

Independence at Home

Shared Savings Calculation Methodology: Regression Approach (Year 1) and Revised Regression Approach (Year 2)

October 2017

I. Overview

This report describes the Independence at Home (IAH) Demonstration shared savings methodologies developed as an alternative to the original, actuarial approach specified in the demonstration solicitation. For a full description of the actuarial approach, see the CMS report “Independence at Home Demonstration Actuarial Shared Savings Methodology: Specifications,” October 2017. The alternative methodologies are called (1) the “regression” methodology, adopted by most practices for Year 1 shared savings, and (2) the “revised regression” methodology, adopted in Year 2 by most of the practices that chose the earlier regression method.

The difference between the actuarial methodology and the regression methodologies lies in the calculation of the spending target and in the calculation of the actual expenditures. The actuarial methodology generates average monthly target expenditures based on historical Medicare fee-for-service (FFS) per capita expenditures for the Medicare FFS population in the same county as each IAH beneficiary. Expenditures are adjusted to reflect the CMS Hierarchical Condition Category (CMS-HCC) risk score and the frailty score (used in the Program of All-inclusive Care for the Elderly (PACE)) and trended to the performance year by the increase in total per capita Medicare FFS expenditures, as estimated by CMS’ Office of the Actuary. Each practice’s spending target is the average of all of the beneficiary-level spending targets, weighted by beneficiary months of enrollment.

The regression methodologies use administrative data to identify a matched comparison group of beneficiaries who did not receive home-based primary care, but who met all of the IAH health care use and health status criteria, as determined from CMS administrative data. The spending targets are generated by (1) using a regression that includes the IAH beneficiaries and the matched comparison group members, and (2) using the results from this regression and characteristics of the IAH beneficiaries. Because the regression methodologies require the use of comparison beneficiaries identified in administrative data, they do not use data from IAH practices’ beneficiaries whose eligibility could not be confirmed in the administrative data.

Given values for the spending target and actual spending, the method for calculating the incentive payment is the same for the actuarial and regression approaches. Please refer to the above-referenced actuarial methodology report for additional information on how the incentive payment calculations are performed, including but not limited to the calculation of quality measures and application of the 10,000 beneficiary cap in the demonstration law.¹

¹ Social Security Act, Sec. 1866E.

In the following sections of this report we provide more information about the regression methodologies. First, we describe the regression methodology offered to the IAH practices as an alternative in Year 1. Second, we describe the revised regression methodology offered for Year 2.

II. Description of Shared Savings Calculation under the Regression Methodology, Year 1

The Year 1 regression methodology is a regression-based approach which uses a comparison group to calculate the difference between Medicare expenditures incurred by IAH enrollees and a propensity-score matched comparison group. The parameters of a regression equation for each practice are used to project the expenses of the practice's IAH enrollees as though they were not involved in IAH. The average projected expenses serve as the spending target for shared savings.

The comparison group consists of Medicare beneficiaries who met the IAH demonstration requirements, lived in the same area as the IAH beneficiaries, had the same characteristics as the IAH beneficiaries, and did not receive home-based primary care. In identifying this comparison group in the data, we wanted to avoid selecting comparison group members who could differ systematically from the IAH beneficiaries, either on characteristics that we could observe or those we could not. Selecting a comparison group that systematically differed could have caused us to consistently set the spending target either too high or too low. In order to implement the regression approach while minimizing the possibility of systematic bias, we identified and measured patients' characteristics in the same way for the IAH enrollees and the comparison group.

Below is a summary of steps in the regression approach. The section following the step-wise summary contains further details of each step.

Summary of Steps in Calculations

Step 1. We identified the universe of Medicare beneficiaries potentially eligible for the demonstration (that is, they met the IAH eligibility criteria but were not necessarily seen by a demonstration practice) based upon information available in Medicare administrative data.² We separated this group into a potential IAH group and a potential comparison group. The potential IAH group for a given year included beneficiaries from the overall group who also received at least one home visit from a demonstration practice and lived in the same state as that IAH practice. The potential comparison group for a given year included beneficiaries from the overall group who also lived in the same zip codes as beneficiaries in the potential IAH group, had no visits with any demonstration practice in the year, and did not receive home-based primary care from anyone. We did this for each of 3 years before the demonstration and for the first demonstration year. Using 4 years of data instead of only the first demonstration year improves the statistical accuracy of the regression results, an important consideration given the small number of enrollees in each practice.

