

## **Medicare Spending and Rehospitalization for Chronically Ill Medicare Beneficiaries: Home Health Use Compared to Other Post-Acute Care Settings**

### **Executive Summary**

The Alliance for Home Health Quality and Innovation commissioned Avalere Health in October 2008 to evaluate the relationship between post-hospital early home health use and Medicare spending and hospital readmissions for chronically ill Medicare beneficiaries. The study focused on Medicare beneficiaries with a hospital admission with a primary or secondary diagnosis of diabetes, chronic obstructive pulmonary disease (COPD), or congestive heart failure (CHF). The study compared post-hospital period-of-care costs and odds of hospital readmission for beneficiaries that use early home health versus beneficiaries that use other, non-home health post-acute care. The basis of the analysis was 2005 and 2006 Medicare claims data. We defined early home health as home health utilization in the same quarter as the first hospitalization stay that initiated the period of care. A period of care began with an initial hospitalization and ended after a one-quarter break in post-acute care or hospital utilization.

The study findings suggested that over the 2005-2006 period, post-hospital period-of-care costs and odds of hospital readmission were significantly lower for beneficiaries with early post-acute home health utilization versus beneficiaries with non-home health post-acute care use. We used regression analysis to control for variables independently expected to influence Medicare post-hospital spending and rates of readmission. We used the severity of illness (SOI) score to assign each patient to a severity level one through four. Results were presented by condition and SOI.

Early home health use was associated with lower post-hospital period-of-care costs for all three diagnoses and levels of severity of illness. The lower post-hospital Medicare spending on periods of care with early home health varied across SOI scores as indicated by the ranges presented below. The ranges show the smallest and greatest differences in Medicare spending between the early home health users and other post-acute care users by condition across SOI levels:

- Diabetes \$6,120 – \$9,441
- COPD \$5,453 – \$10,725
- CHF \$4,588 – \$8,010

For beneficiaries with diabetes, Medicare spending on periods of care with early home health was lower by \$6,120 for the least clinically severe patients (SOI score of 1) and by \$9,441 for the most clinically severe patients (SOI score of 4). For beneficiaries with COPD, Medicare spending on periods of care with early home health was lower by \$5,453 for beneficiaries with the third level of severity (SOI score of 3) and by \$10,725 for patients with a SOI score of 4. Finally, for patients with CHF, period of care costs with early home health were lower by \$4,588 for beneficiaries with a SOI score of 3 and by \$8,010 for beneficiaries with a SOI score of 4.

The study estimated the Medicare spending reduction associated with early home health use at \$1.71 billion over the 2005-2006 two-year period. This estimate was based on the spending reductions by SOI applied to the number of periods of care in the early home health group. If we applied these same lower period-of care costs to the non-

home health post-acute care users, Medicare post-hospital spending would be reduced by an additional \$1.77 billion over the 2005-2006 period.

## **Methodology**

The study's purpose was to better understand Medicare post-hospital spending and odds of hospital readmission for chronically ill beneficiaries who use early home health versus other non-home health post-acute care after a hospital admission. The study population was restricted to fee-for-service beneficiaries with a hospital primary or secondary diagnosis of diabetes, COPD, or CHF.

The data source for this analysis consisted of the limited data set (LDS) version of the standard analytic files (SAF) and the denominator file. Specifically, we used the 2005 and 2006 inpatient hospital, skilled nursing facility (SNF), home health agency, and hospice SAF files. Due to a delay in the release of the 2007 files, we did not include the 2007 SAF files. We linked all beneficiaries' claims across the files using beneficiary ID to create the periods of care. We used the denominator file to identify patients who died during a period of care.

The unit of analysis in this study was a period of care. A beneficiary's period of care began with an inpatient hospitalization and ended after a one-quarter break in hospital or post-acute care utilization. We relied on quarters of service, rather than a fixed time period – for example, 90 days – as the LDS SAF files include only quarters of service. In order to avoid capturing beneficiaries in the middle of an ongoing period of care, we restricted the analysis to beneficiaries with no hospital or post-acute care utilization in the quarter prior to the beginning of the period of care. Since we did not use the 2004 SAF files, we excluded periods of care that began in the first quarter of 2005 because without the 2004 SAF files, we were unable to determine whether these beneficiaries had hospital or post-acute care utilization prior to the first quarter of 2005. The sample size for our analysis consisted of 279,733 periods of care in the early home health user group and 292,360 periods of care in the non-home health user group.

