Evaluation of the Home Health Value-Based Purchasing (HHVBP) Model

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Acronym List

Acronym	Term
ACH	Acute Care Hospitalization
AHRQ	Agency for Healthcare Research and Quality
AHRF	Area Health Resource File
AT	Achievement Threshold
BM	Benchmark
CBSA	Core-Based Statistical Area
CCN	CMS Certification Number
CCS	Clinical Classifications Software
CCW	Chronic Conditions Data Warehouse
CI	Confidence Interval
CMS	Centers for Medicare and Medicaid Services
CY	Calendar Year
D-in-D	Difference-in-Differences
DME	Durable Medical Equipment
ED	Emergency Department
FAQ	Frequently Asked Questions
FFS	Fee-for-Service
HH	Home Health
HHA	Home Health Agency
HHCAHPS	Home Health Consumer Assessment of Healthcare Providers and Systems
HHVBP	Home Health Value-Based Purchasing
HMO	Health Maintenance Organization
HUD	U.S. Department of Housing and Urban Development
ICD	International Classification of Diseases
LUPA	Low Utilization Payment Adjustment
MBSF	Master Beneficiary Summary File
OASIS	Outcome and Assessment Information Set
PECOS	Provider Enrollment, Chain and Ownership System
PEP	Partial Episode Payment
POS	Provider of Services
QIES	Quality Improvement and Evaluation System
RIF	Research Identifiable File
ROC	Resumption of Care
SNF	Skilled Nursing Facility
SOC	Start of Care
TPS	Total Performance Score
UAF	Unified Analytic File

Appendix A: Quantitative Technical Appendix

This Appendix provides details about the data sources and methods used to conduct the quantitative analyses for this Annual Report. Each of the following topics is covered below:

1. Detailed discussion of our quantitative analytic approach, including a discussion of the rationale and methods for defining the comparison group, our difference-in-differences framework, and results of parallel trend tests that informed the selection of our analytic approach (see **Section A.1, "Analytic Approach"**)
2. Detailed explanations of the descriptive variables and impact measures that are presented in the Annual Report, covering Quarter 1, 2013 through Quarter 4, 2017 (see **Section A.2, "Variable and Impact Measure Definitions"**)
3. Information about data acquisition and processing to create the analytic files that are necessary to define the impact measures of interest and conduct the analyses for this Annual Report (see **Section A.3, "Data Sources"**)
4. Step-by-step discussion of how we created the analytic file that we used to generate the results presented in this Annual Report (see **Section A.4, "Analytic File Creation"**)
5. Summary of the results of sensitivity analyses that explored additional covariate adjustments as part of our analytic approach (see **Section A.5, "Sensitivity Analyses"**)
6. Presentation of a Glossary (see **Section A.6, "Glossary"**)

A.1 Analytic Approach

We designed our quantitative analysis to address the question: What was the effect of the Home Health Value-Based Purchasing (HHVBP) Model on impact measures of interest such as health care utilization, quality of health care, health outcomes, and health care costs. From calendar year (CY) 2016 through CY 2022, home health agencies (HHAs) in Arizona, Florida, Iowa, Massachusetts, Maryland, Nebraska, North Carolina, Tennessee, and Washington are required to participate in the HHVBP Model. These states were selected at random from nine state regional groupings that were defined based on geographic location, utilization, demographics, and clinical characteristics, with each regional grouping containing five or six states.[1] To evaluate the impact of HHVBP by comparing the experience of beneficiaries and HHAs in HHVBP and non-Model states, our empirical model must address differing characteristics of beneficiaries and HHAs between HHVBP and non-Model groups. Our analyses used data from multiple sources (described in Section A.3) to estimate impacts of HHVBP on the cumulative impact of HHVBP across the nine HHVBP states. Per direction from the Centers for Medicare and Medicaid Services (CMS), we focused on national level findings in this Report. Most of the relevant data elements for this evaluation are available for both HHVBP and non-Model groups and both before and after the start of the HHVBP Model (i.e., during both the evaluation baseline period from 2013-2015 and the post implementation period starting in 2016). This allowed for both comparing outcomes between HHVBP and non-Model beneficiary populations and assessing whether the relative outcomes for these two groups changed from before to after the start of the HHVBP Model.

Below, we describe the descriptive variables and impact measures used in this Report. We then describe our overall analytic approach to construct a comparison group for the impact measures.

A.1.1 Descriptive Variables

An important step for this evaluation was to assess patterns and trends among HHVBP states in the characteristics of home health patients and HHAs and in the utilization of home health services. We compared descriptive measures in HHVBP and non-HHVBP states for individual years before and after implementation of the HHVBP Model. In multiple ways, these analyses informed the design of our analytic approach for evaluating effects of HHVBP. First, we used these analyses to assess the degree of balance between HHVBP states and all non-HHVBP states as a comparison prior to the implementation of the HHVBP Model. In addition, we used these analyses to identify both any relevant trends that preceded implementation of HHVBP and any trends that coincided with the post-implementation period. The descriptive variables used for these analyses are defined below in Section A.2.1.

A.1.2 Impact Measures

We see two general reasons why outcomes may differ across HHVBP and non-Model states: 1) differing observed characteristics of beneficiaries and HHAs studied; and 2) differing *un*observed characteristics of beneficiaries and HHAs. Our empirical strategies used information on observed characteristics to address differences between the treated populations (i.e., HHVBP states) and the comparison population (i.e., non-HHVBP states). Specifically, these strategies included an approach to establishing a

[1] HHS, CMS. (2015) 42 CFR 409, 424, 484. Medicare and Medicaid Programs; CY 2016 Home Health Prospective Payment System Rate Update; Home Health Value-Based Purchasing Model; and Home Health Quality Reporting Requirements; Final Rule. Federal Register 80 FR 68623. November 5, 2015. Accessed from here.

comparison group to address observed differences and the use of a difference-in-differences (D-in-D) framework to address unobserved differences.

A.1.2.1 Difference-in-Differences Approach for Impact Measures

We used a D-in-D framework to compare changes in impact measures observed over time in the HHVBP states relative to those in non-HHVBP states as the basis for evaluating the effects of HHVBP. The D-in-D framework offers a quasi-experimental design that can address many threats to validity, and rests on the critical assumption that, in the absence of the HHVBP Model, the impact measures in the two groups would have changed in a parallel manner over time. Our D-in-D analysis compared changes in impact measures observed over time in the HHVBP states combined to corresponding changes in the comparison group. The basic D-in-D estimate is defined as the difference in an outcome of interest over time in the Model states, after subtracting the difference, over time, in the comparison group:

$$D\text{-}in\text{-}D = [Y_{INT,POST} - Y_{INT,PRE}] - [Y_{COMP,POST} - Y_{COMP,PRE}]$$

where $Y_{INT,POST}$ and $Y_{INT,PRE}$ are the post- and pre-intervention outcome levels, respectively, for the HHVBP group, and $Y_{COMP,POST}$ and $Y_{COMP,PRE}$ are the post- and pre-intervention outcome levels, respectively, for the comparison group.

With this model specification, the impact estimate is the differential change in an outcome for the HHVBP states between the baseline and follow-up period(s), relative to that same change for the comparison group. That is, the differential change in the outcome over time for the HHVBP states relative to non-HHVBP states represents the estimated effect of HHVBP. The D-in-D design controls for unobserved, time-varying changes that are common to all beneficiaries (i.e., cyclical or seasonal trends or broader changes in the health system) as well as time-invariant, unmeasured differences between HHVBP and comparison states' markets and beneficiary populations. Moreover, through the use of a multivariate regression, we were able to adjust for observed characteristics of beneficiaries influencing the outcome. We also included state fixed effects to account for time-invariant, unobserved differences across states that may be correlated with outcomes and with HHVBP participation.

For most of the impact measures of interest for this Annual Report, we used a D-in-D approach to estimate effects of the Model for all HHVBP states combined.[2] We implemented this approach in a consistent multivariate linear regression framework for a broad range of impact measures of interest for this evaluation. We provide details regarding the specification of D-in-D models below in Section A.1.4.

A.1.3 Construction of the Comparison Group

A.1.3.1 Background

The hybrid strategy we employed in our first Annual Report was complex, leveraging a combination of approaches that were designed for specific categories of impact measures (e.g., entropy balancing,

[2] We were unable to use a D-in-D approach for the three measures that are self-reported by HHAs via the Secure Web Portal since these data are only available for HHAs in the HHVBP states. As such, we instead focused on reporting rates among HHAs in the nine HHVBP states.

reweighting, and matching).[3] For this year's work, we examined alternative approaches that led to a simplified and more unified comparison group methodology.

Balancing the HHVBP and comparison groups on factors that impact our outcomes of interest is important to reduce observed differences in the two populations that could lead us to incorrectly infer an effect of HHVBP that is actually a result of differences in the underlying populations. However, there are numerous and diverse impact measures of interest for this evaluation that correspond to different populations (e.g., Medicare fee-for-service [FFS] beneficiaries who receive home health care, all home health patients with Medicare or Medicaid coverage, HHAs) with different underlying factors that affect the outcome. In addition, broader changes are occurring in the home health landscape that can have varying implications for each of the impact measures. Together, these factors posed considerable challenges in developing a unified comparison group approach that would achieve balance for *all* impact measures of interest.

Therefore, in constructing a unified comparison group approach, we focused our balancing efforts on a subset of key impact measures that encompass important aspects of home health quality of care, utilization of services, and Medicare spending that reflect a range of home health populations that are relevant to the HHVBP measure set. This strategy allowed us to prioritize among the multiple impact measures of interest in designing our analytic approach (Exhibit A-1).

Exhibit A-1. Key Impact Measures Used to Inform Comparison Group Approach

Measure	Underlying Population
Quality	
Unplanned Acute Care Hospitalization/First FFS Home Health (HH) Episodes	FFS Beneficiaries who Received HH Care
Emergency Department (ED) Use (no Hospitalization) among First HH Episodes	FFS Beneficiaries who Received HH Care
Improvement in Ambulation-Locomotion	Medicare and/or Medicaid Beneficiaries (including Managed Care Enrollees)
Discharged to Community	Medicare and/or Medicaid Beneficiaries (including Managed Care Enrollees)
Spending	
Average Medicare Spending per Day during FFS HH Episodes of Care	FFS Beneficiaries who Received HH Care
Average Medicare Spending per Day following FFS HH Episodes of Care	FFS Beneficiaries who Received HH Care
Average Medicare Spending per Day during and following FFS HH Episodes of Care	FFS Beneficiaries who Received HH Care
Average Medicare Spending per Day for Unplanned Acute Care Hospitalizations among FFS HH Beneficiaries	FFS Beneficiaries who Received HH Care
Total Performance Score (TPS)	**Home Health Agencies**

HHVBP Measures indicated by italic text.

[3] Arbor Research Collaborative for Health and L&M Policy Research. (2018) First HHVBP Annual Report: Quantitative Technical Appendix. Prepared for: The Centers for Medicare & Medicaid Services, Center for Medicare and Medicaid Innovation. HHSM-500-2014-00029I. Accessed from here.

Motivation for Selection of Key Measures to Inform the Comparison Group Approach

The two Medicare claims-based HHVBP measures – Unplanned Hospitalization and ED Use among First Home Health Episodes – correspond to measures of quality that were both directly incentivized by the Model and could be seen as indicators of the quality of home health care. These measures reflect aspects of utilization that HHVBP aims to reduce, where appropriate, as a potential means for improving quality while achieving lower average Medicare expenditures among home health beneficiaries.

We also included two Outcome and Assessment Information Set (OASIS)-based HHVBP measures that cover a broader population than the claims-based HHVBP measures and represent different aspects of quality that are incentivized under HHVBP. The use of the Improvement in Ambulation-Locomotion measure – an indicator of Activities of Daily Living – ensures that the comparison group design will take into account functional outcome improvement. This measure is National Quality Forum-endorsed and among the six OASIS outcome improvement measures in the HHVBP Model for CY2017, the Improvement in Ambulation-Locomotion measure is among the more broadly applicable, based on the subset of home health patients for whom it is used. In addition, the Improvement in Ambulation-Locomotion measure represents one of the functional outcome improvement measures identified by a previous Technical Expert Panel as being especially relevant in helping patients be able to stay at home (along with Improvement in Toilet Transferring and Improvement in Bed Transferring).[4] The other OASIS-based measure that we chose to include as a key measure in our comparison group approach – Discharged to Community – identifies successful discharges to remain at home or to self-care. The OASIS items used to define this measure are related to the type of assessment and are less likely to be manipulated than other OASIS-based measures.[5]

The three measures of average daily Medicare spending are important as they can inform conclusions about the impact of HHVBP on Medicare spending for beneficiaries across a wide range of services both during and following episodes of home health care. We also included an aspect of spending that relates more directly to incentives under the Model—spending for unplanned acute care hospitalizations (ACH)—which may be a key contributor to any overall changes in spending that result from the HHVBP Model.

Together, these nine key impact measures served as our basis for developing a simplified, more unified comparison group approach for this evaluation. As discussed below, the methodology we employed to establish a valid comparison group for these measures was then applied to other outcomes of interest, while also allowing for a degree of flexibility where supported by a theory and empirical evidence.

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[4] It was recently finalized as part of the Final Rule for CY 2019 that the Improvement to Ambulation-Locomotion measure will be replaced in the HHVBP measures set with two composite measures of activities of daily living beginning with performance year 4 of HHVBP. HHS, CMS. (2018) 42 CFR 409, 424, 484, 486, & 488. Medicare and Medicaid Programs; CY 2019 Home Health Prospective Payment System Rate Update and CY 2020 Case-Mix Adjustment Methodology Refinements; Home Health Value-Based Purchasing Model; Home Health Quality Reporting Requirements; Home Infusion Therapy Requirements; and Training Requirements for Surveyors of National Accrediting Organizations; Final Rule. Federal Register 83 FR 56406. 11/13/2018. Accessed from here.

[5] For example, the two OASIS items used in constructing the measure are not as subjective as other OASIS-based measures. First, Reason for Assessment (M0100) must indicate that the assessment is a discharge assessment and not a transfer to an inpatient facility, or death at home, and differing items are to be collected. Second, Discharge Disposition (M2420) is used and indicates that the individual remained in the community after discharge, either with or without formal assistance.

A.1.3.2 Comparison Group

We designed the quantitative analyses for this Annual Report to evaluate the effect of the HHVBP Model on a range of impact measures that include Medicare spending, utilization of services, quality of care, and patient experience. As discussed above, we prioritized a subset of impact measures in the design of our overall approach, which we then extended to other impact measures of interest. To facilitate the interpretation of findings across measures, we established a common comparison group approach for our analyses. These analyses involved comparisons for both beneficiaries and agencies between HHVBP and non-HHVBP states.

As important aspects of the design of the HHVBP Model, the randomized selection of nine HHVBP states and mandatory participation of all HHAs in these selected states helped to guard against selection bias. As reflected in the results of our descriptive analyses, we found that the Model design achieved reasonably close balance between HHVBP states and the remaining states in many beneficiary and agency characteristics, and aspects of home health care. Given the extent of diversity in beneficiary and agency characteristics and treatment patterns across states, not all factors were balanced between the two groups through randomization alone, with a degree of imbalance observed for certain factors.

Given the design attributes of randomization and mandatory participation and the degree of balance observed for a range of factors, we defined a single comparison population consisting of beneficiaries and agencies in the 41 states that were not selected for participation in the HHVBP Model.[6] We used a multivariate linear regression approach to compare observations in the nine HHVBP states with those in the 41 comparison states while adjusting for a common set of covariates across measures to the extent possible. In the context of a parametric regression framework, we were able to control for observed differences between the HHVBP and comparison groups, generate a D-in-D estimator, and examine adjusted baseline differences for consideration of the estimator's key parallel trend assumption.

To address the various research questions that are of interest for this evaluation given the goals of the HHVBP Model and the incentives reflected in the HHVBP performance measures, we used this analytic approach and single comparison group to examine a range of impact measures for this Report. These impact measures are enumerated below in Exhibit A-2.

[6] The evaluation restricts comparisons to the 41 non-HHVBP states and excludes the District of Columbia and U.S. Territories, as they were not eligible for selection into the HHVBP Model.

Exhibit A-2. Impact Measures Used to Evaluate HHVBP

Measure	Unit of Analysis	Baseline Period
FFS Claims-Based Quality Measures		
ED Use (no Hospitalization)/First FFS HH Episodes	FFS Episode-Level	2013-2015
Unplanned Acute Care Hospitalization/First FFS HH Episodes	FFS Episode-Level	2013-2015
Unplanned *Acute Care Hospitalization*/All FFS HH Episodes	FFS Episode-Level	2013-2015
Unplanned Hospital Readmission in the First 30 days of HH Care	FFS Episode-Level	2013-2015
ED Use Following Hospitalization (without Hospital Readmission) in the First 30 Days of HH Care	FFS Episode-Level	2013-2015
Skilled Nursing Facility (SNF) Use/All FFS HH Episodes	FFS Episode-Level	2013-2015
FFS Claims-Based Spending Measures		
Average Medicare Spending per Day for Unplanned Acute Care Hospitalizations Among all FFS HH Episodes	FFS Episode-Level	2013-2015
Average Medicare Spending per Day during and following FFS HH Episodes of Care	FFS Episode-Level	2013-2015
Average Medicare Spending per Day during FFS HH Episodes of Care	FFS Episode-Level	2013-2015
Average Medicare Spending per Day following FFS HH Episodes of Care	FFS Episode-Level	2013-2015
OASIS-Based Outcome Measures		
Discharged to Community	OASIS Episode-Level	2013-2015
Improvement in Ambulation-Locomotion	OASIS Episode-Level	2013-2015
Improvement in Bathing	OASIS Episode-Level	2013-2015
Improvement in Bed Transferring	OASIS Episode-Level	2013-2015
Improvement in Dyspnea	OASIS Episode-Level	2013-2015
Improvement in Management of Oral Medications	OASIS Episode-Level	2013-2015
Improvement in Pain Interfering with Activity	OASIS Episode-Level	2013-2015
Improvement in Status of Surgical Wounds	OASIS Episode-Level	2013-2015
OASIS-Based Process Measures		
Drug Education on Medications Provided to Patient/Caregiver during Episodes of Care	HHA-Level	2013-2015
Influenza Immunization Received for Current Flu Season	HHA-Level	2013-2015
Pneumococcal Polysaccharide Vaccine Ever Received	HHA-Level	2013-2015
Depression Assessment Conducted	HHA-Level	2013-2015
Diabetic Foot Care and Patient/Caregiver Education Implemented during All Episodes of Care	HHA-Level	2013-2015
Multifactor Fall Risk Assessment Conducted for All Patients who Can Ambulate	HHA-Level	2013-2015
Timely Initiation of Care	HHA-Level	2013-2015
HHCAHPS-Based Patient Experience Measures		
How often the home health team gave care in a professional way	HHA-Level	2013-2015
How well did the home health team communicate with patients	HHA-Level	2013-2015
Did the home health team discuss medicines, pain, and home safety with patients	HHA-Level	2013-2015
How do patients rate the overall care from the HHA	HHA-Level	2013-2015
Would patients recommend the HHA to friends and family	HHA-Level	2013-2015
HHA TPS	HHA-Level	2015*

HHVBP Measures indicated by italic text. | * As discussed in this Report, a D-in-D approach is not used for analysis of agency TPS. In calculating the TPS, the baseline period for measuring achievement on HHVBP performance measures is 2015. The baseline period for measuring agency improvement on individual measures is the earliest of 2015 or their first full year in operation.
The duration of OASIS episodes of care may differ from that of Medicare FFS episodes.
Note: We do not include the three HHVBP self-reported measures (Influenza Vaccination Coverage for HHA Personnel; Herpes Zoster [shingles] Vaccination for Patient; Advance Care Plan) since these data are only available for HHAs in the HHVBP states.

A key step in designing our regression-based comparison group approach was to select factors for covariate adjustment. We considered a combination of several criteria in selecting factors for inclusion in the regression analyses. While not every factor that was chosen was equally preferred based on each criterion, each factor that was chosen was seen as having advantages for inclusion when balancing among these various criteria and in achieving unbiased estimates of the effects of HHVBP. Below we describe the criteria that were used in selecting among potential factors for covariate adjustment:

- ***Adoption of a uniform analytic approach.*** To the extent possible, we sought to adjust for similar factors in examining the range of impact measures that are of interest for this evaluation. We used this strategy to facilitate interpretation of the estimated effects of HHVBP across numerous impact measures.
- ***Availability of data across multiple populations of interest.*** In particular, while data reported in OASIS are reported for all home health patients with Medicare or Medicaid coverage, there was other information that can be obtained only from Medicare claims or other CMS data sources for Medicare FFS beneficiaries and were therefore not available for analysis of OASIS-based impact measures. In seeking a relatively uniform analytic approach, we therefore sought to limit the selection of factors available for Medicare FFS beneficiaries only unless there was a compelling rationale based on other criteria.
- ***Degree of imbalance between HHVBP and non-HHVBP states.*** As a result of the randomized selection of states for participation in the HHVBP Model, there were many similarities between HHVBP and non-HHVBP states during the baseline period. However, there were larger differences between the two groups in certain beneficiary and agency characteristics. We describe baseline differences in such factors in the Report (e.g., patient race/ethnicity and rural location) and included them as covariates to achieve balance.
- ***Relationship with impact measures of interest for this evaluation.*** Factors that were found to have a relatively strong relationship with certain impact measures and/or to have a relationship with multiple impact measures of interest were given greater emphasis, provided they also satisfied other criteria.
- ***Differential trends in HHVBP and non-HHVBP states prior to the implementation of the HHVBP Model.*** Factors exhibiting such trends may be both exogenous to the HHVBP Model and pose a greater risk of introducing bias should their baseline trends extend into the post-HHVBP period. The extent of this risk also depended on other criteria, such as the strength of their relationship with the impact measures. Adjustment for such factors may help to satisfy the parallel trends assumption of our D-in-D approach.
- ***Potential endogeneity.*** We sought to avoid selection of factors that are endogenous to the HHVBP Model. For example, adjustment for clinical characteristics of patients that were influenced by the quality of prior home health care may lead to biased estimates of the effects of HHVBP. To minimize this risk, we used caution in selecting factors that changed differentially for HHVBP and non-HHVBP states between the pre-implementation and post-implementation periods, unless such differential trends were evident during the pre-implementation period and it was supported by other criteria.
- ***Degree of subjectivity in measurement.*** We also sought to avoid factors reported by agencies that were seen as being very subjective measures of patient status and are therefore more susceptible to changes over time in reporting. We note that in certain instances, other considerations such as the strength of the relationship with patient outcomes were given

precedence. This was relevant when considering the initial status corresponding to each of the OASIS outcome improvement measures (e.g., improvement in ambulation), where there is often a degree of subjectivity in determining the patient's initial status.

- ***Correlation with other factors being considered for covariate adjustment.*** We did not select factors that were strongly correlated with other factors that were preferred as covariates based on other criteria.

The process of selecting covariates based on these criteria resulted in (a) a core set of covariates that were used for analyses of a broad range of impact measures and (b) the inclusion of a relatively small number of additional covariates for the analysis of either a particular impact measure or of a related group of impact measures. In the following sections, we describe both the core set of factors that were used for covariate adjustment as part of our standard model specification (listed below in Exhibit A-3) and the additional covariates or other refinements that apply to a subset of impact measures.

Exhibit A-3. Core Set of Factors for Covariate Adjustment

Beneficiary Characteristics
Age
–<65 years
65 – 84 years
85 years and older
% Female
Race/Ethnicity (Mutually Exclusive)
Hispanic (regardless of black/white/other race)
Non-Hispanic Black
Non-Hispanic White
Non-Hispanic Other
Non-Hispanic Multiracial
% Dual eligible
% Rural
% of Persons in the Patient's County of Residence who are Ages 25 years and Older with Less than a High School Diploma

Agency Characteristics
Ownership
For-profit
Non-profit
Government-owned
Setting
Hospital-based
Freestanding
Chain affiliation
Yes
No
Unknown
HHA Age
<4 years
4-10 years
>10 years
Agency Size: Number of OASIS episodes
1-59
60-249
250-499
500-999
1000+

Core Clinical Indicators Used for Episode-Level Impact Measures*
Ambulation and Locomotion
Able to independently walk with the use of a one-handed device
Requires two handed device for level ground or human assistance for stairs and uneven ground
Walks only with supervision or assistance from another at all times
Chairfast to bedfast
Interaction of HHVBP (treatment) indicator with each of the four levels of Ambulation and Locomotion
Receiving psychiatric nursing services
Risk for Hospitalization
Multiple hospitalizations in past 6 months
History of falls
Currently taking 5 or more medications
Non-surgical wound or skin lesion
Surgical Wound
Requires oxygen therapy
Requires urinary catheter
Discharged from Inpatient Facility in last 14 Days
Orthopedic diagnosis
Pressure Ulcer
Pressure Ulcer Stage 2
Pressure Ulcer Stage 3
Pressure Ulcer Stage 4
Pressure Ulcer Not Stageable
Neoplasm Diagnosis

**Derived from OASIS assessment at start of home health care.*

As noted above, this core list of model covariates was, in certain instances, augmented or otherwise refined for analyses of specific impact measures. In each case, the criteria described above were used in determining whether there was a rationale for inclusion or exclusion of specific covariates. However, these additional covariates were not included among the core list of covariates either because they were obtained from a data source that was not available for the entire population of interest, the rationale for inclusion only applied to a subset of impact measures, or for other reasons given below.

For claims-based impact measures, we also included adjustments for end-stage renal disease or disability as the reason for Medicare entitlement, for which comparable information was not available for non-Medicare patients. These factors were specified as additional covariates based on the strength of their relationship with a range of claims-based impact measures and inexact balance between HHVBP and non-HHVBP groups.

For OASIS episode-level impact measures, we added an adjustment for Medicaid coverage among patients who were not reported as being dually eligible for Medicare and Medicaid. This covariate was not applicable for analysis of claims-based impact measures, which are limited to Medicare FFS beneficiaries.

Additionally, for each of the seven OASIS-based outcome improvement measures, which were used to assess improvement over time in patient functioning or other clinical characteristics, we adjusted for outcome-specific start of care indicators of patient status. More specifically, we adjusted for the indicator of a patient's status from the initial OASIS assessment corresponding to the OASIS outcome of interest being examined. In selecting these relevant initial status indicators as covariates, we considered multiple factors. First, in our analyses of each of these measures, we found a relatively strong positive relationship of greater initial impairment or severity with greater improvement over time in patient status (i.e., such that there was greater opportunity for improvement). In addition, for many of these measures, there was a notable trend towards higher levels of impairment being reported at initial assessment that began during the pre-implementation period. These pre-implementation trends may have reflected agency efforts to increase accuracy in coding in response to public reporting initiatives. Given these considerations, we determined that inclusion of these outcome-specific covariates would allow us to avoid omitted variable bias related to the patient's initial status reported in OASIS.

Additionally, we included an interaction term between the outcome-specific start of care variables and the HHVBP (i.e., treatment) indicator to account for any differences in coding of patient status at the start of care between HHVBP and non-HHVBP states. For example, when modeling improvement in bathing, we adjusted for the initial level of impairment in bathing and also interacted indicators of the level of impairment in bathing with the HHVBP indicator. We used a similar approach in analyzing each of the other OASIS-based improvement measures.

We also explored the possibility that there may have been differences in coding of patient status at the start of care that were initiated specifically in response to HHVBP. We tested this by specifying three-way interactions between (a) the HHVBP indicator, (b) indicators of the level of impairment in the relevant OASIS-based outcome improvement measure, and (c) the post-HHVBP period (2016-2017). The results of these analyses did not indicate a tendency for increasing levels of impairment being reported during the post-HHVBP period specifically for patients in HHVBP states relative to non-HHVBP states.

In general, given the random selection of the states into the HHVBP model, the D-in-D approach (as described above) helps to control for unobserved time-invariant heterogeneity in the treatment model. However, to control for residual time-invariant confounding and to limit selection bias in the estimation of causal effects, we adjusted for a full set of state fixed effects in the D-in-D model specification. By exploiting within-group variation over time, fixed effects regression is a powerful tool for reducing concerns that omitted variables drive any associations between dependent and independent variables.

We examined three distinct sets of HHA-level impact measures: agency TPS, OASIS-derived process measures, and Home Health Consumer Assessment of Healthcare Providers and Systems (HHCAHPS)-derived measures. For analyses of these measures, we included all of the core beneficiary characteristics (aggregated to the agency level) and agency characteristics listed in Exhibit A-3 as covariates, with a few exceptions. For HHCAHPS measures, we excluded patient age and area education variables since comparable factors were already accounted for in the risk adjusted HHCAHPS measure values. Additionally, we did not specify OASIS episode characteristics (aggregated to the agency level) as covariates for analyses of the HHA-level impact measures, given that each of these measure values already reflected risk adjustment based on any clinical factors that were deemed relevant to measuring agency performance under HHVBP.

