based primary care recipients attributed to the IAH practices—about one-fourth of the total sample (Appendix D, Table D.9)—and their matched comparison as a sensitivity check and our results were generally the same (Section F).

Finally, we do not attempt to extrapolate from our results to the effect of home-based primary care nationwide. For such an extrapolation to be valid, health care clinicians—both those providing primary care in the home and those providing care to the comparison beneficiaries in our sample—and the Medicare FFS beneficiaries in these 15 markets who met our eligibility criteria would have to be representative of clinicians and patients nationwide. We do not have sufficient information about either to make that comparison.

2. Conclusion

This chapter provides estimates of the effect of home-based primary care on Medicare expenditures and selected health care utilization outcomes for Medicare FFS beneficiaries with multiple chronic conditions and substantial functional limitations who met the eligibility criteria for the IAH demonstration. By constructing panels of beneficiaries new to home-based primary care, we could compare the differences between their outcomes and those of their matched comparisons before and after they began home-based primary care. This difference-in-differences design controlled for potentially different baseline levels of health-related needs and

risks for each beneficiary and the effect of other, external, factors that affect the changes in expenditures and use over that period for all Medicare FFS beneficiaries.

Our estimates indicate that home-based primary care does not reduce Medicare expenditures. Our findings show that home-based primary care recipients incurred total expenditures that were higher than what they would have experienced otherwise (in other words, relative to the total expenditures incurred by their matched comparisons). As discussed previously, the estimated effect of home-based primary care may be diluted because of nonrandom switching between home-based and office-based primary care after the initial six-month period. While the estimate itself might have differed if there were no switching, the likelihood that expenditures were lower for home-based primary care recipients relative to comparison beneficiaries is low, given the number of switchers. After the first six months, the results consistently suggest that home-based primary care did not reduce total Medicare FFS expenditures. There was a 2 percent probability of any savings being attributable to home-based primary care in the first year after the index date and there was 0 percent probability of any savings in the second year.

A key driver for these results was higher home health expenditures (relative to the matched comparison group), especially in the first year after beginning home-based primary care. Although these higher home health expenditures were offset by their much lower SNF expenditures, home-based primary care recipients also had higher expenditures for inpatient, physician or supplier, and hospice services. Thus, the results suggested substantial differences not only in total expenditures, but in the mix of services those expenditures paid for.

The mortality rate among this population of Medicare beneficiaries is high. About one-fourth died within the first year after the index date; almost one-fifth died during the second year. The mortality rate for those in home-based primary care was higher than that of the matched comparison beneficiaries; the median survival time was about three months longer for the comparisons. However, our core result that home-based primary care results in higher total expenditures did not change when we controlled for differences in expected survival.

Despite our finding that home-based care recipients and comparison survey respondents differed with respect to self-reports of health and limitations in ADLs, controlling for these differences did not result in marked changes in the impact estimates of home-based primary care on expenditures. The survey did not show substantial differences between home-based primary care and comparison groups with regard to attitudes and preferences for home-based primary care. The possibility of selection bias in a study based on observational data can never be ruled out, but our impact estimates were not sensitive to including additional controls constructed from the survey responses.

Those in home-based primary care who died during the 24 months after their initial home visit had total unadjusted end-of-life Medicare expenditures that were lower than comparison beneficiaries who died during that period. Home-based primary care recipients incurred significantly higher increases in hospice expenditures than did the matched comparison beneficiaries, a difference that was larger in the second year after the index date.

These results suggest a different approach to health care use between these two groups of chronically ill Medicare beneficiaries with functional limitations, especially during the last months of life. It is possible that a subset of beneficiaries who opted for home-based primary care do so in part to receive alternatives to institutional and aggressive care during those last months. It is also possible that home-based primary care recipients' attitudes towards palliative and hospice care changed, reflecting the style of care received. Without further information, it is difficult to know how much of the observed difference in health care use reflected different unobserved preferences of the beneficiaries and their caregivers when entering into home-based primary care and how much was the effect of the delivery model.