Step 2. To further refine the demonstration participants in Year 1, we used the list of beneficiaries officially included in the practice's Year 1 population. We excluded potential treatment beneficiaries (and their matched comparisons) whom we identified in the administrative data but who were not enrolled in the demonstration so that the estimation would not include

² Administrative data includes Medicare claims and EDB information as well as information obtained from skilled nursing facility, inpatient rehabilitation, and home health assessment data.

beneficiaries who were not enrolled by the practices. We also excluded those enrolled in the demonstration who did not meet the IAH eligibility criteria, according to the administrative data, to maintain consistency between how the IAH enrollees and their comparisons were selected. The resulting group consisted of all potential IAH beneficiaries enrolled by the practice in Year 1 *and* eligible for the demonstration according to administrative data. We refer to this group of enrollees as the IAH enrolled-and-consistent-with-administrative-data (IAH-ECAD) group.

- Step 3. We matched the potential comparison group to the IAH-ECAD group using propensity-score matching (explained further below), so that the comparison group had characteristics as similar as possible to the IAH enrollees. From the potential comparison group, we matched up to five comparisons per IAH-ECAD beneficiary, to form the final set of comparison group members.
- Step 4. We measured each patient's PBPM Medicare FFS expenditures using the same rules for the IAH enrollees and their comparisons. Note that because the comparison group does not enter the IAH demonstration, the time period that we used to measure expenditures differs from the time period used in the actuarial methodology (details follow below).
- Step 5. Using the IAH-ECAD group and their comparisons in Year 1, as well as the practice's IAH-eligible patients based on administrative data in the 3 pre-demonstration years and their matched comparisons, we estimated a regression to determine the relationship between patients' characteristics and expenditures for each site. These relationships told us how much more or less a beneficiary with a given characteristic costs, on average. We measured the difference between the IAH enrollees and the comparison group by an IAH indicator variable in the regression.
- Step 6. Using the regression results from Step 5, we estimated the amount the IAH-ECAD enrollees would have cost had the IAH practice not treated them. To do this, we multiplied the IAH-ECAD beneficiaries' characteristics by the regression coefficients to obtain a predicted cost for each beneficiary and then calculated the average across all IAH-ECAD beneficiaries in the practice.

Details of the Methodology for Calculating Savings under the Regression Approach

Enrollment and Eligibility for the IAH population (Steps 1 and 2)

To be included in the regression-based approach for shared savings, each practice's beneficiaries had to meet the eligibility and enrollment criteria described in Section II as well as be identified as eligible for the demonstration using only administrative data, as described in Step 1 above. The most common reasons why IAH enrollees were found ineligible using administrative data were that we could not find current measures of activities of daily living (ADLs) or that the ADLs available in Year 1 did not indicate that the individual met the IAH criterion of having at least two ADL limitations. For all practices combined, approximately 29 percent were excluded from the IAH demonstration group.

Comparison Group Matching (Step 3)

To obtain a group that most closely resembled the IAH beneficiaries, we used a propensity-score matching technique for each practice in each year. We matched the potential comparison group to the IAH-ECAD group using exact matching on age categories, Medicaid status, whether the original reason for Medicare entitlement was disability, and (when possible) county of residence. Exact matching

means, for these characteristics, there was at least one and up to five perfect matches for each individual. For example, an IAH-enrolled Medicaid recipient younger than 65 whose original reason for Medicare entitlement was disability and who lived in Sussex County was matched to a comparison group Medicaid recipient younger than 65 whose original reason for Medicare entitlement was disability and who lived in Sussex County.

We also used a number of other variables in the matching procedure, which enabled us to achieve an overall high level of similarity between IAH-enrolled beneficiaries and their comparisons within each practice; Table 1 lists these variables. For example, for each practice in each year, the matched comparison group was chosen so that on average, for each practice, the comparison group and the IAH group had approximately the same share of beneficiaries who were female, were white, had two ADL limitations, and had the remaining characteristics listed in Table 1.

Table 1: Variables Used for Matching Comparisons to IAH Patients, Regression Methodology, Year 1

Variable	Domain
Used for exact matching	
Age (< 65, 65–79, 80 or older)	Demographics
Dually eligible	Medicare enrollment
Original reason for Medicare entitlement was disability	
County ^a	Geographic location
Used as controls in the matching equation	
Female	Demographics
Race (white, black, or other)	
Original reason for Medicare entitlement (ESRD or ESRD/disability, age)	Medicare enrollment
Number of ADLs (2, 3 or 4, 5 or 6)	ADLs
Missing data on feeding ADL	
Number of chronic conditions (2–5, 6–9, 10 or more)	Chronic conditions
Cardiovascular: atrial fibrillation, acute myocardial infarction, ischemic heart disease, congestive heart failure, stroke, or transient ischemic attack ^b	
Cancer: breast, colorectal, endometrial, lung, or prostate ^b	
Cognitive: Alzheimer’s disease, related disorders, or senile dementia ^b	
Depression	
Endocrine or renal: chronic kidney disease, diabetes, or acquired hypothyroidism ^b	
Musculoskeletal or joint: hip fracture, osteoporosis, rheumatoid arthritis, or osteoarthritis ^b	
Ophthalmic: cataract or glaucoma ^b	
Other condition: anemia, benign prostatic hyperplasia, hyperlipidemia, or hypertension ^b	
Pulmonary: asthma or chronic obstructive pulmonary disorder ^b	

^a County was exactly matched when possible. In Year 1, at least one treatment beneficiary at each practice was exempt from exact county matching because, for that beneficiary’s values of age, dual eligibility, and disability, there were fewer candidate comparison beneficiaries than treatment beneficiaries in the county.