Further details regarding how individual covariates were defined for inclusion in regression analyses are provided in Section A.2.

A.1.4 Difference-in-Differences Model

With a baseline period for analysis of 2013-2015, we used a D-in-D model to estimate yearly average treatment effects separately for the two post-implementation years, 2016 and 2017. We also estimated a cumulative average effect over both years (2016-2017).

A.1.4.1 Yearly Difference-in-Differences Estimator

To obtain individual yearly effects in the post-implementation period, we restricted the estimation sample to include observations through the year of interest (i.e., year = 1, 2 for 2016 and 2017 respectively). That is, we included data through 2016 in the model used to obtain D-in-D estimates for 2016, and included data through 2017 in the model used to obtain the D-in-D estimates for 2017.

Defining each episode *i* in time *t*, identifying the treatment episodes with an indicator variable $Treat_i$, identifying the post-implementation year variables *t* with an indicator variable $I(t = t_k)$, and identifying a vector of covariates as $\mathbf{P}_{Cov}$ (defined in Section A.1.3), the D-in-D estimator for outcome *Y* is implemented as:

$$Y_{i,t} = \alpha_0 + \alpha_1 Treat_i + \sum_{k=1}^{k=2} \beta_k I(t = t_k) + \sum_{k=1}^{k=2} \delta_k Treat_i * I(t = t_k) + \sum_{j=1}^{j=3} \rho_j I(q = j) + \omega \mathrm{P}_{Cov} + \sum_{s=3}^{s=50} \theta_s I(S = s) + \epsilon_{i,q,t}$$

Where

- $Treat_i$: 1, 0 indicator (1= HHVBP states, 0= Non-HHVBP states)

- $I(t = t_1)$: 1 , 0 indicator (1 when year = 2016, 0 otherwise)
- $I(t = t_2)$: 1 , 0 indicator (1 when year = 2017, 0 otherwise)
- α_0 is an intercept
- α_1 is the average difference between the HHVBP and comparison populations over the pre-implementation period
- β_k is the average change from pre- to post-implementation for the HHVBP population, where *k* = 1 for year 2016 and *k* = 2 for year 2017
- δ_k is the yearly D-in-D effect, for *k* = 1, 2; the difference in the change from pre-implementation to post-implementation for the HHVBP population relative to the comparison population (i.e., to estimate the treatment effect of HHVBP)
- ρ_j coefficients capture seasonal effects associated with the four quarters of the year, where *j* = 1, 2, 3 (one quarter omitted as reference)
- ω is a vector of coefficients associated with vector of covariates $\mathbf{P}_{Cov}$
- $I(S = s)$: 1, 0 indicator (1 when from state *s*, 0 otherwise); two states omitted as reference since "treat" is also included in the model
- θ_s coefficients are fixed effects for each state *s*
- $\epsilon_{i,q,t}$ episode-specific error term.

In the regression equation, we included three estimates (ρ_1, ρ_2, ρ_3) capturing quarterly effects since we included a constant in the equation. Each episode was given an equal weight except for the four average Medicare spending per day measures, which were appropriately weighted by the number of days included in the denominator (see Section A.2.2).

Standard errors were clustered at the agency-level. Implementation of HHVBP directly impacts HHAs. Since home health episodes within the same agency are correlated, accounting for agency clusters protects against the potential underestimation of standard errors, thereby minimizing the risk that we make false positive inferences about the effect of HHVBP. We also stratified at the state level in the model to account for greater homogeneity within states than across states, i.e. the variance of the outcome variable potentially being smaller within the state than in the population as a whole. Given that the HHVBP effect is analyzed at the national level and all HHA clusters are nested within states, stratification is a method of breaking up the population into different groups and accurately estimating the standard error of the estimates. Stratification exploits this homogeneity within states to produce smaller standard errors for a given overall sample size, thus minimizing the risk of false negative inferences (Type 2 errors) from hypothesis tests.

The derivation of the mean outcome in the HHVBP and comparison group by pre- and post-implementation period is presented below. The D-in-D estimators for 2016 and 2017 are given by the coefficients δ_1 and δ_2, respectively. Between-group differences changed from α_1 in the pre-implementation period to $\alpha_1 + \delta_k, k = 1, 2$ in the post-implementation period. The D-in-D coefficient, δ_k, indicates whether between group differences increased ($\delta_k > 0, k = 1, 2$) or decreased ($\delta_k < 0, k = 1, 2$) after implementation of HHVBP.

Exhibit A-4. Difference-in-Differences Estimators for Individual Post-Implementation Years

Group	Pre-Implementation	Post-Implementation	Pre-Post Difference
2016 Difference-in-Differences Estimator			
HHVBP	$\alpha_0 + \alpha_1$	$\alpha_0 + \alpha_1 + \beta_1 + \delta_1$	$\beta_1 + \delta_1$
Non HHVBP	α_0	$\alpha_0 + \beta_1$	β_1
Between group	α_1	$\alpha_1 + \delta_1$	δ_1
2017 Difference-in-Differences Estimator			
HHVBP	$\alpha_0 + \alpha_1$	$\alpha_0 + \alpha_1 + \beta_2 + \delta_2$	$\beta_2 + \delta_2$
Non-HHVBP	α_0	$\alpha_0 + \beta_2$	β_2
Between group	α_1	$\alpha_1 + \delta_2$	δ_2

A.1.4.2 Cumulative Difference-in-Differences Estimator

We included data from 2013 through 2017 in the model to estimate a cumulative average effect for both post-implementation years combined (2016-2017).

$$Y_{i,t} = \alpha_0 + \alpha_1 Treat_i + \alpha_2 I(t \geq 2016) + \alpha_3 Treat_i * I(t \geq 2016) + \sum_{j=1}^{j=3} \rho_j I(q = j) + \omega \mathrm{P}_{Cov} + \sum_{s=3}^{s=50} \theta_s I(S = s) + \epsilon_{i,q,t}$$

where:

- $Treat_i$: 1, 0 indicator (1= HHVBP states, 0= Non-HHVBP states)
- $I(t \geq 2016)$: 1 , 0 indicator (1 when year >= 2016, 0 otherwise)
- α_0 is an intercept
- α_1 the average difference between the HHVBP and comparison populations over the baseline period
- α_2 is the average change from pre- to post-implementation for the HHVBP population
- α_3 is the D-in-D effect, the difference in the change from pre-implementation to post-implementation for the HHVBP population relative to the comparison population (i.e., to estimate the treatment effect of HHVBP)
- ρ_j coefficients capture seasonal effects associated with the four quarters of the year, where *j* =1, 2, 3 (one quarter omitted as reference)
- ω is a vector of coefficients associated with the vector of covariates $\mathbf{P}_{Cov}$
- $I(S = s)$: 1, 0 indicator (1 when from state *s*, 0 otherwise); two states omitted as reference since "treat" is also included in the model
- θ_s coefficients are fixed effects for each state *s*
- $\epsilon_{i,q,t}$ episode-specific error term.

Exhibit A-5. Cumulative Difference-in-Differences Estimator

Group	Pre-Implementation	Post-Implementation	Pre-Post Difference
HHVBP	$\alpha_0 + \alpha_1$	$\alpha_0 + \alpha_1 + \alpha_2 + \alpha_3$	$\alpha_2 + \alpha_3$
Non-HHVBP	α_0	$\alpha_0 + \alpha_2$	α_2
Between Group	α_1	$\alpha_1 + \alpha_3$	α_3

Between-group differences changed from α_1 in the pre-implementation period to $\alpha_1 + \alpha_3$ in the post-implementation period. The cumulative D-in-D estimator, α_3, indicates whether between-group differences increased ($\alpha_3 > 0$) or decreased ($\alpha_3 < 0$) after HHVBP was implemented.

A.1.4.3 Parallel Trends Testing

As discussed above, our primary analytic approach involves the use of a D-in-D estimator to measure the effects of HHVBP on a range of measures. With this estimator, we measure treatment effects based on changes occurring between the pre- and post-implementations periods in the nine HHVBP states relative to those occurring in the 41 comparison group states. We use a multivariate linear regression framework to adjust for key factors (i.e., Exhibit A-3) that remain imperfectly balanced between the two groups in a context of randomized selection and mandatory participation.

A key assumption with the D-in-D estimator is that the change in outcomes experienced in the comparison population is an accurate portrayal of the change that would have occurred in HHVBP states in the absence of HHVBP, also known as the parallel trends assumption. While the counterfactual of what would have occurred in the absence of HHVBP cannot be observed, we examine whether the measures of interest moved similarly over the baseline period (2013 to 2015) in the nine HHVBP states and the 41 comparison states. That is, we compare relative trends in these measures for the HHVBP and comparison groups during the three years prior to the implementation of HHVBP.

We conducted these analyses with two goals in mind. First, we used the results of these analyses to help inform our analytic approach, and specifically decisions about model covariate selection. As discussed above, one of the criteria we considered as the basis for selecting covariates for adjustment was the presence of differential trends between the HHVBP and comparison groups during the baseline period. We used analyses of baseline trends in impact measures to ascertain how well a particular model specification satisfied the parallel trends assumption. With the results of these analyses, we were able to consider whether certain types of covariates helped to strengthen the validity of this assumption. We considered such benefits in conjunction with any tradeoffs where the inclusion of additional covariates increased complexity and a lack of uniformity in our approach across impact measures. Beyond informing the design of our analytic approach, the results of these analyses help us to determine our level of confidence in using the resulting D-in-D estimator to make inferences about the effects of HHVBP as well as potentially motivating the exploration of alternative model specifications.

To accomplish these goals, we performed two types of analyses of parallel trends that adjust for our core set of covariates (i.e., Exhibit A-3) along with state fixed effects. Each type of analysis is discussed in turn below.

Comparison of Annual Trends between HHVBP and Non-HHVBP States

To assess parallel trends, we compared annual trends in impact measures between HHVBP and non-HHVBP states. We calculated the difference in means of the adjusted measure values for HHVBP and non-HHVBP states across the individual years of the baseline period (2013-2015) as well as for the implementation period (2016-2017). Similarly, we also calculated the difference in means of the unadjusted measure values for the two groups across the individual years.

For each of the eight key impact measures, we plot the differences in both unadjusted and covariate-adjusted (with state fixed effects) measure values between HHVBP and non-HHVBP states in each year (with the difference calculated as the estimated HHVBP measure value minus the estimated non-HHVBP measure value). We examined the slopes of the plotted lines for each measure during 2013-2015, and compared results based on an unadjusted regression model (i.e., having no beneficiary or agency characteristics as covariates) with results based on the adjusted model using the core set of covariates

listed in Exhibit A-3 along with state fixed effects. Slopes of the plotted lines that are close to zero during 2013-2015 would indicate that impact measures for the two groups moved in a parallel manner over the baseline period.

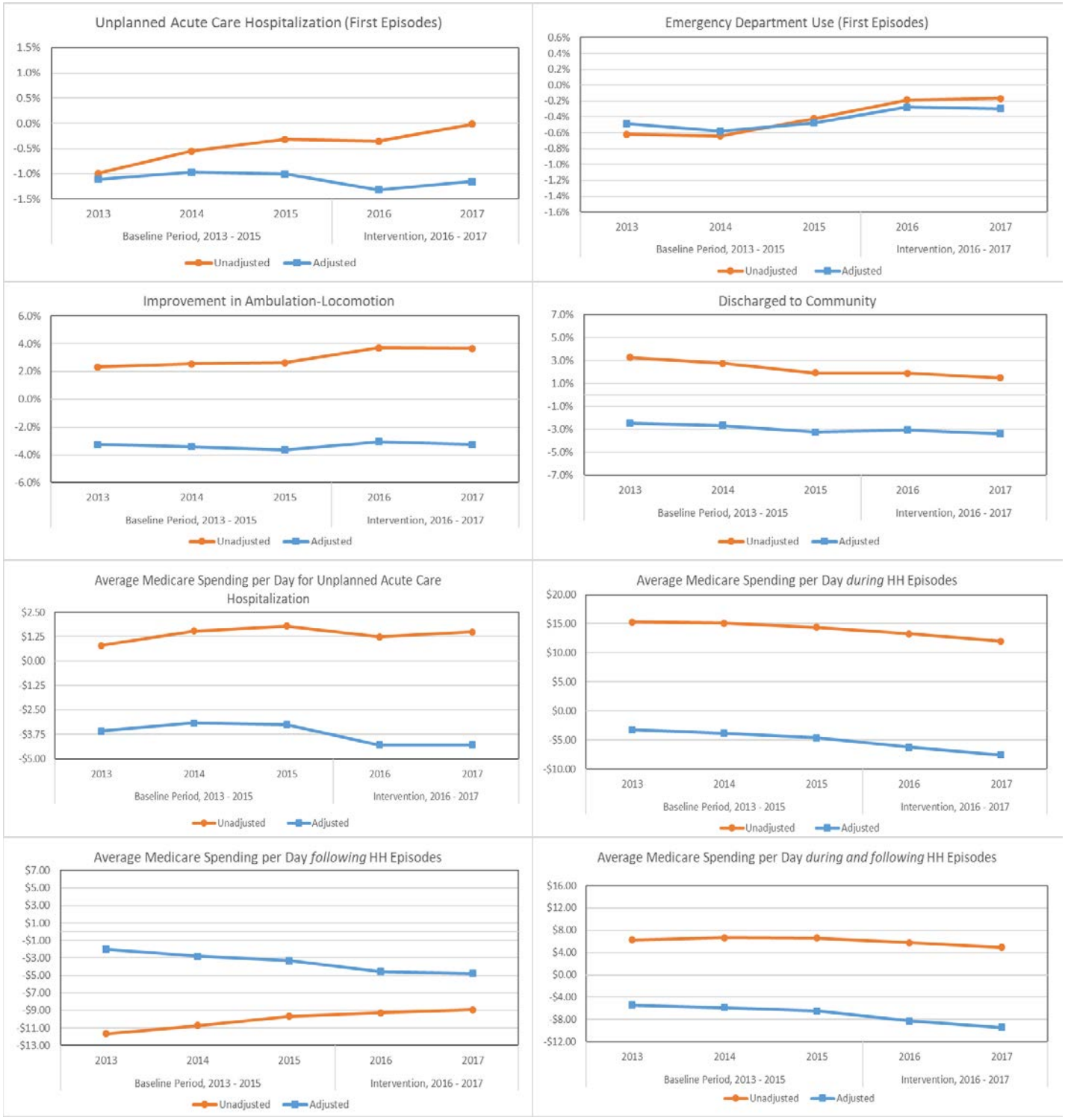
We display results using plots of the difference in yearly means for each of eight key impact measures (Exhibit A-6), grouped as FFS claims-based quality measures, OASIS-based quality measures, and FFS claims-based Medicare spending measures. To facilitate interpretation of results across impact measures, the y-axis scales for the eight plots in Exhibit A-6 are standardized such that the difference between the minimum and maximum values shown on each y-axis corresponds to a difference of approximately 20% of the mean measure value for HHVBP and non-HHVBP states combined during 2013-2015. For example, the difference between the minimum and maximum values on the y-axis for the unplanned ACH measure plot (1.5% – (-1.5%) = 3.0%) corresponds to approximately 20% of the national average hospitalization rate of 16%.

Upward or downward sloping lines during 2013-2015 indicate a lack of parallel trends, as differences between the HHVBP and comparison groups are becoming larger or smaller during the baseline period. For some of the measures – such as unplanned ACH – the unadjusted line (corresponding to the model without any covariate adjustment) shows evidence of a time trend. In comparison, with covariate adjustment, the plotted lines for these measures (including unplanned ACH) show greater indication of parallel trends in the adjusted measure values, with trend lines having slopes closer to zero. Together, these plots for the eight key impact measures reinforced two facts:

1. As clearly shown by the contrast between the unadjusted and adjusted plots, covariate adjustment tended to result in improvements in both the degree of balance and parallel trends between HHVBP and non-HHVBP groups during the baseline period.

Overall, the plotted lines showing trends in the difference in measure values between HHVBP and non-HHVBP populations from the adjusted model (that included state fixed effects) have slopes that tend to be close to zero for some impact measures (e.g., unplanned acute hospitalizations, improvement in ambulation) whereas other measures tend to have downward slopes (e.g. the three Medicare spending per day measures, with the exception of Medicare spending per day for acute hospitalization) during the baseline period. This suggests that adjusting for state fixed effects alone is not adequate to account for non-parallel trends in the baseline period for all measures. It also reinforced the need to control for pre-HHVBP differences in trends between HHVBP and comparison states, thereby warranting a model that includes both state fixed effects and state-specific linear trends along with other covariates for some impact measures, which are discussed in turn below.

Exhibit A-6. Assessing Parallel Trends for Key Impact Measures based on Unadjusted vs. Adjusted Models[7]



[7] The trend lines from the adjusted model (which includes an interaction term of the treatment indicator with each of the three levels of Ambulation and Locomotion along with other covariates and state fixed effects) are plotted on the assumption that the net effect of HHVBP on different levels of ambulation at the start of care is zero.

Falsification Test

We tested for differential changes in impact measures between the HHVBP and comparison groups between the first two years of the baseline period (i.e., 2013-2014) and the last year of the baseline period (i.e., 2015) as a "placebo test." That is, we applied the exact same D-in-D specification (as described above) while assigning 2013-2014 as the baseline period and falsely assigning 2015 as the post-intervention time period, and computed a D-in-D estimate for 2015. Such estimated effects for HHVBP for 2015 should be null since the initial HHVBP performance period did not begin until 2016. Where D-in-D estimates are not statistically different from zero, we would fail to reject the parallel trends assumption (i.e., suggesting that the impact measures moved in a parallel manner for the two groups over the baseline period).

Results of these falsification tests are summarized in Exhibits A-7 through A-11. We report the 2013 mean value for each impact measure in the HHVBP states to facilitate interpretation of the magnitude of the estimated 2015 HHVBP effect. We also use the mean value to calculate the relative change corresponding to the D-in-D falsification estimate for each measure, by expressing the estimated effect as a percentage of the 2013 mean value. The results of these calculations are shown in the last column of each table.

Results of falsification tests for the claims-based quality measures indicated null effects during 2015 for each of the six measures (Exhibit A-7).

For the claims-based spending measures, we found a null effect for Medicare spending for unplanned ACH (Exhibit A-8), but the D-in-D falsification estimates were all statistically significant (at $p < 0.10$ level) for the other three claims-based spending measures and corresponded to -0.6% to -0.9% of the mean value for these measures in 2013 (Exhibit A-8).

Overall, there was a stronger tendency for the falsification tests to indicate non-parallel trends for the OASIS outcome and process impact measures (Exhibits A-9 and A-10). In particular, there were statistically significant estimated effects (at $p<0.10$ level) for four of the eight OASIS outcome impact measures, with estimates at or exceeding 1.0% of the 2013 mean value for two measures (Improvement in Dyspnea and in Management of Oral Medications; Exhibit A-9). Similarly, there were statistically significant estimated effects (at $p<0.05$ level) for three of the seven OASIS process impact measures, with an estimate exceeding 1% of the 2013 mean value for one measure (Influenza Immunization; Exhibit A-10).

Results of falsification tests for the HHCAHPS-based impact measures indicated null effects during 2015 for each of these five measures (Exhibit A-11).

Exhibit A-7. Results of Falsification Tests for Assessing the Impact of the HHVBP Model on FFS Claims-Based Quality Measures

	Model Estimates			D-in-D Falsification[a]	Average Value in HHVBP States, 2013	Estimated Effect of Falsification Findings as % of 2013 Mean
	D-in-D	Lower 90% CI	Upper 90% CI			
ED Use (no Hospitalization)/First FFS HH Episodes						
2016	0.23%**	0.12%	0.35%	0.05%	11.3%	0.4%
2017	0.22%**	0.09%	0.34%			
Cumulative	0.22%**	0.12%	0.33%			
Unplanned Acute Care Hospitalization/First FFS HH Episodes						
2016	-0.30%**	-0.44%	-0.15%	0.02%	15.3%	0.1%
2017	-0.13%	-0.28%	0.02%			
Cumulative	-0.21%**	-0.33%	-0.08%			
Unplanned Acute Care Hospitalization/All FFS HH Episodes						
2016	-0.28%**	-0.40%	-0.15%	0.04%	16.8%	0.2%
2017	-0.26%**	-0.40%	-0.12%			
Cumulative	-0.27%**	-0.38%	-0.15%			
Unplanned Hospital Readmission in the First 30 Days of HH Care						
2016	-0.46%**	-0.65%	-0.26%	0.19%	13.1%	1.5%
2017	-0.10%	-0.30%	0.11%			
Cumulative	-0.29%**	-0.45%	-0.12%			
ED Use Following Hospitalization (without Hospital Readmission) in the First 30 Days of HH Care						
2016	0.10%	-0.06%	0.26%	-0.04%	9.3%	-0.4%
2017	-0.03%	-0.20%	0.15%			
Cumulative	0.04%	-0.10%	0.18%			
SNF Use/All FFS HH Episodes						
2016	-0.19%**	-0.24%	-0.13%	-0.05%	4.7%	-1.1%
2017	-0.22%**	-0.29%	-0.15%			
Cumulative	-0.21%**	-0.26%	-0.15%			

[a] Represents the estimated effect of HHVBP in 2015. *p<0.10, **p<0.05.
CI= Confidence Interval. | *HHVBP performance measures in italics.*

Exhibit A-8. Results of Falsification Tests for Assessing the Impact of the HHVBP Model on FFS Claims-Based Spending Measures

Measure	Model Estimates			D-in-D Falsification[a]	Average Value in HHVBP States, 2013	Estimated Effect of Falsification Findings as % of 2013 Mean
	D-in-D	Lower 90% CI	Upper 90% CI			
Average Medicare Spending per Day for Unplanned Acute Care Hospitalizations among all FFS HH Episodes						
2016	-$0.97**	-$1.29	-$0.64	$0.13	$32.98	0.4%
2017	-$0.96**	-$1.33	-$0.59			
Cumulative	-$0.96**	-$1.27	-$0.65			
Average Medicare Spending per Day during and following FFS HH Episodes of Care						
2016	-$2.28**	-$2.91	-$1.66	-$0.80**	$135.41	-0.6%
2017	-$3.54**	-$4.28	-$2.80			
Cumulative	-$2.92**	-$3.54	-$2.30			
Average Medicare Spending per Day during FFS HH Episodes of Care						
2016	-$2.27**	-$3.06	-$1.48	-$0.98**	$148.29	-0.7%
2017	-$3.68**	-$4.60	-$2.76			
Cumulative	-$2.99**	-$3.79	-$2.20			
Average Medicare Spending per Day following FFS HH Episodes of Care						
2016	-$1.84**	-$2.71	-$0.97	-$0.94*	$102.09	-0.9%
2017	-$2.04**	-$3.01	-$1.07			
Cumulative	-$1.93**	-$2.74	-$1.12			

[a] Represents the estimated effect of HHVBP in 2015. *p<0.10, **p<0.05.
CI= Confidence Interval

Exhibit A-9. Results of Falsification Tests for Assessing the Impact of the HHVBP Model on OASIS Outcome Impact Measures

Measure	Model Estimates			D-in-D Falsification[a]	Average Value in HHVBP States, 2013	Estimated Effect of Falsification Findings as % of 2013 Mean
	D-in-D	Lower 90% CI	Upper 90% CI			
Discharged to Community						
2016	-0.23%	-0.49%	0.02%	-0.64%**	73.0%	-0.9%
2017	-0.57%**	-0.87%	-0.27%			
Cumulative	-0.42%**	-0.67%	-0.16%			
Improvement in Ambulation-Locomotion						
2016	0.40%	-0.09%	0.88%	-0.27%	62.5%	-0.4%
2017	0.18%	-0.38%	0.74%			
Cumulative	0.27%	-0.22%	0.75%			
Improvement in Bathing						
2016	0.37%	-0.21%	0.96%	-0.30%	69.3%	-0.4%
2017	0.59%	-0.07%	1.25%			
Cumulative	0.44%	-0.15%	1.03%			
Improvement in Bed Transferring						
2016	0.76%*	0.27%	1.26%	-0.11%	58.3%	-0.2%
2017	0.85%**	0.26%	1.43%			
Cumulative	0.83%**	0.32%	1.33%			
Improvement in Dyspnea						
2016	1.27%**	0.69%	1.85%	0.66%*	64.5%	1.0%
2017	1.47%**	0.77%	2.17%			
Cumulative	1.39%**	0.79%	2.00%			
Improvement in Management of Oral Medications						
2016	2.48%**	1.70%	3.27%	0.65%*	48.8%	1.3%
2017	3.99%**	3.04%	4.94%			
Cumulative	3.22%**	2.40%	4.04%			
Improvement in Pain Interfering with Activity						
2016	0.25%	-0.31%	0.81%	-0.54%**	70.4%	-0.8%
2017	0.20%	-0.49%	0.90%			
Cumulative	0.17%	-0.43%	0.76%			
Improvement in Status of Surgical Wounds						
2016	-0.07%	-0.43%	0.29%	-0.23%	90.2%	-0.3%
2017	0.24%	-0.26%	0.74%			
Cumulative	0.08%	-0.31%	0.48%			

[a] Represents the estimated effect of HHVBP in 2015. *p<0.10, **p<0.05.
CI= Confidence Interval. | *HHVBP performance measures in italics.*

Exhibit A-10. Results of Falsification Tests for Assessing the Impact of the HHVBP Model on OASIS Process Impact Measures

Measure	Model Estimates			D-in-D Falsification[a]	Average Value in HHVBP States, 2013	Estimated Effect of Falsification Findings as % of 2013 Mean
	D-in-D	Lower 90% CI	Upper 90% CI			
Drug Education on Medications Provided to Patient/Caregiver during Episodes of Care						
2016	1.03%**	0.65%	1.42%	0.33%	90.8%	0.4%
2017	0.95%**	0.55%	1.36%			
Cumulative	0.99%**	0.63%	1.35%			
Influenza Immunization Received for Current Flu Season						
2016	3.37%**	2.61%	4.14%	2.56%**	63.3%	4.0%
2017	3.11%**	2.28%	3.94%			
Cumulative	3.25%**	2.54%	3.97%			
Pneumococcal Polysaccharide Vaccine Ever Received						
2016	1.57%**	0.79%	2.34%	0.09%	65.7%	0.1%
2017	0.89%*	0.04%	1.73%			
Cumulative	1.23%**	0.49%	1.98%			
Depression Assessment Conducted						
2016	0.14%	-0.19%	0.46%	-0.08%	95.5%	-0.1%
2017	0.35%	-0.03%	0.73%			
Cumulative	0.24%	-0.08%	0.55%			
Diabetic Foot Care and Patient / Caregiver Education Implemented during All Episodes of Care						
2016	0.75%**	0.33%	1.18%	0.43%	91.6%	0.5%
2017	1.38%**	0.92%	1.84%			
Cumulative	1.07%**	0.67%	1.47%			
Multifactor Fall Risk Assessment Conducted for All Patients who Can Ambulate						
2016	0.31%**	0.14%	0.48%	0.33%**	97.8%	0.3%
2017	0.22%**	0.05%	0.39%			
Cumulative	0.26%**	0.11%	0.41%			
Timely Initiation of Care						
2016	-0.05%	-0.36%	0.25%	-0.55%**	92.6%	-0.6%
2017	0.04%	-0.29%	0.37%			
Cumulative	-0.01%	-0.29%	0.26%			

[a] Represents the estimated effect of HHVBP in 2015. *p<0.10, **p<0.05.
CI= Confidence Interval. | *HHVBP performance measures in italics.*

Exhibit A-11. Results of Falsification Tests for Assessing the Impact of the HHVBP Model on HHCAHPS-Based Impact Measures

Measure	Model Estimates			D-in-D Falsification[a]	Average Value in HHVBP States, 2013	Estimated Effect of Falsification Findings as % of 2013 Mean
	D-in-D	Lower 90% CI	Upper 90% CI			
How often the home health team gave care in a professional way						
2016	-0.10%	-0.33%	0.13%	-0.06%	89.0%	-0.1%
2017	0.04%	-0.22%	0.29%			
Cumulative	-0.03%	-0.24%	0.17%			
How well did the home health team communicate with patients						
2016	-0.21%	-0.48%	0.05%	-0.24%	86.2%	-0.3%
2017	-0.03%	-0.32%	0.26%			
Cumulative	-0.13%	-0.36%	0.11%			
Did the home health team discuss medicines, pain, and home safety with patients						
2016	-0.34%*	-0.65%	-0.04%	0.22%	82.9%	0.3%
2017	0.26%	-0.06%	0.58%			
Cumulative	-0.04%	-0.31%	0.22%			
How do patients rate the overall care from the home health agency						
2016	-0.10%	-0.48%	0.29%	-0.16%	84.7%	-0.2%
2017	0.04%	-0.35%	0.44%			
Cumulative	-0.03%	-0.35%	0.29%			
Would patients recommend the home health agency to friends and family						
2016	0.01%	-0.44%	0.46%	-0.30%	79.8%	-0.4%
2017	0.31%	-0.15%	0.77%			
Cumulative	0.16%	-0.22%	0.53%			

[a] Represents the estimated effect of HHVBP in 2015. * p<0.10, **p<0.05.
CI= Confidence Interval. | *HHVBP performance measures in italics.*

The validity of inferences that are based on the D-in-D estimator will depend on whether the assumption of parallel trends between the treatment and comparison groups during the baseline period is satisfied. Where baseline trends for the two groups are not found to be parallel, the comparison group will not provide a strong counterfactual for what would have been observed in the post-implementation period in the absence of the treatment. Instead, the D-in-D estimator will in part capture the effects of any pre-existing differential trends between the two groups, where those trends would have otherwise continued in the post-implementation period. This will lead D-in-D estimates to either overestimate or underestimate the true effects of the treatment. Since our falsification tests rejected the null hypothesis of no difference in baseline trends between HHVBP and non-HHVBP states for certain impact measures of interest, we explored alternative model specifications for estimating the effects of HHVBP on these impact measures. As described below, for the impact measures that failed to pass the falsification test with a model specification that adjusted for a set of covariates and state fixed effects, we also adjusted for state-specific linear trends to account for any non-parallel linear trends in the baseline period between the states.