The study population consisted of Medicare beneficiaries with a primary or secondary hospital diagnosis of diabetes, COPD, or CHF. We used the first and second diagnosis code fields on the initial hospital stay claim to identify beneficiaries' primary and secondary diagnoses. Where beneficiaries had more than one of the above diagnoses, we included them in the sample of each diagnostic group. Since the unit of analysis was the period of care, there were more periods of care than beneficiaries in our sample. Due to potential differences in severity across the three conditions, we presented the results separately for diabetes, COPD, and CHF, rather than aggregating period-of-care costs and odds of readmission across all three.

The study group consisted of early users of home health. We defined early home health use as having a home health claim within the same quarter as the initial hospitalization that initiated a period of care. Since the LDS files included quarters of service rather than exact dates of service, we were unable to restrict the study group to beneficiaries discharged from the hospital and admitted directly into a home health agency. Therefore, our study group could consist of beneficiaries that utilized other post-acute care services after their initial hospital stay and before they utilized home health. We referred to the study group as early users of home health because all individuals in this

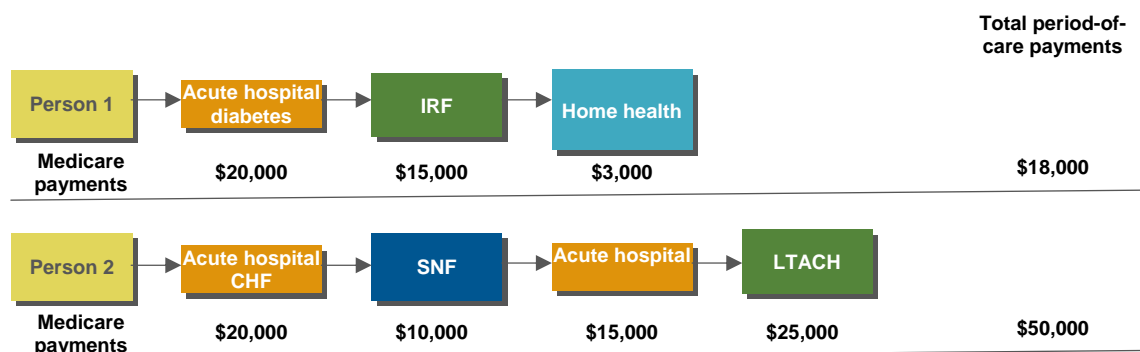
group utilized home healthcare early on during their period of care, specifically within the same quarter of hospitalization. The comparison group consisted of beneficiaries that utilized post-acute care services in any setting or settings other than the home health setting. These beneficiaries could have received post-acute care services from long-term acute care hospitals (LTACHs), inpatient rehabilitation facilities (IRFs), SNFs, or hospice agencies. We defined no home health use as not having a home health claim during the entire period of care.

The study did not include the following beneficiaries:

- Beneficiaries who did not utilize post-acute care
- Beneficiaries who utilized home health services later in their period of care, that is, after the same quarter as the initial hospitalization
- Beneficiaries whose home health utilization was not initiated by an inpatient hospitalization. The latter group was referred to as community home health users and Medicare Part B paid for their home health services.

The study focused on post-acute home health utilization. These excluded groups were distinct from the study population in this analysis and would likely require a different methodology than the one we used.

We calculated period-of-care costs by including all Medicare paid claims in the SAF files after the initial hospital stay until there was a one-quarter break in post-acute care of hospital utilization. Included in the period-of-care costs were any claims for the following types of services: home health, LTACH, IRF, SNF, hospice, and hospital readmissions. We did not include the initial hospital stay costs in the calculation of period-of-care costs because our intent was to measure the effect of home health on spending that occurred after the initiation of home healthcare services. All post-hospital post-acute care costs and hospital readmission costs incurred during the period of care were included. The graphic below depicts example calculations of period-of-care costs.