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V. SUMMARY AND DISCUSSION

A. Summary of results

In our evaluation of the IAH demonstration, we conducted multiple analyses to understand the effects of physician- or NP-led home-based primary care. We conducted two studies: the first study examined the effects of the demonstration payment incentive, and the second study addressed the effects of home-based primary care on Medicare expenditures.

1. Key findings of the effects of the demonstration payment incentive

The sites reported that they responded to the demonstration payment incentive, but we could not be confident that their efforts reduced Medicare expenditures. Estimates of the overall annual change in expenditures (that is, annual estimated effects that combined the first four demonstration years) showed reductions in total Medicare expenditures relative to the pre-demonstration year; however, these reductions were not statistically significant. The overall reduction was $161 PBPM, or 3.7 percent of the IAH beneficiaries' group mean spending in the pre-demonstration year.

Although the probability that the demonstration payment incentive decreased Medicare expenditures over the course of four years by any amount was 69 percent, there was a 31 percent probability that it increased expenditures. In addition, the probability that it decreased expenditures by at least $100 PBPM—about 2 percent of the average—over the course of four years was just 29 percent.

For the first three years of the demonstration, the incentive payments were close to the evaluation's estimated total spending reduction. Over the first three years, CMS paid $24,210,149 in incentive payments to IAH practices, while the evaluation estimated that the incentive reduced expenditures by $24,693,393, a net reduction of $483,244.

The estimated reductions in PBPM and total spending could have been achieved by the sites as a result of the demonstration payment incentive. However, because of the limited number of sites and beneficiaries served—a design feature driven by the congressionally imposed 10,000 beneficiary cap—we had only a low probability of detecting an effect of this size as statistically significant. The results were not statistically significant, which could have been because the reductions in expenditures the evaluation measured were not a result of the demonstration payment incentive or because there was not a large enough sample size to detect the effects that occurred.

Although we observed no statistically significant reductions in overall average annual expenditures across four years, the yearly estimate varied from a reduction of $32 PBPM to a reduction of $282 PBPM. Year 3 ($178 PBPM) and Year 4 ($282 PBPM) had the largest decreases. The probability that the demonstration saved $100 PBPM or more in Year 1 was 41 percent, but it fell in Year 2 to only 2 percent. Then, the probability that the demonstration reduced expenditures by $100 PBPM or more increased to 38 percent in Year 3 and 73 percent in Year 4. It is not possible to say with certainty what factors contributed to the substantial variation in estimated expenditure reductions across the four years. For example, most IAH practices reported that they made relatively few changes in staffing and care delivery during Year 1

relative to the previous year, yet we estimated a 41 percent probability of the demonstration payment incentive reducing expenditures $100 PBPM or more in Year 1. Perhaps of more interest was the large increase in expenditure reduction from Year 3 to Year 4. That large increase may have been related to improvements in the care provided by IAH practices, possibly because practices had more time to improve care processes. However, it is also possible that the large difference between Years 3 and 4 was related to other factors. For example, the increased expenditure reduction in Year 4 coincided with several IAH practices' participating in accountable care organizations. However, we have no strong evidence about whether such participation may have led to higher or lower expenditure reductions in Year 4 than would have occurred without it.

As was the case for total Medicare expenditures, we found no strong evidence that the demonstration reduced overall use of hospital care over the four-year demonstration period. Although most of the impacts on hospital use were not statistically significant, the estimated impacts of the demonstration on the use of hospital care grew more favorable from Year 2 to Year 4, following the same trend as total Medicare expenditures. Even though the total number of hospital admissions did not change significantly, the decline in the number of potentially avoidable hospitalizations (that is, hospitalizations for ACSCs) across the four years was statistically significant. The estimated decreases in potentially avoidable hospitalizations were larger in Years 3 and 4 than in Years 1 and 2. We also found a statistically significant reduction in total ED visits over the four-year demonstration period. Our results suggest that the decrease in total ED visits may have been driven by a decrease in potentially avoidable ED visits that lead to a hospital admission.