A.1.4.4 Incorporating State-Specific Linear Time Trends to Account for Non-Parallel Trends during the Baseline Period

Given our findings of non-parallel trends in certain impact measures during the baseline period, we conducted regression analyses using an alternative D-in-D model that incorporated state-specific linear time trends. We added linear time trends interacted with each state indicator along with state fixed effects to the covariate list discussed above in Section A.1.3, which can be used to account for different linear trends during the baseline period between the states.

Defining each episode *i* in time *t*, identifying the treatment episodes with an indicator variable $Treat_i$, identifying the post-implementation period with an indicator variable $I(t \geq 2016)$, and identifying a vector of covariates as $\mathbf{P}_{Cov}$ (defined in Section A.1.3), the D-in-D estimator for outcome *Y* that includes state-specific linear time trends is implemented as:

$$Y_{i,t} = \alpha_0 + \alpha_1 Treat_i + \alpha_2 I(t \geq 2016) + \alpha_3 Treat_i * I(t \geq 2016) + \sum_{j=1}^{j=3} \rho_j I(q = j) + \sum_{s=3}^{s=50} \theta_s I(S = s) + \sum_{s=1}^{s=50} \gamma_s time * I(S = s) + \omega \mathrm{P}_{Cov} + \epsilon_{i,q,t}$$

where

- $Treat_i$: 1, 0 indicator (1= HHVBP states, 0= Non-HHVBP states)
- $I(t \geq 2016)$: 1 , 0 indicator (1 when year >= 2016, 0 otherwise)
- time is linear term measured in years ranging from 2013-2017
- α_0 is an intercept
- α_1 the average difference between the HHVBP and comparison populations over the baseline period
- α_2 is the average change from pre- to post-implementation for the HHVBP population
- α_3 is the D-in-D effect, capturing any differences in the deviations from the average of state trend lines in the post period for HHVBP relative to the comparison group (i.e., to estimate the effect of HHVBP) from a model that adjusts for state fixed effects and state-specific linear trends
- ρ_j coefficients capture seasonal effects associated with the four quarters of the year, where *j* =1, 2, 3 (one quarter omitted as reference)
- ω is a vector of coefficients associated with the vector of covariates $\mathbf{P}_{Cov}$.
- $I(S = s)$: 1, 0 indicator (1 when from state *s*, 0 otherwise); two states omitted as reference since "treat" is also included in the model
- θ_s coefficients are fixed effects for each state *s*
- γ_s: coefficients associated with state-specific linear trends, time trends for each state interacted with fixed effects indicator for each state *s*
- $\epsilon_{i,q,t}$ episode-specific error term

With this model, the D-in-D estimator measures the difference in the deviations from the average of the state trend lines between the HHVBP and comparison groups in the post-HHVBP period, while accounting for any non-parallel linear trends in the baseline period between the states.

In the regression equation, we included three estimates (ρ_1, ρ_2, ρ_3) capturing quarterly effects since we included a constant in the equation. Each episode was given an equal weight except for the four average Medicare spending per day measures, which were weighted by the number of days included in the denominator (see Section A.2.2). As with our primary D-in-D model specification, standard errors were clustered at the agency level (see Section A.1.4.1).

Exhibit A-12 shows a side-by-side comparison of the cumulative D-in-D estimates obtained from two alternative D-in-D models for the measure sets where there was a pattern of non-parallel trends for some of the individual measures. The first column reports estimates based on the D-in-D model specified in Section A.1.4.1, followed by the falsification results corresponding to the same model specification (these results are identical to those presented in Exhibits A-8 through A-10 above). The last column presents estimates from the D-in-D model that incorporates state-specific linear trends.

Broadly, results from the D-in-D model that adjusts for state-specific linear time trends along with state fixed effects (i.e., in the last column) are in the direction we would expect based on a combination of results from the primary D-in-D model (i.e., in the first column of results) and the falsification test (i.e., in the second column). For example, the inclusion of state-specific linear time trends results in a smaller but still statistically significant reduction in the measure of total Medicare spending during and following home health care when accounting for the relative decline already occurring in HHVBP states in the pre-HHVBP period (i.e., D-in-D estimates of $1.30 vs. $2.92). Similarly, the inclusion of linear trends by state resulted in a smaller but still statistically significant improvement in dyspnea when accounting for the relative improvement already occurring in HHVBP states in the pre-HHVBP period (i.e., D-in-D estimates of 0.83% vs. 1.39%).

Exhibit A-12. Comparison of Cumulative D-in-D Estimates between Models with and without State-Specific Linear Time Trends

Measures	D-in-D Estimate[a]	Falsification[b]	D-in-D Estimate with State-Specific Linear Time Trend[a]
FFS Claims-Based Spending Measures			
Average Medicare Spending per Day for Unplanned ACH/FFS HH Episodes	-$0.96**	$0.13	-$1.30**
Average Medicare Spending per Day among FFS HH beneficiaries during and following HH Episodes of Care	-$2.92**	-$0.80**	-$1.30**
Average Medicare Spending per Day among FFS HH beneficiaries during HH Episodes of Care	-$2.99**	-$0.98**	-$1.04**
Average Medicare Spending per Day among FFS HH beneficiaries following HH Episodes of Care	-$1.93**	-$0.94*	-$0.52
OASIS Outcome Impact Measures			
Discharged to Community	-0.42%**	-0.64%**	0.51%**
Improvement in Ambulation-Locomotion	0.27%	-0.27%	0.77%**
Improvement in Bathing	0.44%	-0.30%	0.86%**
Improvement in Bed Transferring	0.83%**	-0.11%	1.13%**
Improvement in Dyspnea	1.39%**	0.66%*	0.83%**
Improvement in Management of Oral Medications	3.22%**	0.65%*	1.88%**
Improvement in Pain Interfering with Activity	0.17%	-0.54%**	1.21%**
Improvement in Status of Surgical Wounds	0.08%	-0.23%	0.24%
OASIS Process Impact Measures			
Drug Education on Medications Provided to Patient/Caregiver during Episodes of Care	0.99%**	0.33%	0.52%*
Influenza Immunization Received for Current Flu Season	3.25%**	2.56%**	0.59%
Pneumococcal Polysaccharide Vaccine Ever Received	1.23%**	0.09%	1.27%**
Depression Assessment Conducted	0.24%	-0.08%	0.18%
Diabetic Foot Care and Patient / Caregiver Education Implemented during All Episodes of Care	1.07%**	0.43%	0.06%
Multifactor Fall Risk Assessment Conducted for All Patients who Can Ambulate	0.26%**	0.33%**	-0.10%
Timely Initiation of Care	-0.01%	-0.55%**	0.64%**

[a] Cumulative estimates for 2016-17 combined. | [b] Represents the estimated effect of HHVBP in 2015.
* p<0.10, **p<0.05. | *HHVBP performance measures in italics.*

Although incorporating state-specific linear time trends in our D-in-D framework allows us to account for non-parallel trends in the baseline period between the HHVBP and comparison groups for certain impact measures, it assumes that the average difference in slopes between the HHVBP state trends and the comparison state trends observed in the baseline period would have continued to change at the same rate in the absence of HHVBP. This will be an increasingly strong assumption to make throughout course of this eight-year evaluation.

We therefore only incorporated state-specific linear time trends for impact measure sets with a pattern of statistically significant findings for the falsification test: the FFS claims-based Medicare spending measures and the OASIS-based measures (Exhibits A-8 through A-10). Although we failed to reject the null hypothesis of parallel trends for only some of these measures, we used state-specific linear time trends for all measures within these measure sets to facilitate interpretation of results among strongly related impact measures and to maintain a uniform analytic approach where possible. We employed the simpler D-in-D model specification discussed in Section A.1.4.1 for our analyses of the claims-based and HHCAHPS-based quality measures given the overall null findings for the falsification test for these measures (Exhibits A-7 and A-11).

It is possible for there to be residual non-linear, non-parallel trends based on a model that adjusts for state fixed effects and state-specific linear trends. Moreover, there may be non-linear trends in impact measures at the state level that deviate from the D-in-D assumptions; this becomes relevant as we develop state-specific analyses for subsequent reports. We will continue to analyze the influence of such potential deviations from model assumptions on impact estimates throughout the course of this evaluation.

A.2 Variable and Impact Measure Definitions

Below, we describe how we specified and defined descriptive variables and impact measures that were used in this Annual Report.

A.2.1 Descriptive Variables

A.2.1.1 Beneficiary Characteristics

Total Number of Beneficiaries Receiving Home Health Care. Home health claims and OASIS episodes of care were used to identify and count the number of unique home health beneficiaries with at least one home health claim or OASIS episode of care in a specified time period.

Age. Age was calculated based on the floored (i.e., rounding down to nearest integer) year difference between patient birth date on the OASIS assessment and the OASIS assessment effective date; if the OASIS information was missing, then age was calculated based on the floored year difference between patient date of birth and the claims-based episode start date.

Gender. Gender indicator was primarily derived from the OASIS assessment item M0069; if the OASIS information was missing, then gender was derived from the variable SEX_IDENT_CD in the Master Beneficiary Summary File (MBSF) Base segment data file.

Race/Ethnicity. Race indicators (white, black, Hispanic, other race) came from OASIS assessment item M0140; American Indian or Alaska Native, Asian and Native Hawaiian or Pacific Islander are grouped into the "other" race category. The OASIS item allows for selection of more than one race; therefore, a patient could have multiple race flags indicated. If the OASIS information was missing, then RTI_RACE_CD from the MBSF Base segment data was used to calculate race indicators. We recoded race categories to mutually exclusive groups using the following rules:

- Hispanic (regardless of black/white/other race)
- Black (as the only race indicated; will be non-Hispanic)
- White (as the only race indicated; will be non-Hispanic)
- Other (as the only race indicated; will be non-Hispanic)
- Multiracial (combination of black/white/other race; will be non-Hispanic)

Dual Eligible. For the month that a given claim-based episode starts or an OASIS-based episode of care ends, dual status indicators were evaluated in the MBSF. If the beneficiary was in the MBSF Base segment data and had Dual Status code value in ('01','02','03','04','05','06','08'), then their Dual flag was set to 1 for that episode. Otherwise, if they did not have enrollment data for that month in the MBSF or if the Dual Status code was not in ('01','02','03','04','05','06','08'), then their Dual flag was set to 0.

Medicaid Only (either Health Maintenance Organization [HMO] or FFS without dual). For OASIS episodes of care, beneficiaries were marked as Medicaid Only, if they were not dual eligible, as defined via MBSF, and OASIS item M0150 ('Current Payment Sources for Home Care') indicated either '3 - Medicaid (traditional fee-for-service)' or '4 - Medicaid (HMO/managed care).'

Rural/Urban. County Core-Based Statistical Area (CBSA) codes from the Area Health Resource File (AHRF) data were used to identify rural counties (i.e., those that lacked a CBSA code) and urban counties (i.e., those with a CBSA code). Rural/urban indicators were then matched to beneficiaries' county information as derived from the ZIP code reported on the OASIS assessment form. If ZIP code was not

available from the OASIS assessment, then the county where home health services were provided was derived based on a hierarchy of data sources: CBSA code reported on the home health claim, beneficiary ZIP code from OASIS assessment nearest to the home health claim start date, beneficiary address reported on the home health claim, and the beneficiary county provided at month-level in the MBSF Base segment. If beneficiary county of residence/treatment was not available in any of these data sources, then the ZIP code of the HHA providing care was used to derive county information.

Health Conditions. The following chronic health conditions were reported for home health beneficiaries on an annual basis: chronic kidney disease, congestive heart failure, diabetes, ulcers, Alzheimer's disease or related senile dementia, ischemic heart disease, and anemia. These indicators were pulled from the MBSF Chronic Conditions and Other Chronic Conditions segments. The condition flags were provided at both the middle and end of each year for each Medicare beneficiary; for this Report, only end-of-year condition flags were used. The original chronic condition flags have four levels: 1) neither claim nor coverage criteria were met; 2) claim criteria met, coverage criteria not met; 3) claim criteria not met, coverage criteria met; 4) claims and coverage criteria met. Claims criteria are met when the beneficiary has a claim that includes a related diagnosis or procedure code during the given condition's reference period. Coverage criteria are met when the beneficiary is enrolled in full FFS (Medicare Parts A and B) for the entire condition reference period. Our analyses reduced these chronic condition flags to three levels: 1) Beneficiary has condition (claims criteria were met, regardless of coverage criteria); 2) Beneficiary does not have condition (claims criteria were not met); 3) Beneficiary does not have MBSF Chronic Condition data available for the year.

Reason for Medicare Entitlement. Original and current reasons for Medicare entitlement were determined using the entitlement reason variables from the MBSF Base segment, associated with a claims-based home health episode based on the year in which the episode began. Beneficiary Medicare entitlement was coded as disabled, end-stage renal disease, or both.

Percentage of Persons aged 25 years or older with less than a high school diploma 2011-2015. The percentage of each level of education at the county level was reported on the AHRF data (see Section A.3.5). This value was calculated by dividing the number of individuals aged 25 years or older with less than a high school diploma by the standard education level denominator provided on the AHRF then multiplying by 100. This county-level metric was then matched to each home health episode based on the county in which care was provided (see Section A.4.3 for a detailed description in how county was determined).

OASIS Clinical Factors

Inpatient discharge within 14 days. For OASIS-based episodes of care, inpatient discharge within 14 days prior to the start of care was derived from OASIS assessment item M1000. For claims-based episodes, each home health beneficiary's FFS status was determined using the MBSF monthly indicators for the 14 days prior to the start of the episode. Among those beneficiaries who are Parts A & B eligible, inpatient and SNF claims were scanned for those with a clm_thru_dt (i.e. discharge) occurring within the 14-day lookback period.

Receiving psychiatric nursing services. For OASIS-based episodes of care, an indicator variable indicating the reception of psychiatric nursing services was derived from OASIS assessment item M1750, in which a response of '01' indicates that the beneficiary was receiving psychiatric nursing services.

Risk for hospitalization. For OASIS-based episodes of care, three indicators for risk for hospitalization were derived from one of two OASIS assessment items, depending on assessment version. For assessments using the C1 version, item M1032 was used, and for assessments using the C2 version, item M1033 was used. In both cases, responses of '01' were coded as having a history of falls, responses of '03' were coded as having multiple hospitalizations in the past 6 months, and responses of '07' were coded as taking five or more medications.

Requires urinary catheter. For OASIS-based episodes of care, indicators for urinary incontinence or catheter presence were populated only in instances in which the patient had been discharged from an inpatient community (via M1000) or received a diagnosis requiring medical or treatment regimen change (via M1016 for C1 assessments or M1017 if C2 assessments). Among those patients, the indicator was populated when item M1610 had a response of '02.'

Surgical wound. For OASIS-based episodes of care, an indicator variable indicating that the patient has a surgical wound was populated based on OASIS assessment item M1340 with a response of '01,' indicating that the patient has an observable surgical wound.

Non-surgical wound or skin lesion. For OASIS-based episodes of care, an indicator variable indicating that the patient has a skin lesion or open wound was populated based on OASIS assessment M1350 with a response of '01,' indicating that the patient has a lesion or open wound.

Acute Conditions. For OASIS-based episodes of care, acute conditions (need for oxygen therapy, orthopedic conditions, and presence of neoplasm diagnosis) were identified from a series of OASIS assessment items. The need for ***oxygen therapy*** was derived from item M1410 when the response was '01.' The presence of ***orthopedic conditions***, which encompasses a range of conditions including musculoskeletal conditions (e.g., sprain, cartilage tear, gout), was populated only in instances in which the patient had been discharged from an inpatient community (via M1000) or received a diagnosis requiring medical or treatment regimen change (via M1016 for C1 assessments or M1017 if C2 assessments). Among those cases, orthopedic conditions were derived from OASIS assessment items M1010 (for ICD9 codes from an inpatient diagnosis), M1011 (ICD10 codes from an inpatient diagnosis), M1016 (for ICD9 codes from a diagnosis requiring medical or treatment regimen change within the past 14 days), and M1017 (ICD10 codes from a diagnosis requiring medical or treatment regimen change). Those International Classification of Diseases (ICD) codes were then used to populate this indicator according to CMS documentation on OASIS measures.[8] Finally, we derived ***neoplasm diagnosis*** from a series of OASIS assessment items: M1020 (primary diagnosis ICD codes), M1022 (other ICD diagnosis codes), and M1024 (payment ICD diagnosis codes). These ICD codes were then used to indicate the presence of a diagnosis of neoplasm according to CMS documentation on OASIS measures.[8]

[8] Hittle DF, Nuccio EJ. (2017) Home Health Agency Patient-Related Characteristics Reports: Technical Documentation of Measures - Revision 4.1. Prepared for: Department of Health and Human Services; Centers for Medicare & Medicaid Services. *University of Colorado School of Medicine - Division of Health Care Policy and Research*.

Exhibit A-13. Pressure Ulcers

OASIS Item	OASIS Question	Variables	OASIS Response
M1308 (version C1), M1311 (version C2) – Pressure Ulcers	Current Number of Unhealed Pressure Ulcers at Each Stage (or Unstageable)	Pressure Ulcer Stage 2	A
		Pressure Ulcer Stage 3	B
		Pressure Ulcer Stage 4	C
		Pressure Ulcer Not Stageable	D.1-D.3

Source: OASIS-C2 Guidance Manual

Exhibit A-14. Ambulation/Locomotion

OASIS Item	OASIS Question	Variables	OASIS Response
M1860 – Ambulation/Locomotion	Current ability to walk safely, once in a standing position, or use a wheelchair, once in a seated position, on a variety of surfaces.	Able to independently walk with the use of a one-handed device	01
		Requires two handed device or human assistance	02
		Walks only with supervision or assistance from another at all times	03
		Chairfast to bedfast	04, 05, 06

Source: OASIS-C2 Guidance Manual

Exhibit A-15. Bed Transferring

OASIS Item	OASIS Question	Variables	OASIS Response
M1850 – Bed Transferring	Transferring: Current ability to move safely from bed to chair, or ability to turn and position self in bed if patient is bedfast	Able to transfer with minimal human assistance or with use of an assistive device	01
		Able to bear weight and pivot during the transfer but unable to transfer self	02
		Unable to transfer self and is unable to bear weight or pivot when transferred by another person	03
		Bedfast, unable to transfer but is able to turn and position self in bed	04
		Bedfast, unable to transfer and is unable to turn and position self	05

Source: OASIS-C2 Guidance Manual

Exhibit A-16. Bathing

OASIS Item	OASIS Question	Variables	OASIS Response
M1830 – Bathing	Bathing: Current ability to wash entire body safely. Excludes grooming (washing face, washing hands, and shampooing hair).	With the use of devices in shower/tub	01
		With intermittent assistance in shower/tub	02
		Participates with supervision in shower/tub	03
		Independent at sink, in chair, or on commode	04
		Participates with assist at sink, in chair, or commode	05
		Unable to participate; bathed totally by another	06

Source: OASIS-C2 Guidance Manual

Exhibit A-17. Pain

OASIS Item	OASIS Question	Variables	OASIS Response
M1242 – Pain	Frequency of Pain Interfering with patient's activity or movement	Pain does not interfere with activity	01
		Less often than daily pain	02
		Daily, but not constant pain	03
		Constant pain	04

Source: OASIS-C2 Guidance Manual

Exhibit A-18. Oral Medications

OASIS Item	OASIS Question	Variables	OASIS Response
M2020 – Oral Medications	Management of Oral Medications: Patient's current ability to prepare and take all oral medications reliably and safely, including administration of the correct dosage at the appropriate times/intervals. Excludes injectable and IV medications. (NOTE: This refers to ability, not compliance or willingness.)	Patient is able to take oral medications if prepared in advance/another person develops a drug diary	01
		Able to take medications at the correct time if given reminders by another person at the appropriate times	02
		Unable to take medication unless administered by another person	03

Source: OASIS-C2 Guidance Manual

Exhibit A-19. Dyspnea

OASIS Item	OASIS Question	Variables	OASIS Response
M1400 – Dyspnea	When is the patient dyspneic or noticeably Short of Breath?	Patient is short of breath only when walking more than 20 feet	01
		With moderate exertion	02
		With minimal exertion or at rest	03, 04

Source: OASIS-C2 Guidance Manual

Exhibit A-20. Wound Status

OASIS Item	OASIS Question	Variables	OASIS Response
M1342 – Wound Status	Status of Most Problematic Surgical Wound that is Observable	Fully granulating	01
		Early/partial granulation	02
		Not healing	03

NOTE: These indicators are only populated if M1340 = '00' or '02' (i.e., Does this patient have a surgical wound? 00 = No, 02 = Surgical wound known but observable due to non-removable dressing/device). | Source: OASIS-C2 Guidance Manual

A.2.1.2 Episode Characteristics

Episode Type. Home health claims-based episodes with outlier payment adjustments were identified using the variable claim value code = 17. Low Utilization Payment Adjustment (LUPA) payment adjustments were identified using the variable *CLM_HHA_LUPA_IND_CD*, and Partial Episode Payment (PEP) payment adjustments were identified using *PTNT_DSCHRG_STUS_CD = '06.'* Otherwise, all episodes without outlier, LUPA, or PEP adjustments were categorized as "Normal".

Episodes within a Sequence. Claims-based episode sequences were put together by combining episodes whose end date and start dates were within 60 days of one another; a gap of at least 60 days indicated the start of a new sequence. Three different categories of episode were created depending on the order in which an episode appears relative to the larger sequence of episodes in which it occurs: first in a sequence, second in a sequence, and third or higher in a sequence. All episodes, regardless of episode type (i.e., normal, outlier, LUPA, PEP), were included. The logic we employed is in alignment with the methodology for determining home health stays for the two HHVBP claims-based measures.[10]

Visits in an Episode. Using the revenue center codes associated with each home health claim, visits per claims-based episode were counted for each type of home health service: physical therapy visit (revenue center code 042x), occupational therapy visit (revenue center code 043x), speech language pathology visit (revenue center code 044x), skilled nursing visit (revenue center code 055x), medical social services visit (revenue center code 056x), and home health aide visit (revenue center code 057x). These visits were then summed to calculate the total visits per claims-based episode.

Visits in an Episode by Type of Visit. Using the revenue center codes associated with each home health claim, visits per episode were counted for each type of home health service: physical therapy visit (revenue center code 042x), occupational therapy visit (revenue center code 043x), speech language

pathology visit (revenue center code 044x), skilled nursing visit (revenue center code 055x), medical social services visit (revenue center code 056x), and home health aide visit (revenue center 057x).

A.2.1.3 HHA Characteristics

Total Number of HHAs. Home health claims and OASIS episodes of care were used to generate a list of all unique HHAs with at least one home health claim or OASIS episode of care in a specified time period.

Ownership. Using publicly available CMS Provider of Services (POS) data, HHAs were categorized as for-profit, non-profit, or government-owned, conditional on control type. From the provider data, control type is recoded as "non-profit" (control type codes 1,2,3), "for-profit" (control type code 4), and "government-owned" (control type codes 5,6,7).

Setting: Hospital-Based vs. Freestanding. Using publicly available CMS POS data, HHAs were categorized as freestanding or hospital-based conditional on facility type. From the provider data, facility type is recoded as "freestanding" (facility type codes 1,2,3,7) or "hospital-based" (facility type codes 4,5,6).

HHA Age. HHA age was calculated for each HHA by subtracting the specified year from the year the HHA opened, as derived from the *ORGNL_PRTCPTN_DT* variable.

Entry of New/Exit of Existing Providers. This measure was calculated using OASIS and Medicare FFS claims data. A list of unique HHAs with at least one OASIS episode of care or one Medicare FFS episode present each year was generated. Each year's HHA list was then compared to each other year's HHA list, to identify HHAs that were present in one year but not the other. These HHAs were counted to identify how many HHAs were new or no longer active between two given years.

Chain Membership. HHA chain membership was determined for each individual year from 2013-2017 using two sources: Provider Enrollment, Chain and Ownership System (PECOS) and HHA Cost Report data. Using Cost Report data, chain affiliation was determined using the information reported on Line 29 of Worksheet S-2 for a given fiscal year. Extraction of PECOS chain affiliation data is described in Section A.3.9 below. PECOS-based chain affiliation data was assessed for any year in which the HHA was enrolled in Medicare (via the PECOS enrollment parent table) at the end of the CY. If the HHA met this condition and was also under ownership of a chain at the end of the CY, then the HHA was considered to be affiliated with a chain for that year. If the HHA was enrolled in Medicare at the end of the CY and was not under ownership of a chain at the end of the CY, then the HHA was not considered to be affiliated with a chain for that year. If the HHA did not have PECOS enrollment data covering the end of the CY, then chain affiliation based on PECOS data was considered missing.

Using the processed Cost Reports and PECOS, an agency was assigned chain membership if either data source indicated chain membership for the given year. If both sources indicated that the agency was not a chain, or if one source indicated not a chain and the other was missing, then the agency was assigned a non-chain status. If both sources were missing, then the prior year and following year were checked, and if the agency had the same status before and after, that status was assigned (e.g., if an HHA is chain in 2013, missing in 2014, and chain in 2015, their 2014 status would be set to "chain").

HHA Size. HHA size was determined at an annual level by counting the number of OASIS episodes of care that end within a given year. Agencies were then further grouped into mutually exclusive categories based on the number of episodes they provided:

- 1-59 episodes
- 60-249 episodes
- 250-499 episodes
- 500-999 episodes
- 1000+ episodes

Profitability. Profitability measures the Medicare profit margin for agencies. The measure was defined as the difference between total Medicare payments for prospective payment system episodes and the total costs of Medicare services, including drugs and durable medical equipment (DME), divided by total Medicare payments for prospective payment system episodes, (payments – costs)/payments. Medicare payments and costs were taken from Medicare HHA and Hospital Cost Reports for freestanding and hospital-based agencies, respectively. We employed a trimming process to account for extreme values.[9]

A.2.2 Claims-Based Impact Measures

This section presents how the claims-based measures were created. Of note, the bottom row of each table notes the data source(s) used to create the impact measure. Each of the impact measures, episode-level numerator and denominator indicators were merged with other variables to create the analytic file (Sections A.4.1 and A.4.3) that is used to conduct the analyses and produce the results presented in the Report.

Exhibit A-21. Average Number of FFS HH Episodes per 1,000 FFS Beneficiaries

Measure Concept	Definition
Measure Category	Quality
Measure Description	Number of claims-based HH episodes ending in a given quarter per 1,000 FFS beneficiaries alive at the beginning of the quarter.
Measure Numerator	Total number of claims-based HH episodes ending in the quarter.
Numerator Details	Numerator includes all claims-based HH episodes of all types (LUPAs, outliers, PEPs, etc.) irrespective of whether they are first, second, or higher in the sequence, ending in a given quarter.
Measure Denominator	Total number of Medicare-eligible FFS beneficiaries alive at the beginning of the given quarter divided by 1,000.
Denominator Details	Total number of Medicare-eligible FFS beneficiaries alive at the beginning of the quarter (e.g., if a beneficiary is no longer FFS next month, they are still included) is obtained and then the number is divided by 1,000.
Data Sources	MBSF, HHA Claims

[9] Abt Associates. (2013) Analyses in Support of Rebasing & Updating Medicare Home Health Payment Rates; Prepared for the Centers for Medicare and Medicaid Services. Accessed from here.