### Statistical Analyses

We first calculated descriptive statistics on the study population to determine the average period-of-care payments and readmission rates for early home health users and non-home health users with diabetes, COPD, or CHF. We stratified the descriptive statistics by beneficiaries' SOI score. We determined the score by running the patients' hospital procedures and diagnoses from the SAF files through the APR-DRG grouper.

SOI scores ranged from one to four, with four being the most severe. Patients were not included if they did not have a calculable SOI score.

Using a multivariate regression analysis, we estimated the effect of early home health use on post-hospitalization period-of-care costs and odds of hospital readmissions within each condition and SOI score. The odds ratio was the ratio of the odds of readmission in the home health group to the odds of readmission in the comparison group. The regression model included the following risk-adjustment variables:

- SOI
- Age (Ranges as follows: 65-69, 70-74, 75-79, 80-84, 85 and older)
- Sex
- Race
- Dual-eligibility status at any point in the entire period of care
- Geography based on beneficiaries' urban or rural designation
- Hospice utilization

We included hospice utilization as a risk-adjustment variable due to concerns that beneficiaries who elect hospice are a different population than beneficiaries with chronic conditions who utilize post-acute care. To test the impact of death during a period of care on the results, we also ran the regression model with a study population that excluded beneficiaries who died during their period of care.

### Impact Analyses

As discussed below, early home health users with diabetes, COPD, or CHF had lower post-hospitalization period-of-care costs than non-home health post-acute care users. For the impact analyses, we estimated the Medicare program spending reductions and potential spending reductions for the early home health population and the non-home health users. We calculated the total difference in Medicare spending for the early home health users versus the control group by multiplying the post-hospitalization period-of-care spending reductions for each chronic condition and SOI score by the number of periods of care with early home health in each chronic condition and SOI score. We then calculated the potential, estimated Medicare spending reduction from use of early home health by the non-home health users by multiplying the post-hospitalization period-of-care spending reductions for each chronic condition and SOI score by the number of periods of care without home health in each chronic condition and SOI score.

We also estimated the reduction in hospital readmissions due to use of early home health, and the associated estimated potential savings to the Medicare program. We first calculated the average number of hospital readmissions per period of care for both the early home health users and the non-home health users. We then multiplied the difference between the two averages by the number of periods of care in the early home health group to derive the total reduction in readmissions. Finally, we multiplied the total reduction in readmissions by the average cost of a hospital readmission stay for the home health group to estimate the total Medicare savings from reductions in hospital readmissions due to use of early home health.

### **Results**

## Full Sample

The table below illustrates the difference in Medicare spending and odds of readmission for early home health versus non-home health post-acute care periods of care, by SOI over the 2005-2006 two-year period. The negative post-hospitalization period-of-care costs indicated that Medicare post-hospitalization spending for early home health users was lower than the costs experienced by non-home health post-acute care users. An odds ratio of less than one signified that early home health users had lower odds of being readmitted to a hospital than non-home health users. All results were statistically significant.

Clinical Condition	Difference in Medicare Post-Hospital Spending Early Home Health Users Versus Non-Home Health Post-Acute Care Users	Odds Ratio Estimate of Odds of Hospital Readmission Early Home Health Users Versus Non-HH Post-Acute Care Users
Diabetes Patients		
SOI=1	- \$6,120	0.49
SOI=2	- \$7,117	0.53
SOI=3	- \$6,760	0.62
SOI=4	- \$9,441	0.70
COPD Patients		
SOI=1	- \$6,972	0.45
SOI=2	- \$5,996	0.55
SOI=3	- \$5,453	0.69
SOI=4	-\$10,725	0.72
CHF Patients		
SOI=1	- \$6,651	0.54
SOI=2	- \$4,980	0.61
SOI=3	- \$4,588	0.73
SOI=4	- \$8,010	0.79

The Medicare spending impact estimates are in the table below. These estimates reflected total savings over the 2005-2006 two-year period. We estimated that early use of home health over 2005 and 2006 was associated with a \$1.71 billion reduction in Medicare spending. Early home health use was also associated with 24,000 fewer hospital readmissions. We also estimated that if the lower period-of-care costs tied to early home health were applied to periods of care for non-home health users, Medicare spending would decline an additional \$1.77 billion.