^b Categories came from a 2013 Chronic Conditions Data Warehouse chart book, available at <https://www.ccwdata.org/web/guest/medicare-charts/medicare-chronic-condition-charts>.

ADL = activities of daily living; ESRD = end-stage renal disease

Two groups of potential comparison beneficiaries were not included in the Year 1 regressions used to determine the spending target for Year 1 (details below). The first is the group of potential comparison group beneficiaries who were not found to be good matches for the Year 1 IAH-ECAD beneficiaries. The second is the group of comparison beneficiaries who were matched to *potential* IAH beneficiaries who were ultimately not included in the IAH-ECAD group.

Expenditures (Step 4)

To identify the time period over which to calculate expenditures for all individuals (both IAH and comparisons), we started one year before the demonstration began and identified the first date that the individual met two conditions: (1) had an inpatient admission paid by Medicare and (2) had a rehabilitation stay.³ If this occurred before the start of the demonstration, we started counting expenditures on the first day of the demonstration. If it occurred during the demonstration, we started counting expenditures on the first day of the month following the month in which the second of the two conditions was met. For the majority of the IAH-ECAD enrollees, the date that we started counting expenditures was the same as the enrollment date assigned under the actuarial methodology. For a substantial minority of IAH-ECAD enrollees, it was before the enrollment date used under the actuarial methodology. We continued to accumulate costs until (1) the end of the demonstration year, (2) the individual enrolled in a Medicare Advantage plan, or (3) the individual was no longer eligible for Medicare Part A or B (for example, due to death). We did not stop counting expenditures for any other reason, such as a patient leaving the practice and receiving care from another primary care provider. We used this approach because we did not have a method that enabled us to mimic demonstration enrollment and disenrollment for the comparison group, and the regression results would not be valid if expenditures were counted over a time period defined differently for the IAH-ECAD group than for its matched comparisons.

As in the actuarial methodology, actual expenditures for the IAH-ECAD group included the Medicare payments for all Medicare Part A and Part B claims occurring during the time period identified above in Year 1. Expenses incurred on the date of death were included in the actual expenditure calculation. The same period of claims runout (at least 8 months) was used for both the IAH and comparison groups of beneficiaries. There was no outlier adjustment included in the measurement of expenditures; sensitivity testing of the overall regression approach showed no material difference between using an outlier adjustment versus not.

Estimating the Spending Target (Steps 5-6)

To estimate the target expenditure, we estimated the following regression for each practice, as referenced in Step 5:

$$\text{Expenditures PBPM} = \text{constant} + \text{patients' characteristics} + \text{indicators for each year} + \text{indicator for being enrolled in IAH+ (indicators for each year multiplied by indicator for being enrolled in IAH)}$$

This regression gave us an estimate of the relationship between the indicator and the PBPM expenditures, called a coefficient, which told us the extent to which Medicare expenditures are different for individuals with that characteristic relative to an average IAH-eligible beneficiary in that area. We weighted each observation in estimating the regression. We defined fractional eligibility weights that capture the share of months eligible for the demonstration during each pre-demonstration or demonstration period. We also defined matching weights for comparison observations such that the number of weighted matched comparison beneficiaries equaled the number of IAH beneficiaries. The final weight of each observation in the regression was the product of the eligibility weight and the matching weight.

³ Rehabilitation stay is operationalized as any skilled nursing facility, inpatient rehabilitation or home health utilization.

We used 4 years of data to estimate the relationships modeled in the regression--3 years before the start of the demonstration and the first demonstration year--to obtain the most accurate estimates. As noted above in Step 1, this improves the statistical accuracy of the regression results.