Exhibit A-22. Average Medicare Spending per Day for Unplanned Acute Care Hospitalizations among All FFS Home Health Episodes (%)

Measure Concept	Definition
Measure Category	Spending
Measure Description	Medicare payments per day for all unplanned ACHs within 60 days of the start of the HH episode or until the start of the next eligible HH episode that begins on or before the 60th day or until death or loss of FFS Part A eligibility; whichever comes earlier.
Measure Numerator	Total Medicare payments associated with all unplanned ACHs within 60 days of the start of the HH episode and prior to the start of the next eligible HH episode that begins on or before the 60th day or until death or loss of FFS Part A eligibility; whichever comes earlier.
Numerator Details	▪ Total Medicare payments associated with the entire unplanned ACH are included if the ACH occurs within 60 days of the start of the HH episode and prior to the start of the next eligible HH episode that begins on or before the 60th day or until death or loss of FFS Part A eligibility; whichever comes earlier. ▪ Inpatient claims that completely overlap (i.e., claim through date of first claim is greater than claim from date of ensuing claim) are combined in terms of expense and duration. Further, in the case of two consecutive acute care hospital claims for which the later claim begins on the same or next day of the prior claim's end date, following logic is applied: if the provider on each claim is different, then combine the claims into one hospital stay in which the patient transferred hospitals; if the provider on each claim is the same, then maintain the two separate stays and consider the second claim to be a re-admission due to a potentially different diagnosis. ▪ If there are multiple distinct eligible claims associated with a single HH episode then the costs associated with all of them are included. ▪ Planned hospitalizations (defined by a list of Agency for Healthcare Research and Quality [AHRQ] Procedure and Condition Clinical Classifications Software [CCS] and additional ICD-9-CM procedure codes) are excluded from the measure numerator. ▪ The measure specifications, including the AHRQ codes, were pulled from the CMS Home Health Claims-Based Utilization Measures Specifications.[10]
Measure Denominator	Total number of eligible days accrued from periods of up to 60 days following the start date of HH FFS episodes starting in a given calendar quarter.
Denominator Details	All HH episodes that start in the quarter are included with the following exclusions: ▪ HH episodes for patients who are alive and are not continuously enrolled in FFS Medicare for the 60 days following the start of the HH episode. ▪ HH episodes for patients who were not FFS eligible in the six months prior. ▪ HH episodes that begin with a LUPA claim. ▪ HH episodes in which the patient receives service from multiple agencies during the 60-day window (see "Transfer HHAs within 60 days" in Glossary [Section A.6]).
Data Sources	MBSF, HHA Claims, Inpatient Claims. Enrollment status and beneficiary death date are obtained from MBSF.

This measure was capped both at lower and upper ends to reduce the influence of extreme expenditure outliers. For each year, the measure was capped at the 99th percentile of the unweighted positive (i.e., payment values > 0) spending per-day measure (i.e. any value greater than 99th percentile were set to the 99th percentile value), and any negative payment values were set to zero dollars.

[10] See CMS Specifications for Claims-Based Utilization Measures.

Exhibit A-23. Average Medicare Spending per Day during and following FFS Home Health Episodes of Care

Measure Concept	Definition
Measure Category	Spending
Measure Description	Average Medicare Part A and Part B payments per day during and up to 37 days following HH episodes of care. This measure includes payments that occur between the start of the HH episode (SOC) and a 37-day look-out period following the last HH visit (end of care) or until the start of the next HH episode that begins on or before the 37th day. The length of the look-out period (37-day) is composed of 7 days post last HH visit and additional 30 days thereafter or until the start of the next HH episode that begins on or before the 37th day or until death or loss of FFS Part A eligibility; whichever comes earlier.
Measure Numerator	Total Medicare Part A and Part B payments between the SOC and a 37-day look-out period following the last HH visit (end of care) or until the start of the next HH episode that begins on or before the 37th day or until death or loss of FFS Part A eligibility; whichever comes earlier.
Numerator Details	Sum of Medicare payments on all Part A and Part B claims with a claim start date (i.e., based on "clm_from_dt") occurring between the SOC and a 37-day look-out period following the last HH visit (end of care) or until the start of the next HH episode that begins on or before the 37th day or until death or loss of FFS Part A eligibility; whichever comes earlier. Where applicable, the 37-day look-out period following the end of care is truncated to prevent possible double counting of payments for claims that occur during a subsequent HH episode beginning during this 37-day period.
Measure Denominator	Total number of eligible days accrued during and in periods of up to 37 days following the last HH visit date of all HH FFS episodes starting in a given calendar quarter.
Denominator Details	Denominator includes all days occurring between the SOC and a 37-day look-out period following the last HH visit (end of care) or until the start of the next HH episode that begins on or before the 37th day or until death or loss of FFS Part A eligibility, for HH episodes of all types (LUPAs, outliers, PEPs, etc.) starting in a given calendar quarter, irrespective of whether they are first, second, or higher episodes in a sequence. HH episodes are excluded in the absence of a HH visit date. The maximum number of days that can be included in the denominator is 97 days for a 60 day episode of care (60 + 37 days), unless the last HH visit date occurs before the HH episode claim end date and/or a subsequent HH episode, death, or loss of FFS Part A eligibility occurs prior to the 37-day look–out period.
Data Sources	Medicare Part B carrier, DME, HH, Hospice, Inpatient, Outpatient, and SNF claims.

This measure was capped at both the lower and upper ends to reduce the influence of extreme expenditure outliers. For each year, the measure was capped at the 99th percentile of the unweighted spending per-day measure (i.e. any values greater than 99th percentile were set to the 99th percentile value), and any negative payment values were set to zero dollars.

Exhibit A-24. Average Medicare Spending per Day during FFS Home Health Episodes of Care

Measure Concept	Definition
Measure Category	Spending
Measure Description	Average Medicare Part A and Part B payments per day during HH episodes of care. This measure includes payments that occur between the SOC and a 7-day look-out period following the last HH visit (end of care) or until the start of the next HH episode that begins on or before the 7th day or until death or loss of FFS Part A eligibility; whichever comes earlier.
Measure Numerator	Total Medicare Part A and Part B payments between the SOC and a 7-day look-out period following the last HH visit (end of care) or until the start of the next HH episode that begins on or before the 7th day or until death or loss of FFS Part A eligibility; whichever comes earlier.
Numerator Details	Sum of Medicare payments on all Part A and Part B claims with a claim start date (i.e., based on "clm_from_dt") occurring between the SOC and a 7-day look-out period following the last HH visit (end of care) or until the start of the next HH episode that begins on or before the 7th day or until death or loss of FFS Part A eligibility; whichever comes earlier. Where applicable, the 7-day look-out period following the end of care is truncated to prevent possible double counting of payments for claims that occur during a subsequent HH episode beginning during this 7-day period.
Measure Denominator	Total number of eligible days accrued from all HH FFS episodes starting in a given calendar quarter.
Denominator Details	Denominator includes all days occurring between the SOC and a 7-day look-out period following the last HH visit (end of care) or until the start of the next HH episode that begins on or before the 7th day or until death or loss of FFS Part A eligibility, for HH episodes of all types (LUPAs, outliers, PEPs, etc.) starting in a given calendar quarter, irrespective of whether they are first, second, or higher episodes in a sequence. HH episodes are excluded in the absence of a HH visit date. The maximum number of days that can be included in the denominator is 67 days for a 60 day episode of care (60 + 7 days), unless the last HH visit date occurs before the HH episode claim end date and/or a subsequent HH episode, death, or loss of FFS Part A eligibility occurs prior to the 7-day look–out period.
Data Sources	Medicare Part B carrier, DME, HH, Hospice, Inpatient, Outpatient, and SNF claims.

This measure was capped at both the lower and upper ends to reduce the influence of extreme expenditure outliers. For each year, the measure was capped at the 99th percentile of the unweighted spending per-day measure (i.e. any values greater than 99th percentile were set to the 99th percentile value), and any negative payment values were set to zero dollars.

Exhibit A-25. Average Medicare Spending per Day following FFS Home Health Episodes of Care

Measure Concept	Definition
Measure Category	Spending
Measure Description	Average Medicare Part A and Part B payments per day that occur after the 7th day following the last HH visit (end of care) and over the subsequent 30 days or until the start of the next HH episode that begins on or before the 30th day or until death or loss of FFS Part A eligibility; whichever comes earlier.
Measure Numerator	Total Medicare Part A and Part B payments within 30 days following the 7th day after the last HH visit (end of care) or until the start of the next HH episode that begins on or before the 30th day or until death or loss of FFS Part A eligibility; whichever comes earlier.
Numerator Details	Sum of Medicare payments on all Part A and Part B claims with a claim start date (i.e., based on "clm_from_dt") occurring within 30 days following the 7th day after the last HH visit (end of care) or until the start of the next HH episode that begins on or before the 30th day or until death or loss of FFS Part A eligibility; whichever comes earlier. Where applicable, the 30-day downstream period is truncated to prevent possible double counting of payments for claims that occur during a subsequent HH episode beginning during this 30-day period.
Measure Denominator	Total number of eligible days accrued from periods of up to 30 days that occur after the 7th day following the last HH visit date of HH FFS episodes starting in a given calendar quarter.
Denominator Details	Denominator includes all days accrued from periods following the 7th day after the last HH visit date, for HH episodes of all types (LUPAs, outliers, PEPs, etc.) starting in a given calendar quarter, irrespective of whether they are first, second, or higher episodes in a sequence. HH episodes are excluded if: 1. There are no HH visit dates reported. 2. A measurement time period is not available since the claim start date ("clm_from_dt") on a subsequent HH episode, date of death, or loss of FFS Part A eligibility does not exceed the last HH visit date of the HH episode by more than 1 day. The maximum number of days that can be included in the denominator is 30 days, unless a subsequent HH episode, death, or loss of FFS Part A eligibility occurs prior to the 30-day downstream period.
Data Sources	Medicare Part B carrier, DME, HH, Hospice, Inpatient, Outpatient, and SNF claims.

This measure was capped at both the lower and upper ends to reduce the influence of extreme expenditure outliers. For each year, the measure was capped at the 99th percentile of the unweighted spending per-day measure (i.e. any value greater than 99th percentile were set to the 99th percentile value), and any negative payment values were set to zero dollars.

Exhibit A-26. Emergency Department Use (no Hospitalization)/First FFS Home Health Episodes

This impact measure is similar to the HHVBP measure, "Emergency Department Use without Hospitalization". [11] However, unlike the HHVBP measure, it is not risk adjusted.

Measure Concept	Definition
Measure Category	Quality
Measure Description	Percentage of HH stays in which patients used the ED but were not admitted to the hospital during the 60 days following the start of the HH stay.
Measure Numerator	Number of HH stays for patients who have a Medicare claim for outpatient ED use and no claims for ACH in the 60 days following the start of the HH stay.
Numerator Details	The 60 day time window is calculated by adding 60 days to the "from" date in the first HH claim in the series of HH claims that comprise the HH stay. If the patient has any Medicare outpatient claims with any ER revenue center codes (0450-0459, 0981) during the 60 day window AND if the patient has no Medicare inpatient claims for admission to an acute care hospital (identified by the CMS Certification Number [CCN] on the inpatient claim ending in 0001-0879, 0800-0899, or 1300-1399) during the 60 day window, then the stay is included in the measure numerator.
Measure Denominator	Number of HH stays that begin during the 12-month observation period. A HH stay is a sequence of HH payment episodes separated from other HH payment episodes by at least 60 days.
Denominator Details	See below for exclusions about HH stay construction. 1. HH stays for patients who are not continuously enrolled in Medicare FFS for the 60 days following the start of the HH stay or until death. 2. HH stays that begin with a LUPA claim. 3. HH stays in which the patient receives service from multiple agencies during the first 60 days. 4. HH stays for patients who are not continuously enrolled in Medicare FFS for the 6 months prior to the HH stay.
Data Sources	Claims Predicted Probability file

[11] See CMS Specifications for Home Health Claims-Based Utilization Measures, "Emergency Department Use without Hospitalization."

Exhibit A-27. Unplanned Acute Care Hospitalization/First FFS Home Health Episodes

This impact measure is similar to the HHVBP measure, "Acute Care Hospitalization". [12] However, unlike the HHVBP measure, it is not risk adjusted.

Measure Concept	Definition
Measure Category	Quality
Measure Description	Percentage of HH stays in which patients were admitted to an acute care hospital during the 60 days following the start of the HH stay.
Measure Numerator	Number of HH stays for patients who have a Medicare claim for an admission to an acute care hospital in the 60 days following the start of the HH stay.
Numerator Details	The 60 day time window is calculated by adding 60 days to the "from" date in the first HH claim in the series of HH claims that comprise the HH stay. If the patient has at least one Medicare inpatient claim from short term or critical access hospitals (identified by the CCN on the inpatient claim ending in 0001-0879, 0800-0899, or 1300-1399) during the 60 day window, then the stay is included in the measure numerator. Note that planned hospitalizations are excluded from the numerator.
Measure Denominator	Number of HH stays that begin during the 12-month observation period. A HH stay is a sequence of HH payment episodes separated from other HH payment episodes by at least 60 days.
Denominator Details	1. HH stays for patients who are not continuously enrolled in Medicare FFS for the 60 days following the start of the HH stay or until death. 2. HH stays that begin with a LUPA claim. 3. HH stays in which the patient receives service from multiple agencies during the first 60 days. 4. HH stays for patients who are not continuously enrolled in Medicare FFS for the 6 months prior to the HH stay.
Data Sources	Claims Predicted Probability file

[12] See CMS Specifications for Home Health Claims-Based Utilization Measures, "Acute Care Hospitalization."

Exhibit A-28. Unplanned Acute Care Hospitalization/All FFS Home Health Episodes

Measure Concept	Definition
Measure Category	Quality
Measure Description	Percentage of HH episodes with at least one unplanned admission to an acute care hospital within 60 days of the start of the episode or until the start of the next HH episode that begins on or before the 60th day.
Measure Numerator	Number of HH episodes with at least one unplanned admission to an acute care hospital within 60 days of the start of the episode or until the start of the next HH episode that begins on or before the 60th day.
Numerator Details	▪ The 60-day time window is calculated by adding 59 days to the "from" date of the HH episode. If a subsequent HH episode starts on or before the 60th day, the time window is ended early on the day prior to the start of the next episode. ▪ ACH occurs (and the HH episode is included in the numerator) if the patient has at least one Medicare inpatient claim from short-stay or critical access hospitals during the 60-day window. ▪ Planned hospitalizations (defined by a list of AHRQ Procedure and Condition CCS and additional ICD-9-CM procedure codes) are excluded from the measure numerator. The measure specifications, including the AHRQ codes, were pulled from the CMS Home Health Claims-Based Utilization Measures Specifications.[10]
Measure Denominator	Total number of eligible HH episodes starting in a given quarter.
Denominator Details	All HH episodes that start in the quarter are included with the following exclusions: ▪ HH episodes for patients who are alive and are not continuously enrolled in FFS Medicare for the 60 days following the start of the HH episode. ▪ HH episodes for patients who were not FFS eligible in the six months prior. ▪ HH episodes that begin with a LUPA claim. ▪ HH episodes in which the patient receives service from multiple agencies during the 60-day window (see "Transfer HHAs within 60 days" in Glossary [Section A.6]).
Data Sources	MBSF, HHA Claims, Inpatient Claims. Enrollment status and beneficiary death date are obtained from MBSF.

Exhibit A-29. Unplanned Hospital Readmission during First 30 Days of HH Care

Measure Concept	Definition
Measure Category	Quality
Measure Description	Percentage of HH stays that started within five days of discharge from an acute care hospital with at least one Medicare ACH claim during the 30 days following the start of the HH stay.
Measure Numerator	Number of HH stays for patients who have a Medicare claim for unplanned inpatient stay in an acute care hospital in the 30 days following the start of the HH stay.
Numerator Details	The 30-day time window is calculated by adding 30 days to the "from" date in the first HH claim in the series of HH claims that comprise the HH stay. If the patient has at least one Medicare inpatient claim from short-term or critical access hospitals during the 30 day window (identified by the CCN on the inpatient claim ending in 001-0879, 0880-0899, or 1300-1399) then the stay is included in the measure numerator.
Measure Denominator	Number HH stays that begin during the 12-month observation period and prior to which patients who were discharged from an acute inpatient hospital within *five* days of the start of home care. A HH stay is a sequence of HH payment episodes separated from other HH payment episodes by at least 60 days.
Denominator Details	See below for exclusions about HH stay construction. 1. HH stays for patients who are not continuously enrolled in FFS 30 days following the start of the HH stay or until death. 2. HH stays that begin with a LUPA claim. 3. HH stays in which the patient receives service from multiple HHAs during the first 30 days. 4. HH stays for patients who are not continuously enrolled in Medicare FFS for the 6 months prior to the HH stay. 5. HH stays for admissions for the medical treatment of cancer, primary psychiatric diseases, rehabilitation care and the fitting of prostheses and adjustment devices, and admissions ending in patient discharge against medical advice. 6. HH stays for patients who receive intervening care in the window between the index hospital discharge and the start of HH care. 7. HH stays with missing payment-episode authorization strings.
Data Sources	Claims Predicted Probability file

Exhibit A-30. Emergency Department Use Following Hospitalization (without Hospital Readmission) in the First 30 days of Home Health Care

Measure Concept	Definition
Measure Category	Quality
Measure Description	Percentage of HH stays that started within five days of discharge from an acute care hospital in which patients used the ED but were not admitted to the hospital during the 30 days following the start of the HH stay.
Measure Numerator	Number of HH stays for patients who have a Medicare claim for outpatient emergency use and no claims for ACH in the 30 days following the start of the HH stay.
Numerator Details	The 30-day time window is calculated by adding 30 days to the "from" date in the first HH claim in the series of HH claims that comprise the HH stay. If the patient has any Medicare outpatient claims with any ER revenue center codes (0450-0459, 0981) during the 30 day window AND if the patient has no Medicare inpatient claims for admission to an acute care hospital (identified by the CCN on the inpatient claim ending in 0001-0879, 0800-0899, or 1300-1399) during the 30 day window, then the stay is included in the measure numerator.
Measure Denominator	Number HH stays that begin during the 12-month observation period and prior to which patients who were discharged from an acute inpatient hospital within *five* days of the start of home care. A HH stay is a sequence of HH payment episodes separated from other HH payment episodes by at least 60 days.
Denominator Details	See below for exclusions about HH stay construction. 1. HH stays for patients who are not continuously enrolled in Medicare FFS 30 days following the start of the HH stay or until death. 2. HH stays that begin with a LUPA claim. 3. HH stays in which the patient receives service from multiple HHAs during the first 30 days. 4. HH stays for patients who are not continuously enrolled in Medicare FFS for the 6 months prior to the HH stay. 5. HH stays for admissions for the medical treatment of cancer, primary psychiatric diseases, rehabilitation care and the fitting of prostheses and adjustment devices, and admissions ending in patient discharge against medical advice. 6. HH stays for patients who receive intervening care in the window between the index hospital discharge and the start of HH care. 7. HH stays with missing payment-episode authorization strings.
Data Sources	Claims Predicted Probability file

Exhibit A-31. Skilled Nursing Facility Use/All FFS HH Episodes

Measure Concept	Definition
Measure Category	Quality
Measure Description	Percentage of HH episodes with at least one admission to a SNF within 60 days of the start of the HH episode or until the start of the next HH episode that begins on or before the 60th day.
Measure Numerator	Number of HH episodes with at least one admission to a SNF within 60 days of the start of the HH episode or until the start of the next HH episode that begins on or before the 60th day.
Numerator Details	▪ The 60-day time window is calculated by adding 59 days to the "from" date of the HH episode. If a subsequent HH episode starts on or before the 60th day, the time window is ended early on the day prior to the start of the next episode. ▪ The SNF admission is counted if the patient has at least one SNF claim during the 60-day window. ▪ SNF admissions following planned ACH (defined by a list of AHRQ Procedure and Condition CCS and additional ICD-9-CM procedure codes) are excluded from the measure numerator under the following conditions: 1. The planned hospitalization starts within the HH episode 60-day window. 2. The planned hospitalization ends within the HH episode 60-day window. 3. The SNF stay starts within the HH episode 60-day window. 4. The SNF stay starts on or after the planned hospitalization end date.
Measure Denominator	Total number of eligible HH episodes starting in a given quarter.
Denominator Details	All HH episodes that start in the quarter are included with the following exclusions: ▪ HH episodes for patients who are alive and are not continuously enrolled in FFS Medicare for the 60 days following the start of the HH episode. ▪ HH episodes for patients who were not FFS eligible in the six months prior. HH episodes that begin with a LUPA claim. HH episodes in which the patient receives service from multiple agencies during the 60-day window (see "Transfer HHAs within 60 days" in Glossary [Section A.6]).
Data Sources	HHA Claims, SNF Claims, MBSF, Inpatient Research Identifiable File (RIF). Enrollment status is identified using the Medicare Enrollment Database.

A.2.3 OASIS-Based Outcome Impact Measures

This section presents information on the OASIS-based outcome impact measures analyzed in the Final Report. Of note, the measure values were included as part of our Quality Improvement and Evaluation System (QIES) extract (see Section A.3.6.2); no additional measure calculations were necessary. The tables below summarize the measure definitions, as defined by CMS.[13]

Exhibit A-32. Discharged to Community

Measure Concept	Definition
Measure Category	OASIS Outcome
Measure Description	Percentage of HH episodes after which patients remained at home.
Measure Numerator	Number of HH episodes where the assessment completed at the discharge indicates the patient remained in the community after discharge.
Measure Denominator	Number of HH quality episodes ending with a discharge or transfer to inpatient facility during the reporting period, other than those covered by generic or measure-specific exclusions.
Measure-Specific Exclusions	HH quality episodes that end in patient death.

Source: CMS OASIS-C2 Home Health Outcome Measures

Exhibit A-33. Improvement in Ambulation-Locomotion

Measure Concept	Definition
Measure Category	OASIS Outcome
Measure Description	Percentage of HH quality episodes during which the patient improved in ability to ambulate.
Measure Numerator	Number of HH quality episodes where the value recorded on the discharge assessment indicates less impairment in ambulation/locomotion at discharge than at Start or Resumption of Care (SOC/ROC).
Measure Denominator	Number of HH quality episodes ending with a discharge during the reporting period, other than those covered by generic or measure-specific exclusions.
Measure-Specific Exclusions	HH quality episodes for which the patient, at SOC/ROC, was able to ambulate independently, episodes that end with inpatient facility transfer or death, or patient is nonresponsive.

Source: CMS OASIS-C2 Home Health Outcome Measures

[13] See CMS OASIS-C2 Home Health Outcome Measures.

Exhibit A-34. Improvement in Bathing

Measure Concept	Definition
Measure Category	OASIS Outcome
Measure Description	Percentage of HH episodes of care during which the patient got better at bathing self.
Measure Numerator	Number of HH episodes of care where the value recorded on the discharge assessment indicates less impairment in bathing at discharge than at SOC/ROC.
Measure Denominator	Number of HH episodes of care ending with a discharge during the reporting period, other than those covered by generic or measure-specific exclusions.
Measure-Specific Exclusions	HH episodes of care for which the patient, at SOC/ROC, was able to bath self independently, episodes that end with inpatient facility transfer or death, or patient is nonresponsive.

Source: CMS OASIS-C2 Home Health Outcome Measures

Exhibit A-35. Improvement in Bed Transferring

Measure Concept	Definition
Measure Category	OASIS Outcome
Measure Description	Percentage of HH quality episodes during which the patient improved in ability to get in and out of bed.
Measure Numerator	Number of HH quality episodes where the value recorded on the discharge assessment indicates less impairment in bed transferring at discharge than at SOC/ROC.
Measure Denominator	Number of HH quality episodes ending with a discharge during the reporting period, other than those covered by generic or measure-specific exclusions.
Measure-Specific Exclusions	HH quality episodes for which the patient, at SOC/ROC, was able to transfer independently, episodes that end with inpatient facility transfer or death, or patient is nonresponsive.

Source: CMS OASIS-C2 Home Health Outcome Measures

Exhibit A-36. Improvement in Dyspnea

Measure Concept	Definition
Measure Category	OASIS Outcome
Measure Description	Percentage of HH quality episodes during which the patient became less short of breath or dyspneic.
Measure Numerator	Number of HH quality episodes where the discharge assessment indicates less dyspnea at discharge than at SOC/ROC.
Measure Denominator	Number of HH quality episodes ending with a discharge during the reporting period, other than those covered by generic or measure-specific exclusions.
Measure-Specific Exclusions	HH quality episodes for which the patient, at SOC/ROC, was not short of breath at any time, or episodes that end with inpatient facility transfer or death.

Source: CMS OASIS-C2 Home Health Outcome Measures

Exhibit A-37. Improvement in Management of Oral Medications

Measure Concept	Definition
Measure Category	OASIS Outcome
Measure Description	Percentage of HH quality episodes during which the patient improved in ability to take their medicines correctly (by mouth).
Measure Numerator	Number of HH quality episodes where the value recorded on the discharge assessment indicates less impairment in taking oral medications correctly at discharge than at SOC/ROC.
Measure Denominator	Number of HH quality episodes ending with a discharge during the reporting period, other than those covered by generic or measure-specific exclusions.
Measure-Specific Exclusions	HH quality episodes for which the patient, at SOC/ROC, was able to take oral medications correctly without assistance or supervision, episodes that end with inpatient facility transfer or death, patient is nonresponsive, or patient has no oral medications prescribed.

Source: CMS OASIS-C2 Home Health Outcome Measures

Exhibit A-38. Improvement in Pain Interfering with Activity

Measure Concept	Definition
Measure Category	OASIS Outcome
Measure Description	Percentage of HH quality episodes during which the patient's frequency of pain when moving around improved.
Measure Numerator	Number of HH quality episodes where the value recorded on the discharge assessment indicates less frequent pain at discharge than at SOC/ROC.
Measure Denominator	Number of HH quality episodes ending with a discharge during the reporting period, other than those covered by generic or measure-specific exclusions.
Measure-Specific Exclusions	HH quality episodes for which the patient, at SOC/ROC, had no pain reported, episodes that end with inpatient facility transfer or death, or patient is nonresponsive.

Source: CMS OASIS-C2 Home Health Outcome Measures

Exhibit A-39. Improvement in Status of Surgical Wounds

Measure Concept	Definition
Measure Category	OASIS Outcome
Measure Description	Percentage of HH quality episodes during which the patient demonstrates an improvement in the condition of surgical wounds.
Measure Numerator	Number of HH quality episodes where the patient has a better status of surgical wounds at discharge compared to SOC/ROC.
Measure Denominator	Number of HH quality episodes ending with a discharge during the reporting period, other than those covered by generic or measure-specific exclusions.
Measure-Specific Exclusions	HH quality episodes for which the patient, at SOC/ROC, did not have any surgical wounds or had only a surgical wound that was unobservable or fully epithelialized, or episodes that end with inpatient facility transfer or death.

Source: CMS OASIS-C2 Home Health Outcome Measures

A.2.4 OASIS-Based Process Impact Measures

This section presents information on the OASIS-based process impact measures analyzed in the Report. Of note, the measure values were included as part of our QIES extract (see Section A.3.6.2); no additional measure calculations were necessary. The tables below summarize the measure definitions, as defined by CMS.[14]

Exhibit A-40. Drug Education on Medications Provided to Patient/Caregiver during Episodes of Care

Measure Concept	Definition
Measure Category	OASIS Process
Measure Description	Percentage of HH quality episodes during which patient/caregiver was instructed on how to monitor the effectiveness of drug therapy, how to recognize potential adverse effects, and how and when to report problems (at the time of or at any time since the most recent SOC/ROC assessment).
Measure Numerator	Number of HH quality episodes during which patient/caregiver was instructed on how to monitor the effectiveness of drug therapy, how to recognize potential adverse effects, and how and when to report problems (at the time of or at any time since the most recent SOC/ROC assessment).
Measure Denominator	Number of HH quality episodes ending with a discharge or transfer to inpatient facility during the reporting period, other than those covered by generic or measure-specific exclusions.
Measure-Specific Exclusions	HH quality episodes for which the patient was not taking any drugs since the last OASIS assessment prior to transfer/discharge or the patient died.

Source: CMS OASIS-C2 Home Health Process Measures.

Exhibit A-41. Influenza Immunization Received for Current Flu Season

Measure Concept	Definition
Measure Category	OASIS Process
Measure Description	Percentage of HH quality episodes during which patients received influenza immunization for the current flu season.
Measure Numerator	Number of HH quality episodes during which the patient: a) received vaccination from the HHA; b) had received vaccination from HHA during earlier episode of care; or c) was determined to have received vaccination from another provider.
Measure Denominator	Number of HH quality episodes ending with a discharge or transfer to inpatient facility during the reporting period, other than those covered by generic or measure-specific exclusions.
Measure-Specific Exclusions	HH quality episodes for which no care was provided during October 1–March 31, the patient died, or the patient did not meet age/condition guidelines for influenza vaccine.