We documented substantial variation in how the IAH practices provided care throughout the demonstration. That variation could have contributed to the failure to significantly reduce Medicare expenditures. One area of substantial variation was in the composition of the primary care teams. The IAH legislation required team-based care, but it did not identify required members of the team. Some IAH practices relied largely on NPs, and others used primarily physicians. A small number of IAH practices had social workers, though most did not. The variation in how IAH practices implemented the model of care contrasts with studies of the effect of home-based primary care, such as De Jonge et al. (2014), which used a single model that was well defined.

IAH practices reported that they made changes to improve care but that those changes took time to develop. In some cases, practices discontinued strategies deemed ineffective. Overall, however, many practices reported developing and continuing systematic approaches for rapidly following up on transitions in care, such as adding staff dedicated to tracking hospital admissions and discharges. In addition, some practices added social workers or other staff to coordinate care for their patients with other organizations. Care partners reported that they had stronger relationships with the IAH practices relative to those they had with office-based practices. Practices reported a variety of efforts to improve overall quality of care by, for example, conducting chart audits to identify areas for improvement and meetings to discuss solutions for managing patients.

Despite the introduction of the demonstration payment incentive, a large majority of patients and their caregivers reported high levels of satisfaction with home-based primary care, found it

accessible, and reported that clinicians take their opinions into account. About 93 percent of beneficiaries and caregivers reported that they were either satisfied or very satisfied with the overall quality of care they had received from the IAH practice in the past six months. A large majority of beneficiaries preferred receiving primary care in their home a lot more than in an office or clinic, and a similarly large share of caregivers preferred that the beneficiary receive primary care at home.

2.   Key findings of the effects of home-based primary care

Home-based primary care, as delivered in the Medicare program to chronically ill and functionally limited patients, did not lower Medicare expenditures relative to office-based care. Instead, we found that home-based primary care led to expenditures higher in total than those for comparison beneficiaries.

Home-based primary care did not have a statistically significant effect on total Medicare expenditures during the first six months after the initial home visit. However, home-based primary care recipients had significantly higher expenditures over the remaining 18 months. In fact, the probability that home-based primary care increased expenditures in quarters three through eight was nearly 100 percent. Approximately 15 percent of home-based primary care recipients stopped receiving the majority of their primary care in their home after the initial 6 months; approximately 3 percent of the comparison beneficiaries had at least one home visit after the initial 6-month period. Without additional analyses that accommodate ever-changing matched groups, we cannot say definitively how this switching affects our results. We do know, however, that the probability that home-based primary care led to relatively higher expenditures was 77 percent in the second quarter before there was any switching.

The higher total expenditures for those receiving home-based primary care were driven by the larger increase in expenditures for home health services (for example, skilled nursing care and physical and occupational therapy provided by a home health agency) relative to the increase for the matched comparison group, especially in the first year after the start of home-based primary care. Expenditures for other services in the home (hospice and durable medical equipment) were also higher for patients receiving home-based primary care. Expenditures for services provided by physicians and other clinicians were also slightly higher for such patients.

Perhaps surprisingly, expenditures on hospital services were also higher for home-based primary care patients than the comparison group. This finding was unexpected because home-based primary care is hypothesized to reduce the need for hospital care. However, hospital admissions, ED visits, and the probability of an unplanned readmission were all higher for those who received home-based primary care than for the comparison group, resulting in higher inpatient expenses. Home-based primary care recipients had more potentially avoidable hospital admissions and ED visits during the first year after starting home-based primary care than they would have otherwise.

Although we found that home-based primary care led to higher total expenditures, the Medicare expenditures associated with home-based primary care might be decreasing. Patients who entered home-based primary care in earlier years (2010 and 2011) had a higher increase in costs relative to the comparison group than those who entered in later years (2013 and 2014).