Here is a simplified example: Let's say the average IAH-eligible patient costs \$1,000 per month at a given practice; using a regression equation similar to the one described earlier, we estimated that women cost \$100 per month less than men; Alzheimer's patients cost \$300 more per month than those without the condition; and asthma patients cost \$200 more per month. A practice has two patients: one woman with Alzheimer's and no asthma, and one man with no Alzheimer's and no asthma. Each patient was in the demonstration for one month. The spending target would be set as:

$$\text{Man's expenditures} = \$1,000 - (\$100 \times 0) + (\$300 \times 0) + (\$200 \times 0) = \$1,000$$

$$\text{Woman's expenditures} = \$1,000 - (\$100 \times 1) + (\$300 \times 1) + (\$200 \times 0) = \$1,200$$

$$\text{Practice spending target} = (\$1,000 + \$1,200) / 2 = \$1,100$$

The patient characteristics used in the regressions are shown in Table 2, on the next page.

To set the spending target, we used the practice's IAH-ECAD beneficiaries' characteristics and calculated the predicted PBPM average Medicare expenditures, as in the simplified example of how to calculate the target. The average established the spending target. Note that we excluded the IAH indicator variable coefficient in obtaining the target, because that was the estimated difference due to IAH.

Table 2: Patient Characteristics Used in Regressions, Regression Methodology, Year 1

Chronic conditions
Alzheimer's disease, related disorders, or senile dementia
AMI or IHD
Asthma
Breast, colorectal, endometrial, lung, or prostate cancer
CKD
CHF
COPD
Diabetes
Hip or pelvic fracture
Hyperlipidemia
Stroke/TIA
Number of chronic conditions and the square of the number of conditions
ADLs
Number of ADLs for which beneficiary requires human assistance: 2, 3–4, 5–6
Whether information about the feeding ADL was missing
Demographic characteristics
Age: Less than 65; 65–74; 75–79; 80–84; 85 or older
Gender
Race/ethnicity: Caucasian; Black or African American; Hispanic; Asian; American Indian/Alaskan Native, other, or unknown
Whether dually eligible for Medicare and Medicaid
Original reason for Medicare entitlement: Old age; ESRD or ESRD and disability; disability only
Number of months IAH-eligible: 1–3; 4–6; 7–9; 10–12

Notes: ADLs = activities of daily living; AMI = acute myocardial infarction; CHF = failure; CKD = chronic kidney disease; COPD = chronic obstructive pulmonary disease; ESRD = end-stage renal disease; congestive heart IHD = ischemic heart disease; TIA = transient ischemic attack

III. Description of Shared Savings Calculation under the Revised Regression Methodology, Year 2

The revised regression approach for Year 2 resembles the original regression approach for Year 2 in many respects, but we made three improvements.

- We revised the variables used to match a practice's beneficiaries to the comparison group.
- We expanded the analysis sample to include all beneficiaries identified in the administrative data as eligible for the demonstration and as beneficiaries of an IAH practice, regardless of whether the beneficiary enrolled in IAH. Because we did so, under the revised regression methodology we used the enrolled sample's results as the first stage in determining if a practice was eligible for shared savings (prior to considering other eligibility criteria such as quality performance) and then, if eligible, using the expanded-sample results to make an adjustment of the savings.
- We developed a process to include beneficiaries who continued in a practice from Year 1 to Year 2 but did not meet all demonstration eligibility requirements in Year 2. In this approach, we allowed for the patient's case mix characteristics to be updated to the start of their second year.

The revised regression methodology is a regression-based approach that uses a comparison group to calculate the difference between Medicare expenditures incurred by beneficiaries treated by the IAH practices and eligible for the demonstration according to claims data (a group we refer to as IAH beneficiaries) and the Medicare expenditures that would have been incurred had the IAH practice not cared for such beneficiaries. The comparison group consists of Medicare beneficiaries who met the IAH demonstration requirements, lived in the same area as the IAH beneficiaries, had the same demographic characteristics and health status measures as the IAH beneficiaries, and did not receive home-based primary care. In identifying this comparison group in the data, we wanted to avoid selecting comparison group members who could differ systematically from the IAH beneficiaries, either on observed or unobserved characteristics. Selecting a comparison group that systematically differed could have caused us to consistently set the spending target either too high or too low. To implement the revised regression approach *and* minimize the possibility of systematic bias, we identified and measured beneficiaries' characteristics and expenditures in the same way for the IAH beneficiaries and the comparison group.

Below we first summarize the steps in the revised regression approach. Then we provide further details of each step.

Summary of Steps in Calculations

Step 1. We identified the universe of Medicare FFS beneficiaries eligible for the demonstration (that is, they met the IAH eligibility criteria but were not necessarily seen by a demonstration practice) based upon information available in Medicare administrative data.⁴ We separated the set of Medicare FFS beneficiaries eligible for the demonstration into IAH beneficiaries and potential comparison beneficiaries. The IAH beneficiaries for a given year consisted of beneficiaries who lived in the same state as that IAH practice, were eligible for the demonstration, and received at least one home visit from a demonstration practice during the year. The IAH beneficiaries were not limited to beneficiaries enrolled in the demonstration. The potential comparison group for a given year included beneficiaries who were eligible for the demonstration, lived in the same zip codes as IAH beneficiaries, had no visits with any demonstration practice in the year, and did not receive home-based primary care from any provider.