Source: CMS OASIS-C2 Home Health Process Measures.

[14] See CMS OASIS-C2 Home Health Process Measures.

Exhibit A-42. Pneumococcal Polysaccharide Vaccine Ever Received

Measure Concept	Definition
Measure Category	OASIS Process
Measure Description	Percentage of HH quality episodes during which patients were determined to have ever received Pneumococcal Polysaccharide Vaccine.
Measure Numerator	Number of HH quality episodes during which patients were determined to have ever received Pneumococcal Polysaccharide Vaccine.
Measure Denominator	Number of HH quality episodes ending with a discharge or transfer to inpatient facility during the reporting period, other than those covered by generic or measure-specific exclusions.
Measure-Specific Exclusions	HH quality episodes during which patient died, or patient did not meet age/condition guidelines for Pneumococcal Polysaccharide Vaccine.

Source: CMS OASIS-C2 Home Health Process Measures.

Exhibit A-43. Depression Assessment Conducted

Measure Concept	Definition
Measure Category	OASIS Process
Measure Description	Percentage of HH quality episodes in which patients were screened for depression (using a standardized depression screening tool) at SOC/ROC.
Measure Numerator	Number of HH quality episodes in which patients were screened for depression (using a standardized depression screening tool) at SOC/ROC.
Measure Denominator	Number of HH quality episodes ending with discharge, death, or transfer to inpatient facility during the reporting period, other than those covered by generic or measure-specific exclusions.
Measure-Specific Exclusions	HH quality episodes for which the patient is nonresponsive.

Source: CMS OASIS-C2 Home Health Process Measures.

Exhibit A-44. Diabetic Foot Care and Patient/Caregiver Education Implemented during All Episodes of Care

Measure Concept	Definition
Measure Category	OASIS Process
Measure Description	Percentage of HH quality episodes in which diabetic foot care and patient/caregiver education were included in the physician-ordered plan of care and implemented (at the time of or at any time since the most recent SOC/ROC assessment).
Measure Numerator	Number HH quality episodes during which diabetic foot care and patient/caregiver education were included in the physician-ordered plan of care and implemented (at the time of or at any time since the most recent SOC/ROC assessment).
Measure Denominator	Number of HH quality episodes ending with a discharge or transfer to inpatient facility during the reporting period, other than those covered by generic or measure-specific exclusions.
Measure-Specific Exclusions	HH quality episodes for which the discharge/transfer assessment indicates the patient is not diabetic or is a bilateral amputee, OR patient died.

Source: CMS OASIS-C2 Home Health Process Measures.

Exhibit A-45. Multifactor Fall Risk Assessment Conducted for All Patients who can Ambulate

Measure Concept	Definition
Measure Category	OASIS Process
Measure Description	Percentage of HH quality episodes in which patients had a multi-factor fall risk assessment at SOC/ROC.
Measure Numerator	Number of HH quality episodes in which patients had a multi-factor fall risk assessment at SOC/ROC.
Measure Denominator	Number of HH quality episodes ending with discharge, death, or transfer to inpatient facility during the reporting period, other than those covered by generic or measure-specific exclusions.
Measure-Specific Exclusions	HH quality episodes for which the patient is bed-fast or chair-fast.

Source: CMS OASIS-C2 Home Health Process Measures.

Exhibit A-46. Timely Initiation of Care

Measure Concept	Definition
Measure Category	OASIS Process
Measure Description	Percentage of HH quality episodes in which the SOC/ROC date was either on the physician-specified date or within 2 days of the referral date or inpatient discharge date, whichever is later.
Measure Numerator	Number of HH quality episodes in which the SOC/ROC date was either on the physician-specified date or within 2 days of the referral date or inpatient discharge date, whichever is later. For a ROC, per the Medicare Conditions of Participation, the patient must be seen within 2 days of inpatient discharge, even if the physician specifies a later date.
Measure Denominator	Number of HH quality episodes ending with discharge, death, or transfer to inpatient facility during the reporting period, other than those covered by generic or measure-specific exclusions.
Measure-Specific Exclusions	None.

Source: CMS OASIS-C2 Home Health Process Measures.

A.2.5 HHCAHPS-Based Impact Measures

For the five HHVBP performance measures that address beneficiary experience, we used the publicly available, HHA-level HHCAHPS data for CYs 2013 – 2017. To receive the annual Home Health Prospective Payment System payment update, HHAs that do not qualify for an exemption from participating in the HHCAHPS Survey must contract with an approved HHCAHPS Survey vendor, administer the survey on an ongoing (monthly) basis, and submit HHCAHPS Survey data to the HHCAHPS Data Center on a quarterly basis. Agencies are exempted if they serve 59 or fewer survey-eligible patients a year. Survey-eligible patients are those who are at least 18 years old and have their skilled care covered by Medicare or Medicaid.[15]

The five measures—constructed from 19 HHCAHPS questions—are summarized below.[16]

1. **Care of patients** reflects "patients who reported that their home health team gave care in a professional way."[16] This composite measure is comprised of four HHCAHPS questions that address how frequently the HHA treated the patient gently, with courtesy and respect, how frequently the HHA seemed informed and up-to-date, and if the patient had any problems with the care received.
2. **Communication between providers and patients** reflects "patients who reported that their home health team communicated well with them."[16] This composite measure is comprised of six HHCAHPS questions related to different aspects of communication, including how frequently the HHA explained things in an easy to understand manner, listened carefully, and kept the patient informed about when staff would arrive.
3. **Specific care issues** reflect "patients who reported that their home health team discussed medicines, pain, and home safety with them."[16] This composite measure is comprised of seven HHCAHPS questions related to these three areas of care (that is, medicines, pain, and home safety).
4. **Rating of care provided by the agency** is a global rating measure that reflects the percentage of respondents who gave a rating of 9 or 10 to the question, "Using any number from 0–10, where 0 is the worst home health care possible, and 10 is the best home health care possible, what number would you use to rate your care from this agency's home health providers?"[16]
5. **Willingness to recommend the agency to friends and family** is a global rating measure that reflects the percentage of respondents who answered "Definitely Yes" to the question, "Would you recommend this agency to your family and friends if they needed home health care?"[16]

[15] Additional criteria are available here.

[16] Additional information on measure construction is available here.

A.2.6 Total Performance Score

Guided by parameters established by CMS for CY 2016,[17] the TPS was calculated as an aggregate performance metric based on 17 HHVBP measures, including: seven OASIS-based outcomes, three OASIS-based processes, two claims-based measures, and the five HHCAHPS measures.[18]

HHA measure rates were created as 12-month weighted averages, weighted by the episode counts, and rolled up from the agency-month to the agency-year level. An HHA's Performance Year measure rates (ranging from 0 – 100 points) are compared to its baseline year measure rates, as well as state-level performance standards: the achievement thresholds (ATs) and benchmarks (BMs). In the HHVBP Model, the baseline year is defined as CY 2015. For our computation of the TPS for years prior to the implementation of HHVBP, we defined the baseline year as the year prior to the designated Performance Year (e.g., for our calculation of TPS values for CY 2014, we used CY 2013 as the baseline year). ATs and BMs for each measure are calculated based on the distribution of baseline year measure rates for all eligible participating HHAs within a given state (see below for eligibility criteria). For each eligible measure, HHAs receive the higher of either an Achievement Score or an Improvement Score, between 0 and 10 points. Achievement/Improvement Scores are summed across all eligible measures to form an unadjusted performance measure score. For each HHA, this score was then weighted based on the number of eligible measures reported. Note that we excluded Medicaid-certified only HHAs from the ATs/BMs/TPS calculation.

HHA eligibility criteria for the calculation of the ATs and BMs are as follows:

- For OASIS and claim-based measures, an HHA must have at least 20 episodes of care in the baseline year.
    - If an HHA did not have 20 or more episodes of care for a particular measure, the reported measure rates were recoded as missing.
- For HHCAHPS-based measures, an HHA must have at least 40 completed patient surveys during the baseline year for the five measure rates.
    - If an HHA did not have 40 or more completed patient surveys, the five HHCAHPS measure rates were recoded as missing.
- An HHA must have non-missing data for at least five of 17 eligible measures.
    - An "eligible measure count" (0 – 17) was created to tally the number of non-missing measures for each HHA to determine their inclusion/exclusion from AT/BM calculations.

HHA eligibility criteria for the calculation of TPS are as follows:

- HHAs must have data from the full 12 months of baseline year.
    - HHAs were flagged based on their participation date, extracted from the POS file. HHAs with a participation year greater than or equal to the baseline year were excluded from the data set of eligible agencies.
- HHAs must be in operation as of the end of the performance year or as of the release of the latest available POS file.

[17] See 2015 HHVBP Final Rule.

[18] Scores for the three new self-reported measures were not factored into our calculation of the TPS since these data are unavailable for non-HHVBP HHAs. Thus, the adjusted composite score for the 17 performance-based measures will be given full weight, as compared to the 90% weight that has been stipulated by CMS.

        - HHAs were flagged based on their termination status, extracted from the POS file; HHAs that were flagged as terminated (termination year is the same as or before the performance year and non-missing as of the POS data extraction) were excluded from the data set of eligible agencies.
- HHAs must have at least five eligible measures for both the baseline year and the performance year.
    - For measure-level eligibility, see prior list above ("HHA eligibility criteria for calculations of AT/BMs").
- Of an HHA's eligible measures, at least five measures must be the same for both the baseline year and the performance year.
    - HHAs that did not have at least five shared measures between the baseline and performance years were excluded from the data set of eligible agencies.

Using the above methodology, we calculated the TPS for 2013 – 2017. We then validated our TPS calculations in the HHVBP group against those calculated by the HHVBP Implementation Contractor and reported in the Final Annual TPS and Payment Adjustment Report (released November 2017) and the Preliminary Annual TPS and Payment Adjustment Report (released August 2018) for 2016 TPS and 2017 TPS, respectively. Compared to the HHVBP Implementation Contractor, we included 24 additional HHAs in the 2016 TPS calculation and 15 additional HHAs in the 2017 TPS calculation. Our inclusion of additional HHAs that were eligible for a TPS were due to differences in timing of access to the underlying measure data. Among HHAs that were included in both our and the HHVBP Implementation Contractor's calculations, the TPS were very close (e.g., correlation coefficient between our TPS and the HHVBP Implementation Contractor's TPS was 0.999 for both years).

A.2.7 HHVBP Self-Reported Measures

HHAs self-report three new measures through the CMS Secure Portal:

1. The proportion of eligible HHA personnel vaccinated for influenza within the year.
2. The proportion of patients aged 60 or older who either received or reported having a herpes zoster vaccination.
3. The proportion of patients who have an advance care plan or surrogate decision-maker documented in their medical record, or who had a documented discussion about advance care plans or surrogate but refused or were unable to provide the information.

HHA performance regarding these measures was based on the reporting status (i.e., reported/not reported) for each measure. A binary variable indicating the reporting status of each measure (i.e., reported/not reported) at the HHA-level was available from the CMS Secure Portal. We calculated the proportion of HHAs that reported each measure. The numerator included all HHAs that reported the measure of interest, and the denominator included all HHAs operating under the HHVBP Model.

A.3 Data Sources

For this Annual Report, we accessed CMS administrative data from several sources, including the Chronic Conditions Data Warehouse (CCW) via the Virtual Research Data Center, publicly available data sources, and other CMS HHVBP Contractors. We also received varying analytic levels of measure-specific OASIS data, extracted from CMS' QIES. We used these data sources to create the analytic file necessary to conduct the analyses included in this Annual Report. Claims-based impact measures were calculated and analyzed using several data sources, including:

- Common Medicare Environment enrollment data
- HHA claims
- SNF claims
- Inpatient Hospitalization claims
- Outpatient ED claims
- Part B claims
- DME claims
- Hospice claims
- Provider of Services (POS) files
- Area Health Resource File (AHRF)

The data sources discussed below were combined to create impact measures and descriptive variables, inform and construct comparison groups, and contribute to the analytic file that was used to conduct the analyses and produce the results presented in the Report. Below, we describe the process for obtaining data from these sources in more detail.

A.3.1 Home Health Agency Claims

Purpose. HHA claims define the home health care episodes for the claims-based impact measures.

Data Acquisition. HHA claims data were pulled from the CCW's Research Identifiable Files (RIFs) in July 2018, which included all final action claims with claim type code 10 and a service end date (claim "through" date) ranging from January 1999 through June 2018. Although the measurement period for this evaluation began in January 2013, prior years of HHA claims data were needed to establish accurate episode sequence information.

Data Processing. In order to establish the complete set of home health episodes of care, all final-action HHA claims that met the following conditions were included:

- Claim frequency code not equal to each of the following: missing; '0' (Non-payment/Zero Claim); or '2' (Request for Anticipated Payment)
- Included at least one covered visit
- Received a Medicare payment amount greater than $0

Furthermore, if a beneficiary had multiple claims with the same "Statement Covers From" date (i.e., "claim from" date), only the claim with the latest Fiscal Intermediary claim process date was included. In the event that multiple claims for the same beneficiary overlap in a statement period "from" and "through" dates, the "Statement Covers Through" date (i.e., "claim through" date) on the claim starting earlier was adjusted to be the date before the ensuing claim from date. These data steps ensure that a

given beneficiary could not be attributed to multiple HHAs on a given day when calculating episode-based impact measures (discussed below).

Each of the resulting HHA claims were considered a final home health episode with episode start date corresponding to the "claim from" date, and episode end date corresponding to the "claim through" date. In concordance with the measure specifications for the two HHVBP claims-based measures,[10] sequence of episodes (or "home health stay") was defined as a series of consecutive home health episodes for a given beneficiary in which the maximum time between consecutive episodes, end date to start date, was 60 days or less. If the time between the prior episode end date and ensuing episode start was greater than 60 days, the ensuing episode start date began a separate home health stay.

An important by-product of HHA claims processing is a beneficiary finder file that includes a unique list of all beneficiaries with a claims-based home health episode ending on or after January 1, 2013, which includes the full measurement period associated with this Report (2013 – 2017). For the remainder of this Report, we refer to this data set as the "HH Beneficiary Finder File."

A.3.2 Master Beneficiary Summary File

Purpose. MBSF data were the source for determining: beneficiary eligibility in impact measures based on FFS enrollment status, beneficiary demographics, and chronic condition status.

Data Acquisition. MBSF data, sourced from the Common Medicare Environment, were included in the CCW as annual snapshots that were divided into multiple segments: Base (Parts A/B/C/D), Chronic Conditions, Other Chronic or Potentially Disabling Conditions, Cost and Use, and National Death Index. For this Annual Report, we utilized the Base, Chronic Conditions, and Other Chronic Conditions segments.

The MBSF Base segment data provided monthly indicators of enrollment status, in addition to beneficiary demographic information (e.g., state and county of residence, date of birth, gender, race, etc.), for all Medicare enrollees. For this Report, beneficiary year-level MBSF Base data were compiled from 2013 – 2017. For beneficiary gender, race, date of birth and date of death, only information from the most recent year of available MBSF for a given beneficiary was included in analyses.

As of the time of this Report, the MBSF Chronic Conditions and Other Chronic or Potentially Disabling Conditions segments contained 62 beneficiary-year-level condition flags that were "developed from algorithms that search the CMS administrative claims data for specific diagnosis codes, MS-DRG codes, or procedure codes."[19] The condition flags were provided at both the middle and end of each year for each Medicare beneficiary; for this Report, only end-of-year condition flags were used.

Data Processing. In a given month, a beneficiary was determined to be enrolled in "full" Medicare FFS if they were enrolled in both, Parts A and B (including beneficiaries with dual enrollment in Medicare and Medicaid), and were concurrently not enrolled in an HMO. Based on this definition, monthly indicator variables were created to determine a beneficiary's full FFS enrollment status, which was later used as one of the factors to determine eligibility in claims-based impact measure denominator populations (See Section A.2.2).

[19] See CCW Condition Categories.

End-of-year condition indicator variables from both Chronic Condition MBSF segments indicated whether the beneficiary met the CCW claims criteria and/or whether the beneficiary meets the coverage criteria (enrolled in Medicare Parts A and B for the entire specified period). From these indicator variables, we further derived condition flags that indicate whether a beneficiary met the claims criteria portion of the CCW condition algorithm, regardless of whether the beneficiary met the FFS coverage criteria (FFS coverage is separately accounted for in the MBSF Base segment).

The total number of Medicare-eligible FFS beneficiaries alive at the beginning of every quarter (e.g., if a beneficiary is no longer FFS next month, they are still included) was also calculated and then divided by 1000.

A.3.3 Non-Home Health Agency Claims

Purpose. We analyzed non-home health claims in order to create impact measures for spending and utilization of services outside of home health care. These claims were also used to determine a beneficiary's care setting immediately prior to a sequence of home health episodes, which was used in comparison group construction (See Section A.1.3). In this section, we discuss preliminary data processing to support impact measure calculation.

Data Acquisition. For this Annual Report, final action SNF (claim type codes 20 and 30), Inpatient (claim type code 60), and Outpatient (claim type code 40) claims were pulled from the CCW RIFs in July 2018, including claims with a claim through date from April 2010 through June 2018. Claims occurring in this date range potentially contributed to impact measure calculation and determining a home health beneficiary's prior care setting.

Additionally, all claims featuring a beneficiary in our home health Beneficiary Finder File were pulled in July 2018 from the CCW RIFs for Part B, DME, home health, Hospice, SNF, Inpatient, and Outpatient for claims with a claim through date from October 2011 through June 2018. This set of claims was used to calculate total Medicare expenditures for home health beneficiaries.

Data Processing. For impact measure calculation, SNF stays were constructed based on SNF claims with an admission date starting on or after October 1, 2011; furthermore, this set of claims was subset to include only claims corresponding to beneficiaries in the HH Beneficiary Finder File (see Section A.3.1). SNFs submit monthly claims throughout a beneficiary's duration of stay, which spans from admission date to discharge date; therefore, a beneficiary's SNF stay was constructed by combining each of the individual SNF claims with the same associated admission date. The SNF stay start date corresponded to the first claim's "claim from" date, while the SNF stay end date corresponded to the last claim's "claim through" date. Medicare payment amounts for each claim within a given stay were summed up to a final stay-level payment amount.

Inpatient and outpatient claims were used to support impact measures related to unplanned ACH and ED use. Inpatient claims were included if they indicated a planned ACH. To identify a planned ACH, we scanned all diagnoses (ICD 9 or 10 codes) reported on the inpatient claim and cross-referenced the list of AHRQ CCS that defined planned hospitalization, as was done in the measure developer's documentation for the two HHVBP claims-based measures.[10] Outpatient claims were included if they indicated ED visits, as identified by the presence of revenue center codes 0450-0459 or 0981; therefore, only outpatient claims containing these revenue center codes were included. This approach is in

alignment with the measure developer's documentation for the HHVBP claims-based ED use without hospitalization measure.[10]

For the purposes of total expenditure calculations, all claims for home health beneficiaries were pulled from Part B, DME, home health, Hospice, SNF, Inpatient, and Outpatient CCW RIFs. Claim payment amount was summed across all claims based on each home health episode (for full expenditure measure specifications, see Section A.2.2).

A.3.4 Provider Data

Purpose. We utilized publicly available data on HHAs to control for a variety of agency characteristics (i.e., ownership status, hospital-based vs. freestanding) in construction of comparison groups and D-in-D modeling.

Data Acquisition. POS data was downloaded from the CMS "Provider of Services" site.

Data Processing. The final annual POS data sets from each year 2013 – 2017 were subset to HHAs based on provider category code "5". Control types provided in the POS data were re-coded into larger groups of "non-profit" (control type codes 1,2,3; church, private not-for-profit, and other, respectively), "for-profit" (control type code 4; private for-profit), and "government-owned" (control type codes 5,6,7; federal, state, and local, respectively). Additionally, facility type codes were re-coded into groups of "hospital-based" (facility type codes 4,5,6; rehabilitation facility, SNF, and hospital, respectively), and "freestanding" (facility type codes 1,2,3,7; visiting nurse association, combination government voluntary, official health agency, and other, respectively).

A.3.5 County-Level AHRF Data

Purpose. Utilize county-level data from the AHRF to inform comparison group construction based on key county-level demographic information.

Data Acquisition. AHRF data are publicly available from the Health Resources and Services Administration data warehouse, from which we downloaded the 2017 county-level data set.

Data Processing. The following data elements from the AHRF data set were used in the analyses: indication of whether the county was in a rural or urban area (based on CBSA indicator), and the county level average education. The rural/urban variable was used to define rurality of a county, including beneficiaries receiving care in that county, across all analyses. The county level average education was used to define the percentage of persons aged 25 years and older in a county with less than a high school diploma.

A.3.6 OASIS Data

A.3.6.1 Predicted Probabilities for the Risk Adjusted OASIS-Based Outcome Impact Measures

Purpose. We obtained predicted probabilities for the risk adjusted OASIS-based outcome impact measures to support OASIS-based outcomes impact measure calculation and analysis.

Data Acquisition. We received OASIS-based episode-level data (extracted from QIES) for each of the HHVBP OASIS-based outcome impact measures, in which episodes of care were determined from a series of OASIS assessments and had an episode end date ranging from 2013 through 2017.

Data Processing. The data set contained episode-level measure-specific observed and predicted probability values for each of the HHVBP OASIS-based outcome impact measures, as well as a state and facility identifier (unique only within a given state) in which the episode of care occurred. The combination of state and facility identifier were used to look up the HHA's CCN using the CCW's HHA facility file.

A.3.6.2 QIES Roll-Up Measure Data for the OASIS-Based Process Measures

Purpose. We obtained QIES roll-up measure data for OASIS-based process measures in order to calculate and analyze the OASIS-based process impact measures.

Data Acquisition. We received HHA-month-level data sets (extracted from QIES) that contain observed measure values and episode counts for each of the process measures, spanning 2013 through 2017.

Data Processing. Similar to the episode-level QIES data set described above, the data set also contained state and facility identifier (unique only within a given state) in which the episode of care occurred; the combination of state and facility identifier were used to look up the HHA's CCN using the CCW's HHA facility file.

A.3.6.3 Raw OASIS Assessment Data

Purpose. Raw item-level OASIS data was obtained to provide covariates for our analytic models and support our OASIS impact measure analyses.

Data Acquisition. Assessment data was extracted from the CCW Oracle database.

Data Processing. The assessments were subset to versions C, C1, or C2. The most recent SOC/ROC assessments for each beneficiary were flagged based on M0100. Risk factor variables were calculated based on raw assessment data according to CMS documentation[20]. Response-level indicator variables were created for a subset of assessment items, including M0100, M1000, M1810, M1620, M1710, M1870, M2110, M1800, M1880, M1730, M1308, M1311, M2200, M1830, M1400, M1610, M1034, M1840, M1860, M2020, M1720, M1230, M1220, M1870, and M1910. Patient diagnostic information, from which chronic and acute conditions are derived, was pulled from items M1010, M1016, M1011, M1017, M1020, M1022, M1024, M1021, M1023, and M1025.

A.3.7 HHCAHPS Data

Purpose. We utilized HHCAHPS data to analyze the five patient experience impact measures.

Data Acquisition. We downloaded publicly available data from the Home Health Compare (HHC) website in July 2018 for CYs 2013 – 2017.[21]

Data Processing. These data included a score value for each of the five HHCAHPS-based impact measures (see Section A.2.5), rounded to the nearest whole number, HHA's CCN, the number of completed surveys by respondents that received care from the given HHA, and the response rate. For

[20] Hittle DF, Nuccio EJ. (2017) Home Health Agency Patient-Related Characteristics Reports: Technical Documentation of Measures - Revision 4.1. Prepared for: Department of Health and Human Services; Centers for Medicare & Medicaid Services. *University of Colorado School of Medicine - Division of Health Care Policy and Research*.
[21] These data are available here.

this Report, we used data from the January through December report from each year of our analyses, 2013 – 2017 (i.e., measurement period is the CY).

A.3.8 HHVBP Self-Reported Measures Data

Purpose. To provide descriptive statistics on the three new agency self-reported measures.

Data Acquisition. We downloaded the Preliminary Annual TPS and Payment Adjustment Report for CY 2017, made available on the CMS Enterprise Portal on October 24, 2018.

Data Processing. This Report provided HHA-level indicators for whether the agency reported on each of the three measures, in addition to providing the number of points earned for each self-reported measure, and how these points were weighted to contribute to the final TPS.

A.3.9 Provider Enrollment, Chain and Ownership System Data

Purpose. PECOS data were used to determine HHA chain information.

Data Acquisition. PECOS data were downloaded from the Integrated Data Repository.

Data Processing. In order to determine HHA chain affiliation at a given point in time, we extracted data from two views in the Medicare Virtual Data Mart: V2_MDCR_PRVDR_MDCR_ID (parent table for PECOS enrollment database) and V2_MDCR_PRVDR_CHAIN (provider chain affiliation history). All available data were extracted for providers that were identified as HHAs, based on the last four digits of CCN, by joining the two data views based on the tables' key identifier: PRVDR_ENRLMT_ID. The resulting data set provided a history of chain affiliation for each HHA represented in the PECOS database.

A.3.10 Cost Reports

Purpose. Public use HHA Cost Report files (CMS Form 1728-94 and Form 2552-10) for fiscal years 2013 – 2017 were used to obtain chain information and to calculate profitability.

Data Acquisition. HHA-level Cost Report data sets for both freestanding and hospital-based HHAs are publicly available via CMS' Healthcare Cost Report Information System.[22]

Data Processing. The fiscal year 2017 Cost Report file was not finalized at time of reporting, and all records for 2017 represented the most current data available. For any provider number with more than one Cost Report record in a given year, the Cost Report representing the latest fiscal year end date was maintained for analyses.

A.3.11 Data from the HHVBP Implementation Contractor

Purpose. To support calculating a pseudo-TPS for non-HHVBP HHAs, as a means to select an appropriate comparison group.

Data Acquisition. We requested QIES measure roll-up extracts spanning 2013 – 2017 and HHA size data.

Data Processing. With guidance from the HHVBP Implementation Contractor, we received the QIES roll-up data sets that align in content with those used to produce the Annual TPS and Payment Adjustment Report; however, the variable timing of QIES data extracts, as compared to those used by the Implementation Contractor, may result in small discrepancies in measure values. We also received an

[22] These data are available here.

HHA-level file containing metrics of HHA size, including a count of episodes and unique beneficiaries during 2015; these values were used by the HHVBP Implementation Contractor to determine the size cohort for each of the HHAs that were subject to payment adjustment. These files, in conjunction with the publicly reported HHCAHPS measure data, allowed us to calculate a TPS for both HHVBP and non-Model HHAs, which served as both a useful impact measure for comparative analyses and also as a metric on which to construct a comparison group of HHAs with similar performance rates to those in the HHVBP group.

A.3.12 Data from the HHVBP Technical Assistance Contractor

Purpose. To conduct descriptive analysis that assesses use and utilization of the HHVBP Connect website.

Data Acquisition. We requested and obtained HHVBP Connect data for CY 2017 from the HHVBP Technical Assistance Contractor.

Data Processing. With guidance from the HHVBP Technical Assistance Contractor, we compiled the multiple data files into an annual file for 2017, which included monthly unique visitors, resource download, and webinar participation.

A.3.13 Primary Data Collection – Home Health Agency Survey

We conducted a survey of HHAs to examine key agency structural and operational characteristics and the impact of the HHVBP Model on agency operations in HHVBP states compared to agencies in non-HHVBP states.

A.3.13.1 Sample Design

The survey was designed comprising two samples: (i) agencies in the nine HHVBP states and (ii) agencies in non-HHVBP states.

Eligibility for the sample was restricted in two primary ways—it was limited to agencies that have been in operation since 2016 (to allow reporting on response to HHVBP implementation) and to agencies with a sufficient number of episodes to receive a TPS (or for non-HHVBP agencies, a pseudo-TPS) in at least one of the relevant years (2016 or 2017 for this year's survey),[23] making them potentially subject to the HHVBP Model's payment changes.

All HHVBP agencies meeting these criteria were included in the initial sample. The non-HHVBP agency sample was drawn using information from Medicare claims, HHA Cost Reports (CMS-1728-94), and the POS file. The following characteristics were used to draw the sample of non-HHVBP HHAs:

(i) Ownership: For-profit or other (non-profit or government-owned);
(ii) Chain affiliation: Affiliated or not affiliated;
(iii) Setting: Freestanding or hospital-based;
(iv) HHA size: Measured by number of Medicare FFS episodes (<100, 100-499, and 500+)

The universe of eligible agencies was distributed among cells based on the joint distributions of the

[23] Agencies were defined as operating in 2016 if the agency had at least one episode in that year. Other eligibility criteria included having a 2016 TPS (for agencies in HHVBP states), being in the POS, and having at least one FFS episode in 2017.

agency characteristics above, separately for HHVBP and non-Model agencies that were eligible for the survey. A sample of non-Model agencies was selected to mimic the distribution of HHVBP agencies across the cells defined by these characteristics. The final sample sizes were 1,611 HHVBP agencies and 3,189 agencies in non-HHVBP states.