B. Discussion

Congress mandated the IAH demonstration to test a combined payment incentive and service delivery model for Medicare beneficiaries with multiple chronic conditions and functional limitations. Ideally, we would have combined our evaluation of the demonstration payment incentive with the evaluation of the home-based primary care, but we were unable to do so because some beneficiaries in IAH had been already receiving home-based primary care at the start of the intervention. Therefore, we separately assessed the two components of the IAH demonstration: (1) the effect of the demonstration payment incentive on Medicare expenditures and other outcomes and (2) the effect of entering home-based primary care on Medicare expenditures and other outcomes.

It's not necessarily surprising that the results of the two analyses differ; the studies answered different questions, focused on beneficiaries in different circumstances, and included different types of home-based primary care practices. Our analysis of the demonstration payment incentive examined a group of experienced, home-based primary care practices that met key infrastructure requirements to answer the question: When offered a financial incentive, did a select group of practices reduce Medicare expenditures for a subset of their chronically ill, functionally limited patients? This analysis focused on whether IAH practices can reduce Medicare expenditures by changing the way they practice home-based primary care. In contrast, our analysis of home-based primary care answered the question: Did chronically ill, functionally limited beneficiaries have lower Medicare expenditures over a two-year period after starting home-based primary care? This analysis focused on the effect of changing the site at which beneficiaries receive their primary care rather than the effect of the demonstration's financial incentive.

For the IAH demonstration to result in Medicare savings, the costs or savings associated with home-based primary care in expansion areas—plus any savings from the demonstration payment incentive—must net out to lower overall expenditures for the Medicare program after accounting for the cost of incentive payments paid by CMS. However, we are unable to simply combine the estimated costs associated with home-based primary care and estimated savings that may have been associated with the demonstration payment incentive to obtain the overall effect of both parts of the demonstration, because they are calculated using different approaches and different populations of beneficiaries.

This evaluation was not designed to draw conclusions about how the IAH demonstration payment incentive might affect outcomes for Medicare beneficiaries who receive home-based primary care from practices other than those in the demonstration. In addition, the study did not assess how the demonstration payment incentive or home-based primary care might affect outcomes for Medicare beneficiaries who do not meet the demonstration eligibility criteria (for example, Medicare beneficiaries who have multiple chronic conditions but do not require human assistance with daily activities).

Our findings suggest that the IAH demonstration payment incentive may have reduced expenditures and use of some types of hospital care. Qualitative information we gathered annually from the practices suggested that IAH practices made changes in how they provided care during the demonstration. When interpreting the impacts of the demonstration payment

incentive on expenditures and hospital use, we considered changes reported by IAH practices, the consistency of the direction (increase or decrease) of the effects of the demonstration, and the possibility that the effects increased over time. We also considered the fact that because of the small size of the demonstration, we had only a low probability of detecting a reduction in expenditures of 3.7 percent—which is the average annual estimated effect of IAH on expenditures across the four years—as statistically significant. Taken together, this information suggested that the IAH demonstration payment incentive might have decreased expenditures and hospital use, particularly in later years of the demonstration. However, the estimates were not statistically significant, and there could have been differential changes over time in unobserved characteristics of IAH and comparison beneficiaries, which could have caused bias in the estimated effects of the demonstration payment incentive. The possibility of differential changes in unobserved patient characteristics between the year before the demonstration and later demonstration years make it more challenging to interpret the impact of the demonstration payment incentive in the later years and to draw firm conclusions.

When contemplating possible future savings from the IAH demonstration, we have to consider the possible effects of the demonstration payment incentive and the possible effects of home-based primary care. The reduction in expenditures estimated as a result of the demonstration payment incentive would be applicable to all beneficiaries who meet the eligibility criteria—both those who already receive home-based primary care and those who would be new recipients of home-based primary care as a result of any expansion by IAH practices. However, our results show that home-based primary care may result in higher expenditures for those who meet the eligibility criteria, which could result in higher Medicare expenditures for those who newly receive care as a result of an expansion.