Step 2. We defined carryover IAH beneficiaries as those who:

- met the IAH beneficiary criteria described in Step 1 during Year 1,
- did not meet all of those criteria in Year 2,
- continued to receive home visits from the same IAH practice in Year 2 as in Year 1.

As with Step 1, the carryover IAH beneficiaries were not limited to those who were originally enrolled in the demonstration in Year 1; some carryovers were originally nonenrolled IAH beneficiaries seen by the practice in Year 1, did not meet all IAH beneficiary criteria in Year 2, and continued to be seen by the practice in Year 2.

Step 3. We selected a comparison group for the IAH beneficiaries, using propensity score matching (explained further below), so that the comparison group had characteristics as similar as possible

⁴ Administrative data include Medicare claims and EDB information as well as information obtained from skilled nursing facility, inpatient rehabilitation, and home health assessment data.

to the IAH beneficiaries. We conducted matching separately for IAH beneficiaries who met all eligibility criteria in Year 2 and for carryover IAH beneficiaries.

- Step 4. For the expanded-sample, we measured each beneficiary's PBPM Medicare FFS expenditures using the same rules for the IAH beneficiaries and their comparisons. The expanded-sample for Year 2 refers to the IAH beneficiaries who met the eligibility criteria in Year 2 according to administrative data, the carryover IAH beneficiaries, and the comparison beneficiaries selected during propensity score matching for Year 2. We also identified an enrolled sample. To form the enrolled sample, we selected from the expanded sample those members who were on the official enrollment list in Year 2 maintained by the demonstration implementation contractor. Thus, the enrolled-sample refers to enrolled IAH beneficiaries who met the eligibility criteria in Year 2 based upon administrative data, enrolled carryover IAH beneficiaries, and comparison beneficiaries matched to those enrollees. The enrolled sample is a subgroup of the expanded sample.
- Step 5. Using the expanded samples for Years 1 and 2, as well as samples for the two pre-demonstration years, we analyzed the relationship between beneficiaries' characteristics and expenditures. To conduct the analysis of relationships, we estimated a regression for each practice. The relationships told us how much more or less was spent on a beneficiary with a given characteristic, on average. We measured the difference between the IAH beneficiaries and the comparison group by an indicator variable in the regression (details follow).
- Step 6. To establish the spending target, we used the regression results from Step 5 to estimate the amount of Medicare expenditures that the IAH beneficiaries (including carryover IAH beneficiaries) in the expanded-sample would have incurred had the IAH practice not treated them. This gave us the PBPM savings results for the expanded sample.
- Step 7. We repeated Steps 5 and 6 on the enrolled sample. We then used the savings results based on expanded sample to adjust the results from the enrolled sample.

Details of the Methodology for Calculating Savings under the Revised Regression Approach

Identifying the IAH beneficiaries and potential comparison beneficiaries (Step 1)

We identified the IAH and potential comparison beneficiaries for each of two years before the demonstration and for the first two years of the demonstration. Using four years of data instead of only the demonstration years improves the statistical accuracy of the regression results, an important consideration given the small number of IAH beneficiaries in some practices.

Identifying the potential comparison group for carryover IAH beneficiaries (Step 2)

We identified a potential comparison group for the IAH carryovers as those who, like the IAH carryovers, met the eligibility criteria in Year 1 and survived into Year 2. Potential comparisons did not receive home-based primary care (either from a demonstration practice or any other practice).

Comparison group matching (Step 3)

To obtain the comparison group that most closely resembled the IAH beneficiaries, we used propensity score matching for each practice in each year. We matched the potential comparison beneficiaries to the IAH beneficiaries identified in Step 1 using the variables listed in Table 3. Measurements for all matching variables used Medicare administrative data. CMS Hierarchical Condition Category (HCC) scores and individual HCCs were measured at the eligibility start date for the IAH and potential comparison beneficiaries identified in Step 1 as eligible for the demonstration in the given performance year, or at the beginning of Year 2 for the IAH carryover sample and their potential comparison group. We matched the main sample (beneficiaries who met all eligibility criteria) and the carryover sample separately. For the carryover beneficiaries, we used most of the same matching variables, though there were a few exceptions. Separately for the main sample (Step 1) and carryover sample (Step 2), we evaluated the matched comparison group in each practice in each year to ensure that the matched comparison group closely resembled the IAH beneficiaries.