A.3.13.2 Survey Design

We designed two surveys: one for HHVBP agencies and one for non-HHVBP group agencies, drawing on the evaluation research questions. The content of the HHA survey instrument for HHVBP agencies was also informed by interviews with HHAs conducted in the first year of the evaluation (i.e., 2017). The specific set of questions included domains mirroring those for the in-depth interviews, emphasizing impacts on agency operations and quality improvement activities as well as other program- and market-related factors. As appropriate, the survey instrument for non-HHVBP agencies was designed to reflect similar content in order to support assessment of similarities and differences between the two groups.

Prior to finalizing the survey instrument, we conducted a pretest with a total of 23 agencies: 8 agencies in 6 HHVBP states and 15 agencies in 10 non-HHVBP states. We identified HHAs for the pretest through professional networks for the non-HHVBP states and from administrators we interviewed in 2017 for HHVBP states. Our pre-test subjects were associated with different types of agencies to ensure that the instrument works well with the full set of eligible respondent types. The purpose of the pre-test was to test the survey flow, whether questions were interpreted as intended and respondents were able to answer, wording was clear and terminology was used appropriately, and response categories were complete. Pre-test respondents completed the survey independently followed by a debriefing with a member of the survey team to assess needed changes. We revised the survey to incorporate feedback from the pre-test as well as feedback from CMS.

A.3.13.3 Fieldwork

The survey was fielded from the beginning of March through the end of June 2018, using a mixed mode approach of mail and web administration with telephone follow-up to non-responders. An option to complete the web version of the survey was offered through a link provided in the cover letter. Contact information for the HHAs, including agency name, address, and phone number, was obtained from the POS file. For HHVBP states, we also used the list of contact information for each HHA's Primary Point of Contact and Corporate Point of Contact developed by the Lewin Group in their role as the HHVBP Technical Assistance Contractor.

A total of 4,800 surveys were mailed, with six ineligible and 16 undeliverable cases, for a final count of 4,778. The final number of completed surveys was 2,328 (759 in HHVBP states and 1,569 in non-HHVBP states) for an overall response rate of 49% (47% for HHVBP states, 49% for non-HHVBP). Exhibit A-47 provides more detail on the characteristics of responding agencies in both samples.

Exhibit A-47. Sample Sizes, Distribution, and Response Rates: Agencies in HHVBP and Non-HHVBP States

Characteristic	Agencies in HHVBP States			Agencies in Non-HHVBP States		
	No. of Respondents	Percent of Respondents	Response Rate	No. of Respondents	Percent of Respondents	Response Rate
Ownership						
For-profit	508	66.9%	42.3%	1,080	68.8%	45.7%
Other	251	33.1%	61.1%	489	31.2%	59.3%
Chain status						
Not affiliated	550	72.5%	48.6%	1,183	75.4%	51.7%
Affiliated	209	27.5%	43.5%	386	24.6%	42.7%
Setting						
Freestanding	658	86.7%	45.4%	1,363	86.9%	47.6%
Hospital-based	101	13.3%	62.3%	206	13.1%	63.6%
No. FFS Episodes						
< 100	197	26.0%	44.3%	407	25.9%	46.7%
100-499	325	42.8%	48.0%	764	48.7%	51.2%
500+	237	31.2%	48.5%	398	25.4%	48.1%
Total	**759**	**100%**	**47.1%**	**1,569**	**100%**	**49.2%**

If the response rates for each subgroup were the same as the overall response rate of 47%, then the final sample would exactly represent the universe of HHAs in HHVBP states. Given the response rates for the various HHVBP agency subgroups (shown in Column 3), we find no evidence that particular subgroups are substantially under-represented.

A.3.13.4 Analysis

For all respondents, the survey data set was merged by HHA with the unified analytic file to include data elements (e.g., cost, utilization, profitability) from secondary data sources. Because the number of HHAs surveyed in the non-HHVBP states was a subset of all HHAs, this file had a smaller number of observations than the file used in our other quantitative analyses, but is representative of all non-HHVBP HHAs.

The survey data analyses were based on simple univariate and bivariate analyses, including descriptive statistics, to summarize pertinent variables regarding the characteristics of HHAs in terms of structure and operations. We used frequency counts and cross-tabulations to show distributions of HHAs' responses regarding performance improvement activities, factors motivating these efforts, perceptions of and responses to the TPS and Payment Adjustment Report, and perspectives on local markets for home health services. Comparisons were made overall between agencies in HHVBP and non-HHVBP states. We also examined some of the survey responses for subgroups of agencies in order to assess whether impacts or changes differ by agency characteristics. We created five subgroups of agencies, balancing a desire for granularity with sample size needs, based on ownership (for-profit vs not-for-profit), size (< 100 episodes vs 100 or more episodes), and chain status (part of chain vs not part of a chain): (1) large, for-profit, chain; (2) large, for-profit, non-chain; (3) large, non-profit, non-chain; (4) small, all ownership types, non-chain; and (5) all others. We compared findings from Group 1 with findings from Groups 2, 3, and 4 in pairwise comparisons.

A.4 Analytic File Creation

Below, we describe how we created a single Unified Analytic File (UAF) that was used to generate the results presented in this Report. The unit of observation of the UAF was either a claims-based episode or an OASIS-based episode.

A.4.1 Claims-Based Episodes

For observations that represent a claims-based home health episode, the data set provided claims-based episode information (e.g., episode type, therapy visits), HHA information, claims-based measures, MBSF-based beneficiary enrollment and chronic condition data, linked OASIS-based episode information (e.g., start date, end date, OASIS assessment ID), and OASIS assessment information (e.g., demographics, payment, inpatient diagnosis, timing). OASIS information was extracted from the overlapping OASIS-based episode with the earliest episode start date; the rationale behind this was that claims-based episodes were included in claims-based measure denominators based on episode start date, and our goal was to include OASIS information corresponding to the same measurement period.

A.4.2 OASIS-Based Episodes

For observations that represent an OASIS-based home health episode, the data set provided OASIS-based episode information (e.g., start date, end date, OASIS assessment ID), OASIS-based measures, OASIS assessment information (e.g., demographics, payment, inpatient diagnosis, timing), MBSF-based beneficiary enrollment and chronic condition data, linked claims-based episode information (e.g., episode type, therapy visits), and HHA information. Claim information was extracted from the overlapping claims-based episode with the latest episode start date; the rationale behind this was that OASIS-based episodes were included in OASIS-based measure denominators based on episode end date, and our goal was to include claims-based information corresponding to the same measurement period.

A.4.3 Construction of Unified File

The unification of the claims-based and OASIS-based home health episodes began with compiling the base data sources: claims-based episodes, OASIS-based episodes, and OASIS assessment-level data. For claims-based episodes, we maintained all episodes that began on or before 12/31/2017 and ended on or after 01/01/2013. For OASIS-based episodes of care, we maintained all episodes with an end date from 2013 through 2017, including those with end reason for assessment equal to “Death” although these episodes were excluded from the HHVBP OASIS outcome measures. We maintained all OASIS assessments that were pulled from the CCW Oracle database, which covers assessments effective from 2009 through 2017; this ensured that we had all available assessments that could potentially be linked to a claims- or OASIS-based episode during our measurement period. Among these assessment-level records, we kept only the variables of interest to analyses in the Annual Report (see Section A.2.1.1 for list of variables pulled from OASIS assessments). Note that for OASIS-based data, the CCW beneficiary identifier was not always populated, presumably for a variety of reasons related to the beneficiary matching process and the wider scope of insurance coverage among OASIS beneficiaries (e.g. Medicare FFS, Medicare Advantage, Medicare and Medicaid, Medicaid only). For these episodes/assessments, we were unable to link to the CCW-based Medicare claims and enrollment data.

After compiling the basic data sources, we further processed the OASIS-based episodes to ensure there were no overlaps between episodes for the same patient (occurs for approximately 0.1% of all OASIS-based episodes). First, we removed any OASIS-based episodes that began and ended within a longer

OASIS-based episode for the same patient. For example, if a patient had an OASIS-based episode that began on 01/01/2013 and ended on 12/31/2014, and also a shorter episode beginning on 12/23/2013 and ending on 12/26/2013, then the shorter episode beginning on 12/23/2013 would be excluded from further analyses. Second, if multiple OASIS-based episodes for the same patient overlapped in time, but did not meet previously defined exclusion criteria, then we truncated the end of the preceding episode so that the episode ended one day prior to the ensuing episode start date. Although each of these overlapped OASIS-based episodes may be included in HHVBP measure calculation individually, their overlapping nature are problematic when trying to link the OASIS-based episodes of care to their constituent claims-based episodes.

Next, we merged the claims-based episodes and OASIS-based episodes described in the preceding paragraphs based on CCW beneficiary ID and whether the episodes overlap in time. As a result, there could be 0, 1, or multiple OASIS-based episodes that link to one claims-based episode; likewise, there could be 0, 1, or multiple claims-based episodes that link to one OASIS-based episode. In the case, for example, when an OASIS-based episode overlapped with multiple claims-based episodes, the OASIS-based episode would be represented by a record for each of the overlapping claims-based episodes. If, for example, an OASIS-based episode does not link to any claims-based episodes, that OASIS-based episode would be represented by only one observation. Repeated observations for a particular episode, claims-based or OASIS-based, was de-duplicated in a later step.

For the purposes of assigning OASIS assessment data to each resulting linked episode, the set of episodes were conceptually categorized as follows: 1) claims-based episodes that overlap with at least one OASIS-based episode for the same beneficiary and ending prior to 01/01/2015; 2) claims-based episodes that overlap with at least one OASIS-based episode for the same beneficiary and ending on or after 01/01/2015; 3) claims-based episodes that do not overlap with an OASIS-based episode for the same beneficiary; 4) OASIS-based episodes that ended prior to 01/01/2015; and 5) OASIS-based episodes that ended on or after 01/01/2015. OASIS-based episodes were divided into groups based on episode end date due to an issue in the source assessment data, in which the assessment identifier for assessments effective prior to 2015 was not linkable to the assessment identifier provided in the QIES-based OASIS episode-level data. For these cases, there was a suitable alternative for linking the two sources (described below), although not as accurate as linking by the assessment identifier itself. For assessments effective on or after 2015, the assessment identifier was consistent with the assessment identifier provided in the OASIS episode-level data, which meant these assessments were directly linkable to their corresponding episodes.

For episodes belonging to categories 1 and 4, the associated OASIS-based episode was linked to start and end OASIS assessments by matching on the following data elements: QIES state identifier, QIES resident identifier (uniquely identifies a patient when combined with state identifier), assessment effective date corresponding to OASIS episode start and end dates, assessment reason, and QIES provider identifier. For episodes belonging to categories 2 and 5, the associated OASIS-based episode was linked to an OASIS assessment by matching directly on the assessment identifier for the assessments corresponding to the start and end of the OASIS-based episode. For episodes belonging to category 3, we used assessment data elements derived from the claim treatment authorization code[24]

[24] For more information on treatment authorization code, see p. 54-55 of CMS Medicare Claims Processing Manual, Chapter 10. Accessible here.

submitted with each home health claim to link to the OASIS assessment submitted at the beginning of the claims-based episode of care. Because this linked assessment does not always represent a SOC/ROC, the next step was to trace back to the most recent SOC/ROC assessment previously submitted for that beneficiary, if possible. The goal of getting the assessment associated with the SOC/ROC was desirable because these assessment types required completion of more assessment items, as opposed to re-certification assessments (for example) which required fewer items to be completed.

The next step was to ensure that each record in the UAF uniquely represented a home health episode, whether sourced from claims or OASIS. For claims-based episodes that linked to multiple OASIS-based episodes, we only maintained the claims-based episode record that linked to the earliest OASIS-based episode based on start date. For OASIS-based episodes that linked to multiple claims-based episodes, we only maintained the OASIS-based episode record that linked to the latest claims-based episode based on start date. Episodes that linked to zero or one episode were also maintained in the data set as one record per episode. Thus, the resulting file contained one record for each claims- and OASIS-based episode occurring during the measurement period, where the vast majority of episodes had been linked to OASIS data based on previously described logic. Each episode's data source (claims vs. OASIS) was distinguished by a source indicator variable. The CY and quarter to which an episode was assigned was based on the episode start date for claims-based episodes, while for OASIS-based episodes, it was based on episode end date.

For each episode in the data set, we determined both the county in which care was provided (i.e. county of beneficiary residence) and also the state in which the HHA operates. For OASIS-based episodes and claims-based episodes that could be linked to an OASIS assessment, the beneficiary county was derived from the ZIP code reported on the start of care OASIS assessment. If beneficiary ZIP code was invalid or not available from a linked OASIS assessment and the episode is claims-based, then we used the ZIP code provided on the home health claim. If the ZIP code was invalid or unavailable on the linked OASIS assessment and home health claim, then we used the HHA's ZIP code as provided on the POS data set. The resulting ZIP code was mapped to one or more counties using the U.S. Department of Housing and Urban Development (HUD) ZIP-to-county crosswalk file. For cases where the ZIP code overlapped multiple counties, we selected the county that contained the largest proportion of the ZIP code population. For claims-based episodes that still did not have an associated county of beneficiary residence, we went through hierarchical logic spanning several data sources to determine the beneficiary residence at the time of the claims-based episode. This process is described in detail below in Section A.4.3.1. In order to determine the state in which an HHA operates, we used the first two digits of the HHA's CCN and referred to the current CMS CCN documentation.[25]

With the basic units of observation established, the rest of the UAF construction process involved adding data elements from various sources. The list below provides each of the data sources and a brief description of the associated data elements that were added to the UAF. For more detail on each of the data elements as they were incorporated in analyses, see Section A.2.

- Monthly Medicare FFS and dual eligibility indicators derived from the MBSF Base segment data; merged onto the UAF by beneficiary identifier and month

[25] See CMS Manual System Pub 100-07 State Operations Provider Certification - 2779A1. Accessed from here.

- Beneficiary enrollment and demographic data from the MBSF Base segment data; merged onto the UAF by beneficiary identifier and year
- Beneficiary chronic condition indicator variables derived from the MBSF Chronic Conditions segments data; merged onto the UAF by beneficiary identifier and year
- TPS for performance years 2013-2017; merged onto the UAF by HHA CCN and year
- Various HHA-year level characteristics (e.g. chain affiliation, ownership type, count of episodes in year, etc.) sourced from POS data, PECOS and Cost Report data, and OASIS process measure data; merged onto the UAF by HHA CCN and year
- Home health claim-based data elements, either directly pulled from or derived from claim header and line item data; merged onto the UAF for only claims-based episodes using the CCW claim identifier
- OASIS-based episode-level outcome measure predicted probability and measure inclusion flags; merged onto the UAF for only OASIS-based episodes based on OASIS-based episode identifier
- Claims-based episode-level impact measure predicted probability and measure inclusion flags; merged onto the UAF for only claims-based episodes based on beneficiary identifier and episode start date
- OASIS process measure data received at the HHA-month level, but aggregated to the HHA-quarter level using an average weighted by episode count; merged onto the UAF based on HHA CCN and quarter
- County-level AHRF variables; merged onto the UAF based on beneficiary county of residence. See preceding two paragraphs in this section for information regarding how beneficiary county of residence was determined, as well as Section A.4.3.1 below for details on how that information was supplemented.
- The total number of Medicare eligible FFS beneficiaries are merged onto the UAF based on quarter in which the episode occurs (as defined by end date for OASIS episodes of care and start date for claims-based episodes) and beneficiary county of residence. See preceding two paragraphs in this section for information regarding how beneficiary county of residence was determined, as well as Section A.4.3.1 below for details on how that information was supplemented.
- Prior care setting indicator variables based on the 30 days prior to each episode; merged onto the UAF by episode identifier for all claims-based episodes and for OASIS-based episodes in which the beneficiary was full FFS enrolled for the entire 30-day lookback period
- OASIS-assessment items used for risk factor calculations; merged onto the UAF based on the linked OASIS assessment identifier for both the assessment that starts an episode and the assessment that ends an episode

Finally, we excluded all records in which the patient was treated by an HHA that operates in one of the US territories or the District of Columbia (as determined by first two digits of CCN). The resulting UAF was used for all analysis reported in this Report.

A.4.3.1 Identifying Beneficiary County of Residence

To supplement OASIS-based beneficiary ZIP code information used to determine county of residence, we constructed a process for identifying the county in which each home health claims-based episode occurred (i.e., beneficiary residence). The CBSA where services were provided is a claim line item, indicated by value code 61; in our analyses, this is considered the most reliable source of service

location. However, in the case where the beneficiary lives in a rural area (outside of a CBSA), the line item only indicates the state of service; further, many CBSAs included multiple counties. To address these situations while still leveraging the accuracy of the CBSA for determining location of service, we followed a multi-step approach for determining the county in which services were provided during a home health episode:

1. Using the National Bureau of Economic Research's CBSA to Federal Information Processing Standards county crosswalk file, we mapped any valid CBSA code to one or more of its associated counties.
    a. If a non-rural CBSA mapped to one valid county, then the episode was associated with that county in analyses.
    b. If the line item indicated a rural area (i.e., no valid CBSA), or if the CBSA did not map to a single valid Federal Information Processing Standards county code, then we proceeded to the next step.
2. We next used patient ZIP code on the OASIS assessment nearest to the claims-based episode start date to determine the county where home health services were provided. We included any OASIS assessment within 90 days of the claims-based episode start date.
    a. For the selected OASIS assessment, we used the HUD ZIP to county crosswalk to map the county of service. For instances when the CBSA from Step 1 mapped to multiple counties, we ensured that the county derived from the OASIS assessment ZIP code matched one of the counties within the CBSA.
    b. For instances when the episode of care was provided in a rural area, we ensured that the county derived from the OASIS assessment ZIP code existed in the same state that was indicated by the claim line item value.
    c. If there were no OASIS assessments for the beneficiary within 90 days of the claims-based episode start date, *or* the county derived from the OASIS ZIP code did not align with the CBSA or rural area's state, then we proceeded to the next step.
3. Next, we examined the monthly beneficiary county of residence data from the MBSF for the month in which the claims-based episode ended.
    a. If the CBSA from Step 1 mapped to multiple counties, we maintained the county from the MBSF if it matched one of the counties within the CBSA.
    b. If services were provided in a rural area, we maintained the county from the MBSF provided that the corresponding state matched the state of the rural area.
    c. Otherwise, we proceeded to the next step.
4. We next examined the mailing address county associated with the home health claim. We applied the same logic as described in Step 3, but maintained the county from the claim (vs. MBSF).
5. Next, we examined the MBSF monthly beneficiary county of residence data, but expanded our search from Step 3 to include the 3 months preceding and following the month in which the home health episode ended. We applied the same logic as described in Step 3, giving higher priority to counties from months that were closer to and preceding the month in which the home health episode ended (e.g., 1 month before takes precedence over 2 months before, and also takes precedence over 1 month after). If none of the 6 months evaluated yielded a county that aligns with the CBSA or rural area, we proceeded to the next step.

6. Next, we examined the ZIP in which the HHA is located, sourced from the CCW's HHA facility files. Using the HUD ZIP code to county crosswalk file (as in Step 2), we mapped the associated county in which the HHA is located.
    a. If the CBSA from Step 1 mapped to multiple counties, then we assigned the HHA's county to the episode only if it matched one of the counties within the CBSA.
    b. If services were provided in a rural area, then we assigned the HHA's county to the episode only if the corresponding state matched the state of the rural area.
    c. Otherwise, we proceeded to the final step to determine the county in which services were provided.
7. Finally, to account for any remaining episodes that had not yet been assigned a county through this multi-step process (<10% of total episodes), we repeated Steps 2 through Step 5, but *without* enforcing that the county align with the CBSA or rural area state found on the claim.

A.5 Sensitivity Analyses

A.5.1 Expanded Covariate Adjustment

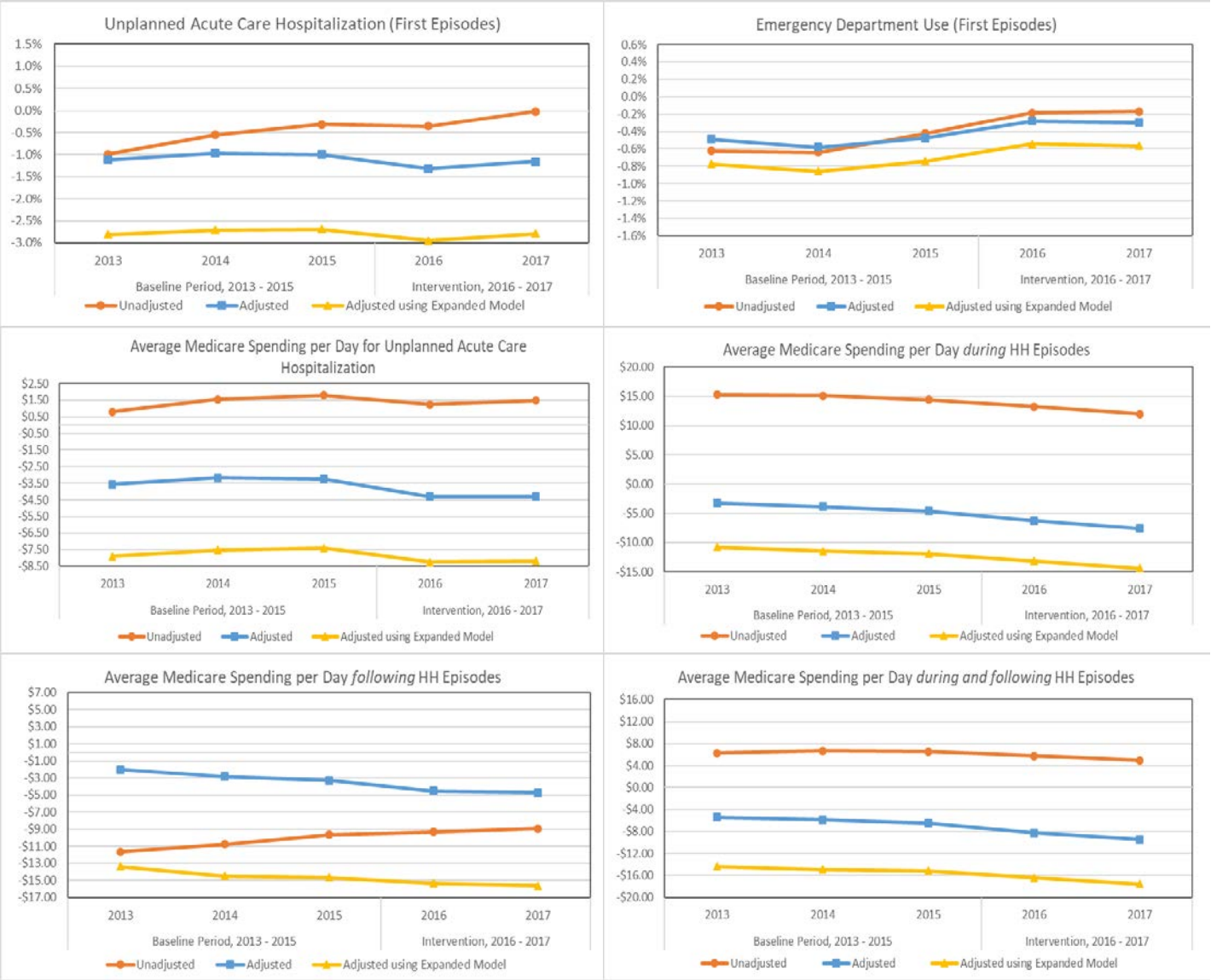
As shown in Exhibit A-6 in Section A.1.4, we noted that covariate adjustment with state fixed effects, as compared to no adjustment, helped in correcting for a lack of parallel trends between HHVBP and non-HHVBP states during the baseline period. In developing our approach to covariate adjustment, we conducted analyses of six claims-based impact measures to examine the impact of potentially expanding the list of covariates to include several chronic conditions identified using Medicare claims. These impact measures included:

- Unplanned Acute Care Hospitalization among All FFS Home Health Episodes
- Emergency Department Use among First FF Home Health Episodes
- Average Medicare Spending per Day during FFS Home Health Episodes of Care
- Average Medicare Spending per Day following FFS Home Health Episodes of Care
- Average Medicare Spending per Day during and following FFS Home Health Episodes of Care
- Average Medicare Spending per Day for Unplanned Acute Care Hospitalization among All FFS Home Health Episodes

As shown in Exhibit 7 on Page 25 of the main report, we observed that the chronic conditions identified using Medicare claims are reasonably balanced overall between the HHVBP and non-HHVBP populations. However, given that these chronic conditions have a strong relationship with some of the impact measures, we included them in an expanded model for testing. We added the following chronic conditions to the covariate list: chronic kidney disease, congestive heart failure, diabetes, ulcers, Alzheimer's disease, heart disease, anemia, mental disorders, depression, chronic obstructive pulmonary disease, atrial fibrillation, disability, cancer, liver disease, and arthritis (see Section A.2.1 for definitions). As explained above in Section A.1.3, we computed the difference in means of the adjusted measure values using the expanded model between HHVBP and non-HHVBP across individual years. We display the results in Exhibit A-48 below using plots of the difference in yearly estimated mean values based on the expanded model as well as differences in yearly estimated mean values based on the unadjusted and original adjusted models (i.e., with the core set of covariates discussed in Section A.1.3).

In comparing the results corresponding to the two adjusted models, we observed that the model incorporating an expanded adjustment for claims-based chronic conditions did not generally help in achieving more parallel trends during the baseline period. As a result, we did not include claims-based chronic conditions as part of our core covariate adjustment for the impact measures being examined in this report. Instead, as discussed in Section A.1.4, we employed a D-in-D model that incorporated state-specific linear time trends for those impact measures where our falsification testing rejected the null hypothesis of parallel trends during the baseline period.

Exhibit A-48. Assessing Parallel Trends for Key Impact Measures Based on Unadjusted, Adjusted, and Expanded Models[26]



[26] The trend lines from the adjusted model (which includes an interaction term of the treatment indicator with each of the three levels of Ambulation and Locomotion along with other covariates and state fixed effects) are plotted on the assumption that the net effect of HHVBP on different levels of ambulation at the start of care is zero.

A.6 Glossary

Term	Definition
Claims-Based Episode	Standard episode of HH care as defined by Medicare claims data. Each episode is 60 days or less and defined by clm_from_dt and clm_thru_dt reported on the claim.
PEP	Claims-based episodes subject to a Partial Episode Payment (PEP) are identified by patient discharge status code in the HH claims RIFs (PTNT_DSCHRG_STUS_CD) equal to 06.
LUPA	Claims-based episodes subject to a Low Utilization Payment Adjustment (LUPA) are identified by the LUPA indicator variable (CLM_HHA_LUPA_IND_CD) in the HH claims RIFs.
OASIS-Based Episode of Care	Standard episode of HH care as defined by OASIS assessments. Unlike claims-based episodes, OASIS episodes do not have time limits and can span years. Episode start is defined by the effective date of the SOC/ROC assessment that begins an episode. Episode end is defined by the effective date of the assessment indicating patient discharge, admission to inpatient facility, or death.
Outlier	Outlier payment adjustments are made for claims-based episodes representing a relatively high utilization of HH services. Episodes subject to an outlier payment are identified by the presence of a claim line value code (CLM_VAL_CD) equal to 17 in the HH claims RIFs.
Normal	A claims-based episode is considered normal if it did not receive a PEP, LUPA, or Outlier payment adjustment.
Full FFS	A beneficiary is considered full FFS for a given month if they are enrolled in Medicare Parts A and B and are not receiving HMO coverage, based on MBSF monthly enrollment indicators.
FFS Part A	A beneficiary is considered FFS Part A eligible for a given month if they are enrolled in Medicare Part A and are not receiving HMO coverage, based on MBSF monthly enrollment indicators. This eligibility determination is primarily used in calculating the FFS Claims-Based Spending Measures.
Home Health Stay	A home health stay is a sequence of home health payment episodes separated from other home health payment episodes by at least 60 days.[10]
Predicted Probabilities	Episode-level values indicating the probability that the episode is included in the measure numerator, based on the measure-specific risk adjustment model.
Sequence of Episodes	Multiple claims-based episodes for the same beneficiary in which the subsequent episode starts within 60 days of the previous episode end date are considered to be part of the same episode sequence.
Sequence Start Date	Date on which the first episode in a sequence of claims-based episodes starts.
Sequence End Date	Date on which the last episode in a sequence of claims-based episodes ends.
Transfer HHAs within 60 Days	If a beneficiary has multiple claims-based episodes for different HHAs in which one episode starts within 60 days of the previous episode, the first episode is flagged to indicate a transfer of HHAs within 60 days. These flagged episodes are excluded from the denominator of several measures in this Report.