Home-based primary care, however, is already covered by Medicare, and patients who are not as sick as patients eligible for the demonstration can still receive home-based primary care. Should the IAH demonstration be expanded, it could also provide more opportunities for increased use of home-based primary care by patients who are less sick. Since Medicare pays more for home-based primary care than it does for an equivalent primary care office visit, increased use of home-based primary care could result in additional costs to Medicare.

At the same time, we have reason to believe that the costs associated with home-based primary care might be decreasing, even without the demonstration. Patients who entered home-based primary care in later years (2013 and 2014) had a smaller increase in costs relative to the comparison group than those who entered in earlier years (2010 and 2011). The additional expenditures associated with home-based primary care could decline without an added payment incentive if either or both of the following occurs: clinicians learn how to deliver home-based primary care more effectively over time or more effective clinicians start delivering home-based primary care and less effective clinicians stop delivering such care.

There are also reasons to believe that the demonstration payment incentive will not be able to generate savings for Medicare. First, we measured only modest reductions in expenditures, which we could not confidently attribute to the demonstration payment incentive. The small, not statistically significant changes in expenditures could suggest that the incentive structure is a weak instrument for achieving changes in care patterns.

Second, as a technical matter, it has been challenging to evaluate the demonstration for the beneficiaries targeted by the demonstration. Key challenges were the poor health of the IAH beneficiaries and the small sample sizes. Some beneficiaries died before the sites could reasonably affect their expenditures. Many of the demonstration practices were relatively small, and the number of beneficiaries who met the demonstration criteria was only a subset of the practices' patients. With such small numbers of participants, incentive payment calculations and site-level evaluation results may be strongly influenced by the presence or absence of a few particularly high-cost or sick beneficiaries and may not be stable from year to year. Even if the practices grow substantially, measuring the effects of the demonstration payment incentive and home-based primary care would remain challenging. Of primary concern is the fact that administrative data have limited usefulness for identifying beneficiaries who are at the same stage in their illness and have functional status and non–health-related characteristics similar to the IAH beneficiaries.

Despite these concerns, there are reasons to be open-minded about the potential for the demonstration payment incentive and home-based primary care—or some variation of the incentive and service delivery model—to reduce Medicare expenditures. Although the impact of the payment incentive on expenditures was not statistically significant in any of the first four years of the demonstration, the magnitude increased substantially in Years 3 and 4, relative to Years 1 and 2. If it takes time for practices to alter the ways in which they deliver care, and if the demonstration's increased reduction in expenditures over time reflects changes that the practices made, then it is possible that a payment incentive in home-based primary care could eventually reduce Medicare expenditures.

In addition, it is possible that there is some specific model of home-based primary care that would reduce Medicare expenditures aside from any effect of a payment incentive. We found that changing to home-based primary care led to higher total expenditures than continuing to receive office-based care. However, previous research shows that expenditures for patients receiving home-based primary care were lower (Edes et al. 2014; De Jonge et al. 2014). These conflicting results could be due to differences in study design, differences in the model of home-based primary care, or both. For example, unlike previous research, we estimated the effect of home-based primary care relative to a comparison group of similar patients using data from before and after the first home visit. In contrast to previous research, which focused on a well-defined model operating within a single health system, our study included the full range of practices who offer home-based primary care. There is substantial variation in how IAH practices provide home-based primary care and the health care settings in which they operate. There is likely even more variation among non-IAH practices, such as those who typically provide office-based primary care but offer home-based primary care for a minority of their patients. Well-defined models of home-based primary care may reduce expenditures in some health care settings, but that result may not apply to the broad spectrum of clinicians providing this care to similarly chronically ill, functionally impaired Medicare beneficiaries.

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