Table 3. Variables Used for Matching Comparisons to Main and Carryover Samples, Revised Regression Methodology (Year 2)

Variable	Main sample identified in Step 1	Carryover sample identified in Step 2
Eligibility and utilization		
Number of months since most recent inpatient admission before eligibility (or start) date (1, 2 or 3, 4 or more) ^a	X	X
Whether beneficiary was eligible for the demonstration in Year 2 ^b		X
Month of the demonstration year that beneficiary met eligibility criteria in Year 2 (1, 2–6, 7–12) ^c	X	
Whether beneficiary had an observation stay and no inpatient admission in prior 12 months	X	X
Demographic characteristics		
Age (< 65, 65–79, 80 or older) ^d	X	X
Dually eligible ^d	X	X
Gender	X	X
Race (white, black, or other) ^d	X	X
Medicare enrollment		
Original reason for Medicare entitlement (age, disability, ESRD or ESRD and disability) ^d	X	X
ADLs^e		
Number of ADLs (2, 3 or 4, 5 or 6)	X	X
Missing data on feeding ADL ^d	X	X
Health status		
CMS-HCC risk score ^d	X	X
HCC 8: Metastatic cancer and acute leukemia ^d	X	X
HCC 9-10: Lung and other severe cancers; lymphoma and other cancers	X	X
HCC 11-12: Colorectal, bladder and other cancers; breast, prostate, and other cancers and tumors	X	X
HCC 18: Diabetes with chronic complications	X	X
HCC 21: Protein-calorie malnutrition ^d	X	X
HCC 27: End-stage liver disease	X	X
HCC 28-29: Cirrhosis of liver; chronic hepatitis	X	X
HCC 46: Severe hematological disorders	X	X
HCC 48: Coagulation defects and other specified hematological disorders	X	X
HCC 51: Dementia with complications ^d	X	X
HCC 52: Dementia without complications ^d	X	X
HCC 54-55: Drug/alcohol psychosis; drug/alcohol dependence	X	X

Variable	Main sample identified in Step 1	Carryover sample identified in Step 2
HCC 57-58: Schizophrenia; major depressive, bipolar, and paranoid disorders	X	X
HCC 70-71: Quadriplegia; paraplegia	X	X
HCC 72: Spinal cord disorders/injuries	X	X
HCC 85: Congestive heart failure ^d	X	X
HCC 96: Specified heart arrhythmias	X	X
HCC 103-104: Hemiplegia/hemiparesis; monoplegia, other paralytic syndromes	X	X
HCC 106: Atherosclerosis of the extremities with ulceration or gangrene	X	X
HCC 107-108: Vascular disease with complications; vascular disease	X	X
HCC 111: Chronic obstructive pulmonary disease	X	X
HCC 134: Dialysis status ^d	X	X
HCC 136-138: Chronic kidney disease, stages 3-5 ^d	X	X
HCC 139-140: Chronic kidney disease, stages 1 or 2 or unspecified; unspecified renal failure	X	X
HCC 157-159: Pressure ulcer of skin with necrosis through to muscle, tendon or bone; or with full or partial thickness skin loss	X	X
Depression	X	X
Anemia ^f	X	
Fluid and electrolyte disorders ^f	X	
Whether beneficiary had a major complicating condition or complication condition during the most recent inpatient admission ^f	X	
Chronically critically ill/medically complex diagnosis ^f	X	
Number of chronic conditions ^g	X	X

Note: Main sample refers to beneficiaries who were eligible for the demonstration in Year 2 and met the criteria for inclusion as an IAH beneficiary or potential comparison beneficiary (see Step 1 above). Carryover sample refers to IAH beneficiaries who met the IAH beneficiary criteria described in Step 1 during Year 1, did not meet all of those criteria in Year 2, but continued to receive home visits from the same IAH practice in Year 2 as in Year 1 and also refers to their matched comparison group.

^aUsed for exact matching. For Louisville, we also used state for exact matching.

^bAll IAH and potential comparison beneficiaries in the main sample were eligible for the demonstration in Year 2, so we did not use eligibility as a matching variable. For the carryover sample, eligibility was used for exact matching. This was necessary as a small number of beneficiaries requalified for the demonstration but were not attributed to the practice after requalifying. However, they were attributed to the practice before requalifying. For example, a beneficiary may have been hospitalized in month 9 and received home health in month 10, but the beneficiary became stable and did not receive a visit during months 11 and 12. Thus, the beneficiary did not meet the attribution criteria after the requalifying event.

^cFor practices that began the demonstration in June 2012, month 1 is June. For practices that began the demonstration in September 2012, month 1 is September. This variable is not relevant to the carryover sample since the start date for all IAH and potential comparison carryover beneficiaries was the first day of Year 2.

^dIdentified as a key predictor of mortality (Gagne et al. 2011) or expenditures; these are the variables we prioritized most highly when determining which of several alternative matched comparison groups was most appropriate for a particular practice in a particular year.