Appendix B: Qualitative Technical Appendix

This Appendix provides details about the primary data collection activities, which were conducted to inform the qualitative analyses for this Annual Report.

B.1 Home Health Agency Interviews

Between September and October of 2018, we conducted 49 interviews HHAs in the nine intervention states via telephone. We selected agencies to interview by stratifying agencies by TPS within each intervention state (sampling was done based on 2016 TPS scores which were used to adjust payments in 2018). Using a semi-structured discussion guide, we asked HHA representatives to discuss: 1) general background information regarding the HHA, and the population they serve, 2) performance improvement activities since the start of HHVBP, including any activities related to the OASIS, HHCAHPS, or claims-based measures, 3) HHA awareness and use of the TPS, and 4) the impact of the first year of HHVBP-related payment adjustments on agency operations. We excluded agencies we interviewed in 2017 to minimize burden.

B.1.1 Outreach and Interviewing Strategy

We ranked HHAs in each HHVBP state by their 2016 TPS and randomly selected interview candidates from the highest and lowest quartiles in each state, excluding agencies we interviewed in 2017 to minimize burden. Interviews were allocated across states as shown in Exhibit B-1, with relatively more interviews allocated to Florida and fewer to Maryland, Nebraska, and Washington to reflect the relative allocation of agencies across the HHVBP states.

Exhibit B-1. Count of Agency Interviews by HHVBP State and 2016 TPS

State	High 2016 TPS	Low 2016 TPS	Total
Arizona	2	3	5
Florida	4	4	8
Iowa	3	3	6
Maryland	2	2	4
Massachusetts	3	3	6
North Carolina	3	3	6
Nebraska	2	2	4
Tennessee	2	3	5
Washington	3	2	5
Total	**24**	**25**	**49**

Each interview slot was assigned to an interview team consisting of a lead interviewer and a note-taker, both of whom were trained on the outreach materials and discussion guide. The team contacted each HHA by email and/or telephone and scheduled a 30-minute interview with key personnel. During the outreach and scheduling process, the interview team explained the topics that would be covered and requested that key personnel be available to participate. Based on discussion topics, the contacts at the HHA determined who would be able to respond to the interview questions. The interview team spoke

with a wide variety of agency staff; while their titles varied across agencies, in general, we spoke with key informants who were the administrator for their agency (e.g., administrators and branch managers), worked on clinical services (e.g., clinical directors), or worked on the quality team (e.g., quality improvement managers). Some agencies selected to be interviewed ultimately did not participate in the interviews, for the following reasons:

- Declined to be interviewed
- Failed to respond to multiple outreach attempts from the team
- Failed to attend the scheduled interview times to which they had agreed

When any of these issues arose, the interview team selected an alternate agency in the state to contact using the method described above. Alternates were selected from the same performance group as the HHA being replaced, e.g., low TPS agencies were replaced with low TPS agencies. In total, 120 HHAs were contacted in order to yield the 49 interviews, resulting in a response rate of 41%.

B.1.2 Data Collection and Analysis

We used a semi-structured discussion guide to conduct the interviews and audio recorded the majority of interviews with permission of the interviewee. The guide was reviewed by CMS and revised to incorporate their feedback.

The team produced transcript-style notes for each interview in a note-taking template that mirrored the discussion guide. The team retained recordings and the raw notes for backup. Lead interviewers summarized themes by state. Two senior members of the evaluation team identified key themes across all the transcript-style interview notes and summarized each interview by theme in an Excel database. The database included key descriptors of each agency, and they then sorted the findings by agency type, state, TPS category, and by theme to identify patterns across interviews. The same senior members of the evaluation team facilitated a debriefing with all lead interviewers to independently hear their impressions, and to confirm and further refine the themes to be included in the Report. Quotations taken from the transcript-style notes were selected to demonstrate common themes or interesting insights and were reviewed by team members for quality and illustrative value.

B.2 Referrer Interviews

We conducted 58 interviews with referrers in the nine HHVBP states between May and August of 2018 via telephone to better understand working relationships between HHAs and their referral sources, and to discern how, if at all, if these relationships have changed since the beginning of the HHVBP Model. To capture the perspective of a variety of referral sources, interviews with referrers included a mix of different provider types, including acute care hospitals, SNFs, rehabilitation facilities, critical access hospitals, and community providers.

B.2.1 Outreach and Interviewing Strategy

Due to challenges in the sampling approach (associated with contacting and interviewing physicians) and the fact that physicians' offices may refer to home health less frequently than discharge planners or social workers in inpatient facilities and are less familiar with the referral process, most of the interviews we conducted were with discharge planners at hospitals and SNFs, as shown in Exhibit B-2. We allocated interviews across HHVBP states to roughly reflect the relative concentration of HHAs.

Each referrer interview slot was assigned to an interview team consisting of a lead interviewer and a note-taker, both of whom were trained on the outreach materials and discussion guide. To identify referring physicians and discharge planners to interview, interview teams began by contacting the HHAs interviewed in year one of the evaluation to provide us with contacts for referrers with whom they commonly work. This approach had uneven success, eliciting fewer contacts in some states than the target number of interviews. To increase the number of participants, the interview team conducted supplemental outreach, contacting hospitals and other providers that were mentioned by name in the interviews with HHAs in year one of the evaluation. When HHAs did not name specific referrers in their interviews, we reached out to hospitals in the same city or county.

Exhibit B-2. Count of Referrers Interviewed by HHVBP State and Facility Type

State	Acute Care Hospitals	Skilled Nursing Facilities	Other	Total
Arizona	4	2	1	7
Florida	6	3	1	10
Iowa	5	1	1	7
Maryland	1	2	1	4
Massachusetts	3	2	1	6
North Carolina	3	1	2	6
Nebraska	1	5	1	7
Tennessee	4	2	0	6
Washington	0	1	4	5
Total	**27**	**19**	**12**	**58**

The team contacted each referrer by email and/or telephone and scheduled a 30 to 45-minute interview with key personnel. During the outreach and scheduling process, the interview team explained the topics that would be covered during the interview and requested that key personnel engaged in discharge planning be available to participate. Based on discussion topics, the contacts at the referral sources determined who would be able to respond to the interview questions. Due to the nature of the interview, we attempted to speak with key informants who had been providing referrals to HHAs for at

least two years, so that they would be able to speak to any historical trends. In general, we spoke to individuals in the social services or case management department (e.g. director of social services, social worker, or case manager) at SNFs and acute care hospitals. Facilities ranged in size from 25 beds to 2,000 beds; the number of patients discharged to home health ranged from 10% to almost 100%.

Some referrers contacted ultimately did not participate in the interviews, for the following reasons:

- Declined to be interviewed
- Failed to respond to multiple outreach attempts from the team
- Failed to attend the scheduled interview times to which they had agreed

When any of these issues arose, the interview team identified an alternative referrer to contact using the method described above.

B.2.2 Data Collection and Analysis

We used a semi-structured discussion guide to ask referrers about (1) patient preferences and the referral process, particularly with regard to the use of quality data, (2) changes to working relationships with HHAs including beneficiary access to care and changes in marketing strategies since the implementation of HHVBP, and (3) expected impact of paying HHAs for performance. The guides were reviewed and revised over discussions with the qualitative research team and CMS.

We audio recorded the majority of interviews with permission of the interviewee; some interviews were not recorded because they were conducted at the point of initial contact with the referral source. For all interviews, the team produced transcript-style notes for each interview in a note-taking template that mirrored the discussion guide. The team retained recordings and the raw notes for backup. Using the questions in the discussion guide, we developed a user interface in SurveyMonkey, a web-based application that facilitates data collection and aggregation. Given the narrow scope of the interview topic, this tool allowed multiple users to enter summaries of referrer responses to questions simultaneously into a common spreadsheet so that we could look across interviews at responses to specific questions in the discussion guide. One member of the evaluation team reviewed each interview and input the findings into SurveyMonkey in order to aggregate the data by topic area and/or question from the discussion guide. The data was then exported into Excel to facilitate review and create a summary of the responses by question, which was used to generate the findings.

Appendix C: Supplemental Tables and Results

C.1 Annual Means for TPS, Spending Measures, and Quality Measures

Exhibit C-1. Unadjusted Annual Means and Standard Errors for Impact Measures 2013-2017, HHVBP States

Measure	2013	2014	2015	2016	2017
TPS	30.9 (0.3561)†	28.1 (0.3452)	30.9 (0.3621)	37.1 (0.4141)	42.6 (0.4102)
FFS Claims-Based Quality Measures					
*ED Use (no Hospitalization)/First FFS HH Episodes**	11.3% (0.0004)	11.7% (0.0004)	12.2% (0.0004)	12.6% (0.0004)	12.9% (0.0004)
*Unplanned Acute Care Hospitalization/First FFS HH Episodes**	15.3% (0.0004)	15.6% (0.0004)	16.1% (0.0004)	16.3% (0.0004)	15.8% (0.0004)
Unplanned Acute Care Hospitalization/All FFS HH Episodes	16.8% (0.0003)	17.2% (0.0003)	17.0% (0.0003)	16.8% (0.0003)	17.1% (0.0003)
Unplanned Hospital Readmission in the First 30 Days of HH Care	13.1% (0.0007)	12.9% (0.0007)	13.2% (0.0007)	13.0% (0.0007)	12.2% (0.0007)
ED Use Following Hospitalization (without Hospital Readmission) in the First 30 Days of HH Care	9.3% (0.0006)	9.8% (0.0007)	9.9% (0.0006)	10.1% (0.0006)	10.1% (0.0007)
SNF Use/All FFS HH Episodes	4.7% (0.0002)	5.0% (0.0002)	5.0% (0.0002)	5.0% (0.0002)	5.0% (0.0002)
FFS Claims-Based Spending Measures					
Average Medicare Spending per day for Unplanned Acute Care Hospitalizations among all FFS Home Health Episodes*	$32.98 (0.0961)	$34.16 (0.0981)	$33.62 (0.0961)	$32.41 (0.0931)	$33.77 (0.0963)
Average Medicare Spending per Day during and following FFS HH Episodes of Care*	$135.41 (0.1471)	$138.65 (0.1521)	$140.99 (0.1546)	$143.18 (0.1594)	$146.09 (0.1643)
Average Medicare Spending per Day during FFS HH Episodes of Care*	$148.29 (0.1546)	$150.69 (0.1596)	$152.82 (0.1621)	$155.47 (0.1675)	$158.66 (0.1734)
Average Medicare Spending per Day following FFS HH Episodes of Care*	$102.09 (0.2393)	$106.81 (0.2496)	$109.28 (0.2542)	$110.69 (0.2578)	$113.14 (0.2646)
OASIS-Based Outcome Quality Measures					
*Discharged to Community**	73.0% (0.0004)	72.8% (0.0004)	72.4% (0.0004)	72.9% (0.0004)	72.8% (0.0004)
*Improvement in Ambulation-Locomotion**	62.5% (0.0005)	64.8% (0.0005)	68.4% (0.0004)	74.0% (0.0004)	77.7% (0.0004)
Improvement in Bathing	69.3% (0.0004)	70.0% (0.0004)	72.2% (0.0004)	76.5% (0.0004)	79.6% (0.0004)
Improvement in Bed Transferring	58.3% (0.0005)	60.2% (0.0005)	64.7% (0.0005)	71.8% (0.0004)	77.6% (0.0004)
Improvement in Dyspnea	64.5% (0.0005)	65.2% (0.0005)	70.2% (0.0005)	74.9% (0.0005)	79.5% (0.0004)
Improvement in Management of Oral Medications	48.8% (0.0006)	50.5% (0.0006)	55.0% (0.0005)	61.6% (0.0005)	67.5% (0.0005)
Improvement in Pain Interfering with Activity	70.4% (0.0005)	69.9% (0.0005)	71.9% (0.0005)	76.7% (0.0004)	80.3% (0.0004)
Improvement in Status of Surgical Wounds	90.2% (0.0007)	90.2% (0.0008)	90.5% (0.0008)	91.4% (0.0007)	92.2% (0.0007)

Measure	2013	2014	2015	2016	2017
OASIS-Based Process Quality Measures					
Drug Education on Medications Provided to Patient/Caregiver during Episodes of Care	90.8% (0.1621)	91.2% (0.1606)	93.7% (0.1372)	95.4% (0.1298)	96.2% (0.1262)
Influenza Immunization Received for Current Flu Season	63.3% (0.3269)	65.2% (0.3240)	56.5% (0.3491)	64.9% (0.3385)	67.6% (0.3309)
Pneumococcal Polysaccharide Vaccine Ever Received	65.7% (0.2989)	68.1% (0.2930)	64.5% (0.3186)	72.9% (0.2861)	74.2% (0.2762)
Depression Assessment Conducted	95.5% (0.1475)	95.8% (0.1430)	96.0% (0.1365)	96.1% (0.1339)	95.9% (0.1334)
Diabetic Foot Care and Patient / Caregiver Education Implemented during All Episodes of Care	91.6% (0.1748)	92.4% (0.1669)	93.5% (0.1625)	94.7% (0.1535)	95.6% (0.1449)
Multifactor Fall Risk Assessment Conducted for All Patients who Can Ambulate	97.8% (0.0759)	98.3% (0.0665)	98.8% (0.0640)	99.0% (0.0634)	99.0% (0.0610)
Timely Initiation of Care	92.6% (0.1106)	92.6% (0.1112)	92.6% (0.1170)	93.4% (0.1184)	93.9% (0.1210)
HHCAHPS-Based Patient Experience Measures					
How often the home health team gave care in a professional way	89.0% (0.1246)	88.7% (0.1412)	88.8% (0.1416)	88.5% (0.1299)	88.4% (0.1375)
How well did the home health team communicate with patients	86.2% (0.1468)	85.9% (0.1663)	85.7% (0.1581)	85.5% (0.1528)	85.5% (0.1540)
Did the home health team discuss medicines, pain, and home safety with patients	82.9% (0.1828)	82.8% (0.1836)	82.8% (0.1836)	82.3% (0.1904)	82.6% (0.1847)
How do patients rate the overall care from the home health agency	84.7% (0.1993)	84.3% (0.2243)	84.3% (0.2186)	84.3% (0.2084)	84.1% (0.2060)
Would patients recommend the home health agency to friends and family	79.8% (0.2380)	79.8% (0.2732)	79.4% (0.2638)	79.2% (0.2589)	78.9% (0.2494)

* Key Impact Measure | † Values in parentheses indicate standard errors. | *HHVBP Measures indicated by italic text*.

Exhibit C-2. Unadjusted Annual Means and Standard Errors for Impact Measures 2013-2017, Non-HHVBP States

Measure	2013	2014	2015	2016	2017
TPS	30.4 (0.1762)†	28.4 (0.1763)	30.6 (0.1834)	34.9 (0.1996)	40.0 (0.2007)
FFS Claims-Based Quality Measures					
*ED Use (no Hospitalization)/First FFS HH Episodes**	11.9% (0.0002)	12.4% (0.0002)	12.6% (0.0002)	12.7% (0.0002)	13.0% (0.0002)
*Unplanned Acute Care Hospitalization/First FFS HH Episodes**	16.2% (0.0003)	16.2% (0.0003)	16.4% (0.0003)	16.5% (0.0003)	15.8% (0.0003)
Unplanned Acute Care Hospitalization/All FFS HH Episodes	15.9% (0.0002)	15.9% (0.0002)	15.8% (0.0002)	15.6% (0.0002)	15.9% (0.0002)
Unplanned Hospital Readmission in the First 30 Days of HH Care	13.2% (0.0004)	12.9% (0.0004)	13.0% (0.0004)	13.2% (0.0004)	12.1% (0.0004)
ED Use Following Hospitalization (without Hospital Readmission) in the First 30 Days of HH Care	9.7% (0.0004)	10.1% (0.0004)	10.3% (0.0004)	10.4% (0.0004)	10.5% (0.0004)
SNF Use/All FFS HH Episodes	3.9% (0.0001)	4.0% (0.0001)	4.1% (0.0001)	4.2% (0.0001)	4.2% (0.0001)
FFS Claims-Based Spending Measures					
Average Medicare Spending per day for Unplanned Acute Care Hospitalizations among all FFS Home Health Episodes*	$32.07 (0.0519)	$32.58 (0.0522)	$31.79 (0.0510)	$31.10 (0.0496)	$32.29 (0.0515)
Average Medicare Spending per Day during and following FFS HH Episodes of Care*	$128.79 (0.0816)	$131.80 (0.0834)	$134.25 (0.0844)	$137.35 (0.0867)	$141.22 (0.0903)
Average Medicare Spending per Day during FFS HH Episodes of Care*	$132.48 (0.0832)	$135.30 (0.0850)	$138.25 (0.0861)	$142.16 (0.0889)	$146.88 (0.0931)
Average Medicare Spending per Day following FFS HH Episodes of Care*	$113.70 (0.1570)	$117.48 (0.1610)	$118.54 (0.1612)	$119.50 (0.1607)	$121.44 (0.1641)
OASIS-Based Outcome Quality Measures					
*Discharged to Community**	69.8% (0.0002)	70.1% (0.0002)	70.5% (0.0002)	71.0% (0.0002)	71.3% (0.0002)
*Improvement in Ambulation-Locomotion**	60.2% (0.0003)	62.2% (0.0003)	65.7% (0.0003)	70.3% (0.0002)	74.0% (0.0002)
Improvement in Bathing	66.4% (0.0003)	67.4% (0.0003)	70.0% (0.0002)	73.6% (0.0002)	76.6% (0.0002)
Improvement in Bed Transferring	55.9% (0.0003)	57.7% (0.0003)	61.4% (0.0003)	67.0% (0.0003)	72.4% (0.0002)
Improvement in Dyspnea	64.4% (0.0003)	65.1% (0.0003)	68.7% (0.0003)	72.2% (0.0003)	76.2% (0.0002)
Improvement in Management of Oral Medications	51.6% (0.0003)	53.2% (0.0003)	56.5% (0.0003)	60.8% (0.0003)	65.3% (0.0003)
Improvement in Pain Interfering with Activity	66.6% (0.0003)	67.0% (0.0003)	69.5% (0.0003)	73.6% (0.0002)	77.1% (0.0002)
Improvement in Status of Surgical Wounds	89.0% (0.0004)	89.0% (0.0004)	89.5% (0.0004)	90.3% (0.0004)	90.7% (0.0004)

Measure	2013	2014	2015	2016	2017
OASIS-Based Process Quality Measures					
Drug Education on Medications Provided to Patient/Caregiver during Episodes of Care	91.3% (0.0779)	91.4% (0.0799)	93.9% (0.0696)	94.8% (0.0690)	95.7% (0.0640)
Influenza Immunization Received for Current Flu Season	68.2% (0.1458)	68.8% (0.1458)	57.5% (0.1628)	64.1% (0.1644)	66.8% (0.1636)
Pneumococcal Polysaccharide Vaccine Ever Received	68.8% (0.1408)	69.9% (0.1406)	65.9% (0.1510)	72.6% (0.1441)	74.3% (0.1416)
Depression Assessment Conducted	94.9% (0.0759)	95.2% (0.0727)	95.6% (0.0702)	95.7% (0.0718)	95.3% (0.0747)
Diabetic Foot Care and Patient / Caregiver Education Implemented during All Episodes of Care	93.6% (0.0750)	93.9% (0.0736)	94.8% (0.0707)	95.6% (0.0685)	96.0% (0.0688)
Multifactor Fall Risk Assessment Conducted for All Patients who Can Ambulate	98.0% (0.0387)	98.4% (0.0346)	98.7% (0.0335)	98.9% (0.0328)	99.0% (0.0319)
Timely Initiation of Care	89.5% (0.0695)	89.7% (0.0687)	90.3% (0.0680)	91.0% (0.0698)	91.5% (0.0696)
HHCAHPS-Based Patient Experience Measures					
How often the home health team gave care in a professional way	88.2% (0.0709)	88.3% (0.0701)	88.2% (0.0762)	88.0% (0.0765)	87.9% (0.0798)
How well did the home health team communicate with patients	85.4% (0.0761)	85.3% (0.0787)	85.2% (0.0843)	85.2% (0.0859)	85.1% (0.0876)
Did the home health team discuss medicines, pain, and home safety with patients	83.8% (0.0881)	83.9% (0.0875)	83.6% (0.0921)	83.6% (0.0933)	83.4% (0.0976)
How do patients rate the overall care from the home health agency	83.6% (0.1110)	83.7% (0.1126)	83.6% (0.1208)	83.7% (0.1217)	83.5% (0.1250)
Would patients recommend the home health agency to friends and family	78.5% (0.1364)	78.5% (0.1380)	78.3% (0.1433)	78.1% (0.1435)	77.6% (0.1479)

* Key Impact Measure | † Values in parentheses indicate standard errors. | *HHVBP Measures indicated by italic text*.

C.2 Sample Size Tables

The tables in this section provide the sample size for their corresponding table in the Second Annual Report. For example, Exhibit 22n corresponds to Exhibit 22 in the Second Annual Report.

Exhibit 22n. Sample Size for Baseline and Performance Period Means for FFS Claims-Based Health Care Utilization Measures, All HHVBP States and Non-HHVBP States

FFS Claims-Based Health Care Utilization Measures	All HHVBP States 2013-2015	All Non-HHVBP States 2013-2015	All HHVBP States 2016	All Non-HHVBP States 2016	All HHVBP States 2017	All Non-HHVBP States 2017
*ED Use (no Hospitalization)/First FFS HH Episodes**	2,185,882	6,155,132	706,397	2,081,561	693,239	2,044,619
*Unplanned Acute Care Hospitalization/First FFS HH Episodes**	2,185,882	6,155,132	706,397	2,081,561	693,239	2,044,619
Unplanned Acute Care Hospitalization/All FFS HH Episodes	3,738,888	12,864,287	1,207,487	4,222,621	1,177,989	4,056,390
Unplanned Hospital Readmission in the First 30 Days of HH Care	632,997	1,891,967	221,906	665,858	214,128	638,856
ED Use Following Hospitalization (without Hospital Readmission) in the First 30 Days of HH Care	632,997	1,891,967	221,906	665,858	214,128	638,856
SNF Use/All FFS HH Episodes	3,738,888	12,864,287	1,207,487	4,222,621	1,177,989	4,056,390

** Key Impact Measure | HHVBP Measures indicated by italic text*.

Exhibit 23n. Sample size for Cumulative D-in-D Results for FFS Claims-Based Utilization Measures

Measure	HHVBP	Non-HHVBP
ED Use (no Hospitalization)/First FFS HH Episodes	3,427,753	9,746,355
Unplanned Acute Care Hospitalization/First FFS HH Episodes	3,427,753	9,746,355
Unplanned Acute Care Hospitalization/All FFS HH Episodes	5,885,911	20,154,148
Unplanned Hospital Readmission in the First 30 Days of HH Care	1,008,042	2,986,009
ED Use following Hospitalization (without Hospital Readmission) in the First 30 Days of HH Care	1,008,042	2,986,009
SNF Use/All FFS HH Episodes	5,885,911	20,154,148

Sample size reflects episodes from 2013-2017 with non-missing data.

Exhibit 28n. Sample Size for Baseline and Performance Period Means for FFS Claims-Based Spending Measures, All HHVBP States and Non-HHVBP States

FFS Claims-Based Spending Measures	All HHVBP States 2013-2015	All Non-HHVBP States 2013-2015	All HHVBP States 2016	All Non-HHVBP States 2016	All HHVBP States 2017	All Non-HHVBP States 2017
Average Medicare Spending per day for Unplanned Acute Care Hospitalizations among all FFS Home Health Episodes*	3,738,888	12,864,285	1,207,486	4,222,621	1,177,988	4,056,389
Average Medicare Spending per Day during and following FFS HH Episodes of Care*	4,397,045	15,025,265	1,420,698	4,945,133	1,380,548	4,734,903
Average Medicare Spending per Day during FFS HH Episodes of Care*	4,397,045	15,025,265	1,420,698	4,945,133	1,380,548	4,734,903
Average Medicare Spending per Day following FFS HH Episodes of Care*	2,982,701	8,481,215	971,203	2,889,141	949,529	2,833,452

** Key Impact Measure*

Exhibit 29n. Sample size for Cumulative D-in-D Results for FFS Claims-Based Spending Measures

Measure	HHVBP	Non-HHVBP
Average Medicare Spending per Day for Unplanned Acute Care Hospitalizations among all FFS HH Episodes	5,885,909	20,154,145
Average Medicare Spending per Day during and following FFS HH Episodes of Care	6,902,706	23,491,793
Average Medicare Spending per Day during FFS HH Episodes of Care	6,902,706	23,491,793
Average Medicare Spending per Day following FFS HH Episodes of Care	4,684,921	13,449,864

Sample size reflects episodes from 2013-2017 with non-missing data.

Exhibit 31n. Sample Size for Baseline and Performance Period Means for OASIS-Based Impact Measures, All HHVBP States and Non-HHVBP States

OASIS-Based Impact Measures	All HHVBP States 2013-2015	All Non-HHVBP States 2013-2015	All HHVBP States 2016	All Non-HHVBP States 2016	All HHVBP States 2017	All Non-HHVBP States 2017
OASIS-Based Outcome Quality Measures						
*Discharged to Community**	4,433,461	14,432,630	1,539,169	5,165,640	1,579,538	5,383,823
*Improvement in Ambulation-Locomotion**	3,148,985	9,843,983	1,115,975	3,634,879	1,150,177	3,828,697
Improvement in Bathing	3,212,949	10,058,664	1,130,290	3,683,344	1,160,898	3,870,143
Improvement in Bed Transferring	2,982,966	9,269,136	1,086,084	3,515,773	1,131,754	3,753,305
Improvement in Dyspnea	2,345,358	7,229,847	870,611	2,748,114	927,294	2,948,866
Improvement in Management of Oral Medications	2,427,719	7,643,359	955,180	3,027,057	1,036,593	3,365,460
Improvement in Pain Interfering with Activity	2,639,964	8,393,550	961,005	3,158,172	998,118	3,350,341
Improvement in Status of Surgical Wounds	461,014	1,604,143	147,003	524,363	143,424	517,644
OASIS-Based Process Quality Measures						
Drug Education on Medications Provided to Patient/Caregiver during Episodes of Care	25,299	109,553	7,786	35,369	7,597	34,292
Influenza Immunization Received for Current Flu Season	24,101	105,501	7,466	34,111	7,239	33,049
Pneumococcal Polysaccharide Vaccine Ever Received	25,283	109,385	7,768	35,285	7,572	34,178
Depression Assessment Conducted	25,259	109,448	7,752	35,304	7,568	34,218
Diabetic Foot Care and Patient / Caregiver Education Implemented during All Episodes of Care	24,486	105,685	7,515	33,939	7,320	32,930
Multifactor Fall Risk Assessment Conducted for All Patients who Can Ambulate	25,016	108,420	7,694	34,855	7,488	33,788
Timely Initiation of Care	25,317	109,634	7,787	35,394	7,602	34,323

** Key Impact Measure | HHVBP Measures indicated by italic text.*

Exhibit 35n. Sample size for Cumulative D-in-D Results for OASIS Outcome Impact Measures

Measure	HHVBP	Non-HHVBP
Discharged to Community	7,526,891	24,910,683
Improvement in Ambulation-Locomotion	5,398,192	17,258,601
Improvement in Bathing	5,486,722	17,562,192
Improvement in Bed Transferring	5,184,447	16,491,931
Improvement in Dyspnea	4,129,102	12,896,561
Improvement in Management of Oral Medications	4,413,579	14,001,384
Improvement in Pain Interfering with Activity	4,583,881	14,860,722
Improvement in Status of Surgical Wounds	748,729	2,639,304

Sample size reflects episodes from 2013-2017 with non-missing data.

Exhibit 36n. Sample size for Cumulative D-in-D Results for OASIS Process Impact Measures

Measure	HHVBP	Non-HHVBP
Drug Education on Medications Provided to Patient/Caregiver during Episodes of Care	40,659	179,075
Pneumococcal Polysaccharide Vaccine Ever Received	40,600	178,715
Depression Assessment Conducted	40,558	178,834
Diabetic Foot Care and Patient / Caregiver Education Implemented during All Episodes of Care	39,308	172,472
Multifactor Fall Risk Assessment Conducted for All Patients who Can Ambulate	40,178	176,948
Timely Initiation of Care	40,683	179,208

Sample size reflects episodes from 2013-2017 with non-missing data.