Impact Analysis	Result
Estimated reduction in Medicare post-hospital spending over 2005-2006 period associated with use of early home health	\$1.71 billion
Fewer hospital readmissions over 2005-2006 period associated with use of early home health	24,000
Reduction in Medicare spending over 2005-2006 period associated with the 24,000 fewer readmissions	\$216 million
Estimated reduction in Medicare post-hospital spending over 2005-2006 period if lower period-of-care costs associated with early home health were applied to periods of care for non-home health users	\$1.77 billion

### Excluding Deceased Patients

To assess the impact of death on post-hospitalization period-of-care costs and hospital readmissions we performed a multivariate analysis where we excluded patients who died during their period of care. After excluding deceased patients, early home health users had even lower post-hospitalization period-of-care costs for all conditions, at each SOI level, and better odds of avoiding readmissions to the hospital across all diagnoses and SOI levels. All results were statistically significant.

Clinical Condition	Estimate of Effect of Early HH Utilization on Post-Hospitalization Period-of-Care Costs
Diabetes Patients	
SOI=1	- \$5,794
SOI=2	- \$7,153
SOI=3	- \$7,848
SOI=4	- \$10,783
COPD Patients	
SOI=1	- \$6,539
SOI=2	- \$6,419
SOI=3	- \$7,208
SOI=4	- \$11,224
CHF Patients	
SOI=1	- \$7,690
SOI=2	- \$6,088
SOI=3	- \$6,656
SOI=4	- \$9,586

### Study Variation

We completed a variation of this analysis where the study group consisted of all home health users, defined as beneficiaries who utilized home health early in their period of care or later on in their period of care. The comparison group remained beneficiaries with post-acute care use who did not utilize home health services. The post-hospitalization period-of-care cost results showed that for all conditions except SOI 2 and 3 for CHF patients, home health users had lower period-of-care costs. All results were statistically significant.

Clinical Condition	Estimate of Effect of HH Utilization on Post-Hospitalization Period-of-Care Costs
Diabetes Patients	
SOI=1	- \$2,057
SOI=2	- \$2,228
SOI=3	- \$1,248
SOI=4	- \$1,024
COPD Patients	
SOI=1	- \$1,944

SOI=2	- \$824
SOI=3	- \$455
SOI=4	- \$3,097
CHF Patients	
SOI=1	- \$1,062
SOI=2	\$93
SOI=3	\$593
SOI=4	- \$591

## Discussion

Study results suggested that early use of home health was associated with lower Medicare spending across all conditions and SOI levels. Although lower spending occurred across all SOI levels, the greatest Medicare spending differentials were among the most severely ill patients. We excluded dead patients to analyze the impact of death on the study. Death during a period of care magnified the differential in spending between the early home health and non-home health post-acute care users.

We also analyzed Medicare spending for beneficiaries with home health use at any point in a period of care versus non-home health post-acute care users. This study variation indicated that home health use at any point in a period of care cut post-hospital period-of-care costs for the majority of conditions and SOI levels. However, we did not report the results of this variation along with the main study results because this particular home health group includes late users of home health. This population of home health users could differ from early users of home health as there was a substantial lag time between the hospitalization and the home health use.

### Study Limitations and Areas for Further Research

There were a number of limitations to this analysis. The Medicare claims data available for this analysis did not include dates of service. The study relied on quarters of service. The study selected only those patients with an acute hospital service and home health service within the same quarter. Dates of service would allow for a more precise period of care definition – for example, 90 days. In addition, dates of service might allow for a better understanding of how specific post-acute care sequencing could affect Medicare period-of-care costs as well as odds of readmission.

Due to the delay of the release of the 2007 SAF files, our analysis was limited to the use of 2005 and 2006 SAF Medicare claims data. As such, we excluded periods of care from the analysis that did not end in 2006. In addition, we excluded periods of care that began in the first quarter of 2005 because without the 2004 SAF files, we could not determine whether these beneficiaries were in the middle of a period of care. Nevertheless, our sample size was robust enough to obtain statistically significant results.

In addition, in an effort to properly define and isolate the study population, we limited the Medicare population for which these results were applicable. Future research could apply this analysis to a broader population, such as all beneficiaries with chronic conditions or the entire Medicare population including those without chronic conditions.