^eBecause many of the carryover beneficiaries did not have rehabilitation care during the demonstration year, updated ADLs were unavailable. As a result, we did not update the ADL variables for carryovers.

^fFor the main sample, we measured these variables using the claim from the most recent hospitalization in the year before the beneficiary became eligible for Year 2. Because some beneficiaries in the carryover sample did not have a hospitalization in the 12 months before Year 2 began, these data were missing for those beneficiaries, and we could not use the variables when matching the carryover sample.

^gNumber of chronic condition categories measured by the CMS Chronic Conditions Warehouse. For the main sample, the categories were 2-5, 6-9, or 10 or more. For the carryover sample, the categories were 0-3, 4-6, 7-9, or 10 or more.

ADLs = activities of daily living; ESRD = end-stage renal disease; HCC = hierarchical condition category.

Measuring PBPM Medicare Expenditures (Step 4)

To identify the time period over which to calculate expenditures for all beneficiaries (both IAH and comparisons) identified in Step 1, we started examining the claims history one year before the

performance year began and identified the first date by which the individual met two conditions: (1) had an inpatient admission paid by Medicare and (2) had a rehabilitation stay. If this occurred before the start of the performance year, we started counting expenditures on the first day of that year. If it occurred during the performance year, we started counting expenditures on the first day of the month following the month in which the latest occurring of the two conditions was met. For the majority of the IAH beneficiaries in the enrolled-sample, the date that we started counting expenditures was the same as the enrollment date assigned by the demonstration records maintained by the demonstration implementation contractor. We continued to accumulate expenditures until (1) the end of the performance year, (2) the individual enrolled in a Medicare Advantage plan, or (3) the individual was no longer eligible for Medicare Part A or B (for example, due to death). We did not stop counting expenditures for any other reason, such as a beneficiary leaving the practice and receiving care from another primary care provider. We used this approach because we did not have a method that enabled us to mimic demonstration enrollment and disenrollment for the comparison group, and the regression results would not be valid if expenditures were counted over a time period defined differently for the IAH beneficiaries than for their matched comparisons.

For the carryover IAH beneficiaries and their matched comparison group in Year 2, we started accumulating their expenditures on the first day of the second year of the demonstration. We then combined the carryover and non-carryover beneficiaries to create the expanded sample.

As in the Year 1 regression methodology, actual expenditures for the expanded sample included the Medicare payments for all Medicare Part A and Part B claims occurring during the time period identified above in Year 1 as well as in Year 2. Expenses incurred on the date of death were included in the actual expenditure calculation. The same period of claims runout (at least 8 months) was used for both the IAH and comparison groups of beneficiaries. There was no outlier adjustment included in the measurement of expenditures; sensitivity testing of the overall regression approach showed no material difference between using an outlier adjustment versus not.

Estimating the Spending Target (Steps 5 and 6)

We pooled four yearly samples to provide data for the regression analysis—yearly samples for two pre-demonstration years and two demonstration years. As noted above, including pre-demonstration years in the regression improves the statistical accuracy of the results. Per the description in Step 1, we constructed each of the four yearly samples so that they comprised IAH beneficiaries eligible based on administrative data and seen by the practice, and their matched comparisons. Like the Year 1 regression methodology’s data (see Section III), pre-demonstration-year samples consisted of all IAH beneficiaries eligible based on administrative data and seen by the practice, since no enrollees existed before the demonstration. Unlike the Year 1 regression methodology’s data, the samples for demonstration years included IAH beneficiaries seen by the practices but not enrolled. Carryovers were not identified for any year’s sample other than the Year 2 sample.

We weighted each observation in estimating the regression. We defined fractional eligibility weights that capture the share of months eligible for the demonstration during each pre-demonstration or demonstration period. We also defined matching weights for comparison observations such that the number of weighted matched comparison beneficiaries equaled the number of IAH beneficiaries. The final weight of each observation in the regression was the product of the eligibility weight and the matching weight.

We estimated the following regression equation for each practice, as referenced in Step 5:

$$\text{Expenditures PBPM} = \text{constant} + \text{beneficiaries' characteristics} + \text{indicators for each year} + \text{indicator for receiving care from an IAH practice} + (\text{indicators for each year multiplied by indicator for receiving care from an IAH practice})$$

This regression provides estimates of the amount by which Medicare expenditures are different for individuals with a given characteristic relative to an average IAH beneficiary in that practice.

To calculate the spending target, we multiplied the characteristics of the IAH beneficiaries in the expanded-sample for the practice by the regression coefficients to obtain predicted expenditures for each IAH beneficiary (see the simplified example in Section III) and then calculated the average across all IAH beneficiaries in the practice. We excluded the IAH indicator variable coefficient in obtaining the spending target, because that was the estimated benefit from receiving care from an IAH practice.

The beneficiary characteristics used in the expanded-sample regressions and enrolled-sample regressions are shown in Table 4.

Table 4. Beneficiary Characteristics Used in Regressions, Revised Regression Methodology, Year 2

Eligibility for the demonstration
Number of months since last inpatient admission: 1; 2–3; 4 or more Month of the demonstration year that beneficiary met eligibility criteria (1, 2–6, 7–12) ^a
Demographic characteristics
Age: less than 65; 65–74; 75–79; 80–84; 85 or older Gender Race/ethnicity: Caucasian; black or African American; Hispanic; Asian; American Indian/Alaskan Native, other, or unknown Dually eligible for Medicare and Medicaid Original reason for Medicare entitlement: old age; ESRD or ESRD and disability; disability only
ADLs
Number of ADLs for which beneficiary requires human assistance: 2, 3–4, 5–6 Whether information about the feeding ADL was missing
Health status
HCC risk score HCCs: HCC8: Metastatic cancer and acute leukemia HCC9: Lung and other severe cancers HCC10: Lymphoma and other cancers HCC11: Colorectal, bladder and other cancers HCC18: Diabetes with chronic complications HCC21: Protein-calorie malnutrition HCC27: End-stage liver disease HCC28: Cirrhosis of liver HCC29: Chronic hepatitis HCC46: Severe hematological disorders HCC51: Dementia with complications HCC52: Dementia without complications HCC54: Drug/alcohol psychosis HCC55: Drug/alcohol dependence HCC57: Schizophrenia HCC58: Major depressive, bipolar and paranoid disorders HCC70: Quadriplegia

HCC71: Paraplegia
HCC85: Congestive heart failure
HCC103: Hemiplegia/hemiparesis
HCC106: Atherosclerosis of the extremities with ulceration or gangrene
HCC107: Vascular disease with complications
HCC111: Chronic obstructive pulmonary disease
HCC134: Dialysis status
HCC157: Pressure ulcer of skin with necrosis through to muscle, tendon, or bone
HCC158: Pressure ulcer of skin with full thickness skin loss
HCC159: Pressure ulcer of skin with partial thickness skin loss
Chronic conditions measured by Chronic Conditions Warehouse
Alzheimer's or dementia
Acute myocardial infarction or ischemic heart disease
Asthma
Hip or pelvic fracture
Stroke or transient ischemic attack
Number of chronic conditions; also, the square of the number of conditions
Anemia^b
Fluid and electrolyte disorders^b
Chronically critically ill or medically complex diagnosis^c

^aFor practices that began the demonstration in June 2012, month 1 is June. For practices that began the demonstration in September 2012, month 1 is September.

^bMeasured using claims from the most recent inpatient stay and observation stay in the year prior to the demonstration eligibility date. Diagnosis codes for these conditions were drawn from Gagne et al. (2011). Not used for carryovers.

^cMeasured using diagnoses from the most recent inpatient stay in the year prior to the demonstration eligibility date. Diagnoses were drawn from Kandilov et al. (2014).

ADLs = activities of daily living; ESRD = end-stage renal disease; HCC = hierarchical condition category.

Determining savings eligibility based on the enrolled sample and using the expanded sample to adjust the savings estimate (Step 7)

We estimated another regression using four yearly samples, incorporating only enrolled samples in the data for Years 1 and 2. In other words, the data file for this regression analysis consisted of the same pre-demonstration samples that were used in Step 5, and the enrolled subsamples for Years 1 and 2.

We used the enrolled-sample results to determine eligibility for shared savings. If the PBPM expenditures for a practice in Year 2 were less than the PBPM spending target for the practice, and if that difference, the savings result, was statistically significant, then the practice was eligible for shared savings.

Given results that indicated eligibility for shared savings, we generated the final savings by applying an adjustment factor to the enrolled sample savings result. The adjustment factor is equal to the expanded-sample result divided by the enrolled-sample result. We applied the adjustment factor in the following way: Multiply the savings result from the enrolled sample by the adjustment factor.

References

Gagne J.J., Glynn R.J., Avorn J., Levin R., Schneeweiss S. A combined comorbidity score predicted mortality in elderly patients better than existing scores. *J Clin Epidemiol*, vol. 64, no. 7, 2011, pp. 749-759.

Kandilov, A., M. Ingber, M. Morley, N. Coomer, K. Dalton, B. Gage, C. Superina, and D. Kennell.
“Chronically Critically Ill Population Payment Recommendations.” Research Triangle Park, NC:
RTI International, March, 2014.

<https://innovation.cms.gov/files/reports/chronicallycriticallyillpopulation-report.pdf>