Exhibit 37n. Sample Size for Baseline and Performance Period Means for HHCAHPS-Based Patient Experience Impact Measures, All HHVBP States and Non-HHVBP States

HHCAHPS-Based Patient Experience Impact Measures	All HHVBP States 2013-2015	All Non-HHVBP States 2013-2015	All HHVBP States 2016	All Non-HHVBP States 2016	All HHVBP States 2017	All Non-HHVBP States 2017
How often the home health team gave care in a professional way	4,501	19,000	1,519	6,322	1,529	6,278
How well did the home health team communicate with patients	4,501	19,000	1,519	6,322	1,529	6,278
Did the home health team discuss medicines, pain, and home safety with patients	4,501	19,000	1,519	6,322	1,529	6,278
How do patients rate the overall care from the home health agency	4,501	19,000	1,519	6,322	1,529	6,278
Would patients recommend the home health agency to friends and family	4,501	19,000	1,519	6,322	1,529	6,278

** Key Impact Measure | HHVBP Measures indicated by italic text*.

Exhibit 38n. Sample size for Cumulative D-in-D Results for HHCAHPS-Based Impact Measures

Measure	HHVBP	Non-HHVBP
How often the home health team gave care in a professional way	7,531	31,548
How well did the home health team communicate with patients	7,531	31,548
Did the home health team discuss medicines, pain, and home safety with patients	7,531	31,548
How do patients rate the overall care from the home health agency	7,531	31,548
Would patients recommend the home health agency to friends and family	7,531	31,548

Sample size reflects episodes from 2013-2017 with non-missing data.

C.3 TPS Supporting Analyses

Exhibit C-3. Correlation of Average Measure Scores with Average Differences in Measure Rates, 2016 and 2017

Correlation of Average Measure Score with:	Average change in measure rate, for performance period minus agency baseline period*		Average difference in measure rate, for performance period minus achievement threshold*	
	2016	2017	2016	2017
ED Use (no Hospitalization)/First FFS HH Episodes	-0.673	-0.656	-0.702	-0.674
Unplanned Acute Care Hospitalization/First FFS HH Episodes	-0.876	-0.816	-0.838	-0.827
Drug Education on Medications Provided to Patient/Caregiver during Episodes of Care	0.584	0.346	0.775	0.817
Influenza Immunization Received for Current Flu Season	0.621	0.640	0.641	0.746
Pneumococcal Polysaccharide Vaccine Ever Received	0.561	0.635	0.633	0.687
Discharged to Community	0.763	0.786	0.600	0.619
Improvement in Ambulation-Locomotion	0.676	0.585	0.456	0.409
Improvement in Bathing	0.741	0.754	0.727	0.732
Improvement in Bed Transferring	0.664	0.621	0.555	0.573
Improvement in Management of Oral Medications	0.739	0.609	0.551	0.455
Improvement in Dyspnea	0.740	0.705	0.611	0.652
Improvement in Pain Interfering with Activity	0.857	0.855	0.789	0.813
How often the home health team gave care in a professional way	0.904	0.749	0.753	0.659
How well did the home health team communicate with patients	0.748	0.792	0.705	0.721
Did the home health team discuss medicines, pain, and home safety with patients	0.793	0.698	0.766	0.685
How do patients rate the overall care from the home health agency	0.842	0.789	0.673	0.692
Would patients recommend the home health agency to friends and family	0.954	0.763	0.880	0.632

**p<0.01 for all correlations.*

Exhibit C-4. Average Measure Achievement Thresholds and Benchmarks Measure, Performance Year 2016

HHVBP Performance Measure	Average Achievement Threshold		Average Benchmark	
	HHVBP	Non-HHVBP	HHVBP	Non-HHVBP
ED Use (no Hospitalization)/First FFS HH Episodes	11.9%	12.3%	6.2%	6.0%
Unplanned Acute Care Hospitalization/First FFS HH Episodes	15.9%	15.6%	9.1%	8.8%
Discharged to Community	71.1%	69.5%	83.5%	85.1%
Improvement in Ambulation-Locomotion	66.1%	63.0%	85.0%	84.5%
Improvement in Bathing	70.9%	67.3%	88.1%	88.5%
Improvement in Bed	62.0%	57.7%	81.6%	82.3%
Improvement in Management of Oral Medications	54.0%	52.1%	74.4%	76.0%
Improvement in Dyspnea	69.7%	64.4%	88.0%	87.3%
Improvement in Pain Interfering with Activity	71.4%	66.9%	90.5%	90.9%
Drug Education on Medications Provided to Patient/Caregiver during Episodes of Care	97.2%	97.4%	99.9%	99.9%
Influenza Immunization Received for Current Flu Season	67.9%	68.5%	91.0%	90.2%
Pneumococcal Polysaccharide Vaccine Ever Received	71.4%	73.3%	93.6%	94.5%
How often the home health team gave care in a professional way	89.1%	89.0%	94.2%	94.0%
How well did the home health team communicate with patients	86.4%	85.9%	91.9%	92.3%
Did the home health team discuss medicines, pain, and home safety with patients	83.8%	84.0%	90.3%	91.6%
How do patients rate the overall care from the home health agency	84.8%	84.9%	93.1%	93.2%
Would patients recommend the home health agency to friends and family	80.2%	79.8%	90.5%	90.5%

Exhibit C-5. HHA Eligibility for Total Performance Scores, 2016

	Agencies in HHVBP States			Agencies in Non-Model States		
	Eligible for TPS		Total	Eligible for TPS		Total
	Yes	No		Yes	No	
Total number of HHAs	1,646	473	2,119	7,023	2,556	9,579
% of HHAs	77.7%	22.3%	100.0%	73.3%	26.7%	100.0%
Number of OASIS episodes	1,533,918	32,360	1,566,278	5,152,707	106,498	5,259,205
% of OASIS episodes	97.9%	2.1%	100.0%	98.0%	2.0%	100.0%
Number of Medicare claims episodes	1,398,949	31,399	1,430,348	4,924,334	163,245	5,087,579
% of Medicare claims episodes	97.8%	2.2%	100.0%	96.8%	3.2%	100.0%

Exhibit C-6. Characteristics of HHAs by Eligibility for TPS, 2016

HHA Characteristics	Agencies in HHVBP States			Agencies in Non-Model States		
	Eligible for TPS		Total	Eligible for TPS		Total
	Yes	No		Yes	No	
Total number of HHAs	1,646	473	2,119	7,023	2,556	9,579
HHA Size: Number of OASIS Episodes (%)						
1-59	5.9%	73.5%	19.7%	7.7%	85.4%	27.3%
60-249	28.6%	19.4%	26.7%	37.7%	12.3%	31.3%
250-499	19.7%	3.5%	16.4%	21.2%	1.6%	16.2%
500-999	18.5%	2.6%	15.2%	15.3%	0.5%	11.6%
≥1,000	27.3%	0.9%	21.9%	18.1%	0.2%	13.6%
Ownership (%)						
For-profit	74.7%	89.9%	78.1%	77.8%	88.3%	80.5%
Non-profit	18.5%	4.5%	15.4%	17.9%	7.9%	15.3%
Government-owned	6.8%	5.6%	6.5%	4.3%	3.8%	4.2%
Setting (%)						
Hospital-based	9.8%	2.6%	8.2%	10.1%	2.7%	8.1%
Freestanding	90.2%	97.4%	91.8%	89.9%	97.3%	91.9%
Chain affiliation (%)						
Chain=Yes	38.2%	7.1%	31.3%	25.1%	7.1%	20.4%
Chain=No	60.1%	71.4%	62.6%	72.8%	74.8%	73.3%
Chain=Missing	1.7%	21.5%	6.1%	2.1%	18.0%	6.3%
HHA Years in Operation (%)						
<4 years	8.6%	38.1%	15.1%	7.4%	27.2%	12.6%
4-10 years	33.2%	34.4%	33.4%	35.0%	41.3%	36.6%
>10 years	58.3%	27.5%	51.5%	57.6%	31.5%	50.8%

Exhibit C-7. Characteristics of HHAs by Eligibility for TPS, 2017

HHA Characteristic	Agencies in HHVBP States			Agencies in Non-Model States		
	Eligible for TPS		Total	Eligible for TPS		Total
	Yes	No		Yes	No	
Total number of HHAs	1,631	397	2,028	6,919	2,272	9,191
HHA Size: Number of OASIS Episodes (%)						
1-59	6.1%	84.0%	20.7%	7.8%	86.1%	26.5%
60-249	26.7%	11.7%	23.9%	37.2%	10.8%	30.9%
250-499	19.4%	2.1%	16.2%	19.8%	2.1%	15.6%
500-999	19.0%	1.1%	15.7%	16.0%	0.7%	12.3%
≥1,000	28.8%	1.1%	23.6%	19.2%	0.4%	14.7%
Ownership (%)						
For-profit	76.1%	87.6%	78.3%	78.2%	90.3%	81.2%
Non-profit	17.7%	6.8%	15.5%	17.7%	7.9%	15.3%
Government-owned	6.3%	5.6%	6.1%	4.1%	1.8%	3.5%
Setting (%)						
Hospital-based	9.2%	3.3%	8.0%	9.7%	1.7%	7.7%
Freestanding	90.8%	96.7%	92.0%	90.3%	98.3%	92.3%
Chain affiliation (%)						
Chain=Yes	38.8%	7.6%	32.7%	25.2%	7.1%	20.8%
Chain=No	60.1%	75.1%	63.1%	73.5%	80.7%	75.3%
Chain=Missing	1.0%	17.4%	4.2%	1.3%	12.1%	4.0%
HHA Years in Operation (%)						
<4 years	7.3%	32.6%	12.2%	5.2%	25.4%	10.1%
4-10 years	31.9%	32.6%	32.0%	33.4%	40.1%	35.1%
>10 years	60.8%	34.8%	55.7%	61.4%	34.6%	54.8%

Exhibit C-8. Average Measure Scores among Agencies in HHVBP and Non-Model States, 2016 and 2017

HHVBP Performance Measure	2016		2017	
	HHVBP	Non-HHVBP	HHVBP	Non-HHVBP
ED Use (no Hospitalization)/First FFS HH Episodes	2.3	2.5	2.2	2.3
Unplanned Acute Care Hospitalization/First FFS HH Episodes	2.2	2.2	2.7	2.8
Discharged to Community	2.9	2.6	2.8	2.5
Improvement in Ambulation-Locomotion	4.5	3.9	5.7	5.0
Improvement in Bathing	4.2	3.6	5.3	4.4
Improvement in Bed	4.5	3.9	6.5	5.4
Improvement in Management of Oral Medications	4.2	3.6	5.8	4.9
Improvement in Dyspnea	4.0	3.6	5.3	4.6
Improvement in Pain Interfering with Activity	4.2	3.7	5.2	4.5
Drug Education on Medications Provided to Patient/Caregiver during Episodes of Care	5.7	5.2	6.1	5.7
Influenza Immunization Received for Current Flu Season	4.6	4.4	4.8	4.9
Pneumococcal Polysaccharide Vaccine Ever Received	4.6	4.6	4.7	4.9
How often the home health team gave care in a professional way	2.5	2.7	2.5	2.7
How well did the home health team communicate with patients	2.8	2.9	2.8	2.8
Did the home health team discuss medicines, pain, and home safety with patients	2.6	2.8	2.8	2.9
How do patients rate the overall care from the home health agency	2.8	2.9	2.7	2.8
Would patients recommend the home health agency to friends and family	2.6	2.7	2.5	2.6
TPS	**37.1**	**34.9**	**42.6**	**40.0**

C.4 Payment Adjustment Supporting Analyses

Exhibit C-9. Distribution of CY 2018 HHA Payment Adjustments across HHA Characteristics

	N	Minimum	25th percentile	Mean	Median	75th percentile	Maximum
All	1,622	-2.58	-0.77	0.00	-0.08	0.65	3.00
Type							
Freestanding	1,459	-2.58	-0.77	0.00	-0.09	0.66	3.00
Hospital-based	163	-1.86	-0.80	-0.06	-0.03	0.48	2.44
Ownership							
For profit	1,210	-2.58	-0.78	0.00	-0.10	0.65	3.00
Nonprofit	301	-2.23	-0.66	0.07	0.04	0.77	3.00
Government owned	111	-1.87	-0.84	-0.19	-0.29	0.21	2.44
Chain Affiliation							
Yes	623	-2.10	-0.59	0.02	-0.02	0.60	3.00
No	975	-2.58	-0.88	-0.02	-0.15	0.73	3.00
Unknown	24	-1.38	-0.97	0.15	-0.09	1.14	2.90
Size: Number of OASIS Episodes							
1-59	94	-2.58	-0.96	0.06	-0.08	1.15	3.00
60-249	458	-2.55	-0.88	0.12	-0.05	0.94	3.00
250-499	319	-2.25	-0.82	0.02	0.01	0.80	3.00
500-999	303	-2.30	-0.68	-0.06	-0.10	0.56	2.72
1000+	448	-2.07	-0.68	-0.12	-0.13	0.46	2.22
HHA Age							
<4 years	134	-2.55	-1.32	-0.16	-0.24	0.77	3.00
4-10 years	540	-2.30	-0.72	0.15	0.02	0.88	3.00
>10 years	948	-2.58	-0.74	-0.07	-0.11	0.53	3.00

C.5 OASIS Supporting Analyses

Exhibit C-10. "Start of Care" Values for OASIS Outcome Measures in 2013-2017, by Year, HHVBP States and Non-HHVBP States

	HHVBP					Non-HHVBP				
	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Improvement in Ambulation-Locomotion	1,034,496	1,043,296	1,066,695	1,114,366	1,139,339	3,146,272	3,253,529	3,427,753	3,623,538	3,807,509
Able to independently walk with the use of a one-handed device	12.2%	10.1%	8.5%	6.3%	4.7%	13.1%	11.3%	9.8%	7.7%	6.1%
Requires two handed device or human assistance	39.7%	35.6%	31.2%	24.1%	18.9%	38.8%	36.0%	32.8%	28.0%	23.9%
Walks only with supervision or assistance from another at all times	39.4%	45.4%	50.9%	59.2%	65.2%	38.8%	43.1%	47.7%	54.0%	59.3%
Chairfast to bedfast	8.7%	9.0%	9.4%	10.3%	11.2%	9.3%	9.6%	9.7%	10.3%	10.7%
Improvement in Bed Transferring	965,716	989,777	1,023,338	1,084,577	1,121,039	2,925,095	3,062,206	3,266,522	3,505,000	3,733,108
Able to transfer with minimal human assistance or with use of an assistive device	72.1%	66.1%	58.8%	47.6%	34.2%	71.1%	67.0%	61.0%	52.2%	40.2%
Able to bear weight and pivot during the transfer but unable to transfer self	22.1%	27.6%	34.2%	43.5%	55.1%	22.2%	25.8%	31.1%	38.5%	49.3%
Unable to transfer self and is unable to bear weight or pivot when transferred by another person	4.4%	5.0%	5.8%	7.7%	9.5%	5.1%	5.6%	6.4%	7.8%	9.1%
Bedfast, unable to transfer but is able to turn and position self in bed	0.5%	0.5%	0.4%	0.4%	0.4%	0.6%	0.5%	0.5%	0.5%	0.5%
Bedfast, unable to transfer and is unable to turn and position self	0.9%	0.9%	0.8%	0.8%	0.7%	1.1%	1.0%	1.0%	0.9%	0.9%

	HHVBP					Non-HHVBP				
	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Improvement in Bathing	1,060,364	1,063,575	1,084,287	1,128,536	1,149,960	3,227,726	3,324,858	3,489,248	3,671,776	3,848,584
With the use of devices in shower/tub	7.8%	6.6%	6.1%	4.8%	3.7%	9.1%	8.0%	7.2%	6.0%	4.9%
With intermittent assistance in shower/tub	24.3%	22.4%	20.4%	17.0%	14.1%	23.9%	23.1%	22.0%	19.6%	17.2%
Participates with supervision in shower/tub	41.8%	43.9%	45.5%	47.1%	49.0%	39.8%	41.4%	43.3%	45.5%	47.4%
Independent at sink, in chair, or on commode	7.9%	7.7%	7.3%	7.1%	6.7%	8.2%	7.9%	7.3%	7.0%	6.6%
Participates with assist at sink, in chair, or commode	12.9%	14.0%	15.1%	17.6%	19.4%	13.6%	14.1%	14.5%	16.0%	17.6%
Unable to participate; bathed totally by another	5.2%	5.4%	5.6%	6.4%	7.1%	5.4%	5.5%	5.5%	5.9%	6.3%
Improvement in Pain Interfering with Activity	865,801	873,717	896,554	959,567	988,242	2,667,191	2,777,158	2,935,101	3,148,719	3,332,553
Pain does not interfere with activity	10.4%	9.8%	9.8%	8.7%	8.1%	10.7%	10.1%	9.6%	8.9%	8.6%
Less often than daily	11.7%	11.5%	11.9%	11.8%	12.3%	13.3%	12.9%	12.7%	12.3%	12.5%
Daily, but not constant	59.7%	59.7%	58.4%	57.6%	56.9%	58.0%	58.2%	58.3%	57.8%	57.4%
Constant	18.2%	19.0%	19.9%	21.9%	22.7%	18.0%	18.8%	19.4%	20.9%	21.5%
Improvement in Management of Oral Medications	771,658	800,342	852,293	953,796	1,035,490	2,384,007	2,513,772	2,732,705	3,018,211	3,352,689
Patient is able to take oral medications if prepared in advance/another person develops a drug diary	41.7%	39.6%	37.0%	31.6%	24.3%	41.6%	39.8%	37.4%	33.8%	28.5%
Able to take medications at the correct time if given reminders by another person at the appropriate times	20.3%	20.2%	19.5%	18.3%	16.6%	22.0%	21.9%	21.5%	20.7%	19.5%

	HHVBP					Non-HHVBP				
	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Unable to take medication unless administered by another person	38.0%	40.3%	43.5%	50.1%	59.2%	36.4%	38.3%	41.1%	45.5%	52.0%
Improvement in Dyspnea	766,639	775,289	800,014	869,325	917,835	2,308,712	2,381,241	2,528,163	2,741,681	2,936,764
Patient is short of breath only when walking more than 20 feet	38.4%	37.7%	37.6%	35.8%	33.2%	37.1%	36.8%	36.6%	35.3%	33.5%
With moderate exertion	43.4%	43.9%	43.5%	43.5%	45.2%	42.9%	43.1%	42.8%	43.1%	44.5%
With minimal exertion or at rest	18.2%	18.4%	18.9%	20.7%	21.6%	20.0%	20.0%	20.6%	21.6%	22.0%
Improvement in Status of Surgical Wounds	159,858	152,722	147,641	146,781	141,727	542,855	534,246	524,484	522,802	514,917
Fully granulating	10.1%	8.7%	7.9%	7.0%	6.6%	10.1%	8.8%	8.2%	7.7%	7.4%
Early/partial granulation	25.3%	20.9%	18.1%	15.7%	14.3%	24.2%	20.4%	18.4%	16.9%	15.5%
Not healing	64.6%	70.4%	74.0%	77.3%	79.1%	65.7%	70.7%	73.4%	75.4%	77.1%

These numbers reflect all OASIS HH episodes in the calendar year that were eligible for the specific OASIS outcome measure (regardless if their HHA received a TPS in 2017).

C.6 HHVBP Self-Reported Measures

Exhibit C-11. Reporting Rates for HHVBP Self-Reported Measures in 2017, by HHA Characteristic

Agency Characteristics		All 3 Measures Reported (%)	All 3 Measures Reported	N of HHAs
All HHAs with a TPS		**83.4%**	**1,351**	**1,617**
Size Cohorts	Small HHAs	60.8%	93	153
	Large HHAs	83.8%	806	962
	Single Size (Statewide)	90.0%	452	502
Setting	Freestanding	82.6%	1,212	1,467
	Hospital-Based	92.7%	139	150
HHA Age	<4 Years Old	64.4%	58	90
	4-10 Years Old	75.0%	388	517
	>10 Years Old	89.6%	905	1,010
Ownership Status	For-Profit	81.6%	1,002	1,228
	Government-Owned	88.1%	89	101
	Non-Profit	90.3%	260	288
Chain Status	Chain - No	77.7%	757	974
	Chain - Yes	93.0%	585	629
	Chain - Information not available	64.3%	9	14
Size (# of OASIS episodes)	1-59	62.9%	61	97
	60-249	73.1%	313	428
	250-499	82.4%	258	313
	500-999	90.0%	279	310
	1000+	93.8%	440	469
2017 TPS Quartile*	First Quartile (0-35.427)	65.3%	264	404
	Second Quartile (35.427-46.826)	86.1%	348	404
	Third Quartile (46.826-57.681)	88.6%	358	404
	Fourth Quartile (57.681-93.553)	94.1%	381	405
CY 2019* Payment Adjustment Category	[-5%, -3%)	25.0%	15	60
	[-3%, -1%]	74.2%	299	403
	(-1%, 0%]	88.5%	340	384
	(0%, 1%]	90.3%	355	393
	(1%, 3%]	91.7%	300	327
	(3%, 5%]	84.0%	42	50

*HHA characteristics from CY 2017 | *Payment adjustments and TPS (announced to HHVBP HHAs in Fall 2018) determined by HHA performance in 2017.*

C.7 Use of HHVBP Connect

C.7.1 Background

HHVBP Connect is an interactive web-based platform that allows HHAs in the nine HHVBP Model states to:

- "Find the latest updates for the HHVBP Model; download valuable resources to help [agencies] succeed in the model;
- View upcoming HHVBP events and key Model milestones;
- View the '2015 Benchmarks and Achievement Thresholds';
- Obtain the updated Frequently Asked Questions (FAQs);
- View past webinars and register for future webinars;
- Share best practices and chat with colleagues in the nine Model states; and,
- Understand when to submit New Measures data to the HHVBP Secure Portal and when and how to retrieve performance reports."[27]

It was launched in January 2016, coinciding with the beginning of HHVBP Model implementation. HHVBP Connect allows the HHVBP Technical Assistance staff and HHAs in the nine intervention states to securely login to the platform and communicate with each other and share best practices for improving performance and quality among competing HHAs. The resources available on the HHVBP Connect website include newsletters, FAQs, quality improvement tools, materials regarding HHVBP performance measures, and other information pertinent to the HHVBP Model. As part of our evaluation, we assess use of the HHVBP Connect website and its resources to answer these research questions: To what extent did participants use the technical assistance provided? How did use change between the first and second performance years of the HHVBP Model?

C.7.2 Approach & Methodology

We assessed use of the HHVBP Connect site by reviewing 2017 data on monthly unique visitors, resource downloads, webinar participation, and online posts provided by the HHVBP Technical Assistance Contractor. We also conducted a manual count of HHVBP Connect "Chatter" activity to obtain data regarding posts and responses by HHAs versus non-HHAs. The majority of the data provided by the Technical Assistance Contractor did not include information that allowed for identification of individual HHAs. However, we were able to review flags for HHA user type (including HHVBP Practice Users, HHVBP Administrator, and other non-HHA user types[28]) and organization name. This information allowed us to determine that between 97.8%–100% of users (depending on the resource) represent HHAs in the HHVBP states. The 2.2% of HHVBP Connect users who are not HHA users include CMS staff, Technical Assistance Contractor staff and other CMS Contractors. Exhibit C-12 below identifies the populations used for analysis of each type of HHVBP Connect activity or resource. We used data for CY 2017 and, where relevant, compared to CY 2016 data.

[27] CMS (2016) Home Health Value-Based Purchasing Model. Accessed from here.
[28] Primarily, CMS staff and its contractors.

Exhibit C-12. Population Analyzed for Each HHVBP Connect Activity/Resource

HHVBP Connect Activity/Resource	Description of Population
Monthly Unique Visitors	All HHVBP Connect Users*
"Chatter" Activity	All HHVBP Connect Users*
Resource Downloads	All HHVBP Connect Users*
Webinar Participation	HHAs Only

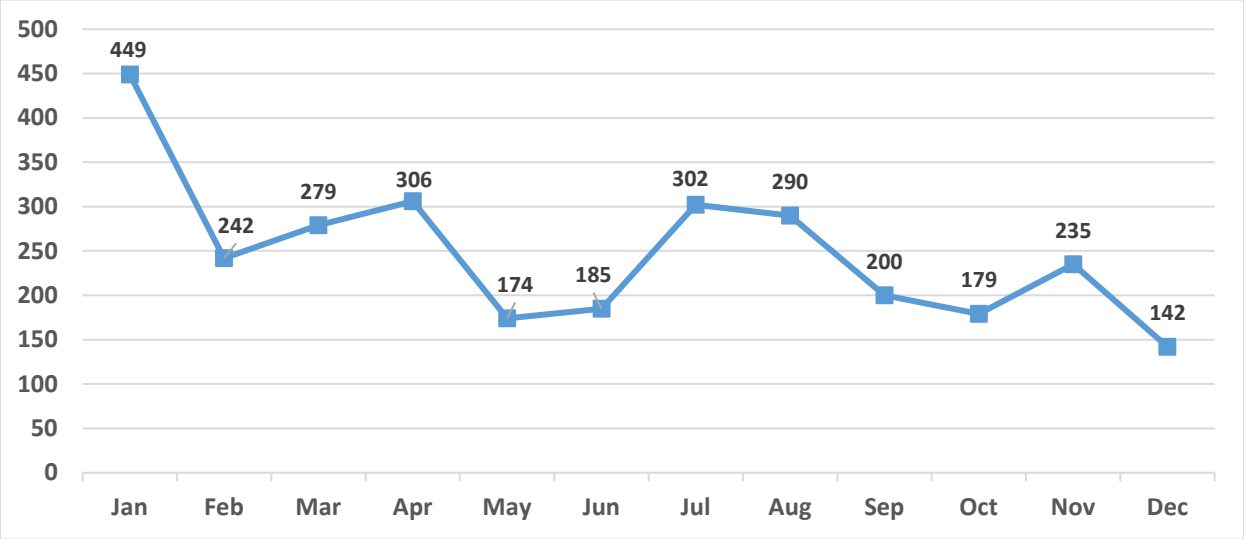
**Based on available 2016 and 2017 data, approximately 97.8% of all HHVBP Connect users are HHAs (identified via the HHVBP Connect user profile name variable sent by the Technical Assistance Contractor).*

C.7.3 Summary of Participation and Resource Use

C.7.3.1 Monthly Unique Visitors to HHVBP Connect

New in 2017, the HHVBP Technical Assistance Contractor tracked the number of monthly unique visitors for all HHVBP Connect users via weekly dashboards. Users were required to enter a user name and password for each login to the HHVBP Connect website. Monthly unique visitor data represent the aggregate activity across all users. The highest number of monthly unique visitors (449) occurred in January 2017; monthly unique visitors declined throughout the remainder of the year, with the lowest number of visitors (142) occurring in December 2017 (Exhibit C-13).

Exhibit C-13. Monthly Unique Visitors to HHVBP Connect in 2017, by Month



Data include unique logins by all HHVBP Connect users, 97.8% of whom are HHAs. Data not available for 2016.

C.7.3.2 Use of HHVBP Connect Library Resources and Live Webinar Participation

The most frequently used HHVBP Connect resources were downloading files posted in the website's library and participation in live webinars. This was consistent with use of HHVBP Connect in 2016, although total number of downloads and webinar participation were both lower in 2017.

Download of HHVBP Connect Library Resources

To provide assistance to HHAs, the HHVBP Technical Assistance Contractor made several resources available in the HHVBP Connect Library on a broad range of topics and categories. Throughout 2017, the HHVBP Technical Assistance Contractor created and shared 115 different library resources that were downloaded from the HHVBP Connect website in a variety of formats, including audio webinar

recordings and documents (e.g., PDFs, Excel files). This is a slight increase from 2016, which had 96 resources that were downloaded from the HHVBP Connect website.

In order to understand the types of content most frequently downloaded by users in the second year of the HHVBP Model, we grouped the library resources into three broad domains and counted the number of downloads corresponding to each domain (Exhibit C-14). These domains are similar to those from the first year of the HHVBP Model, allowing for a comparison across years.

- Domain 1 encompasses background material on the HHVBP Model and regularly updated reference documents (i.e., newsletters and FAQs). This domain contains similar resources to those offered in the first year of the Model (2016) as well as new materials (e.g., an environmental scan related specifically to HHVBP). The number of resources and downloads in this domain both increased in 2017 from 2016.
- Domain 2 provides materials to help HHAs understand and use resources and websites pertinent to the HHVBP Model, including HHVBP Connect and the HHVBP Secure Portal. As to be expected, use and availability of these resources was much higher in 2016 when the Model was newer, but declined in 2017 as HHAs became familiar with these resources (Exhibit C-15).
- Finally, Domain 3 includes materials developed by the Technical Assistance Contractor to facilitate quality improvement. These resources evolved slightly from an initial focus on understanding HHVBP measures and data in 2016 to providing guidance on improving on specific measures, more advanced understanding of TPS calculations, payment adjustments, IPRs, and other quality improvement resources in 2017. Resources about OASIS measures were most common in this domain. Availability and use of TPS and payment adjustment information aligns with the release of HHA TPS and payment adjustment reports, which HHAs were first able to access in August 2017.

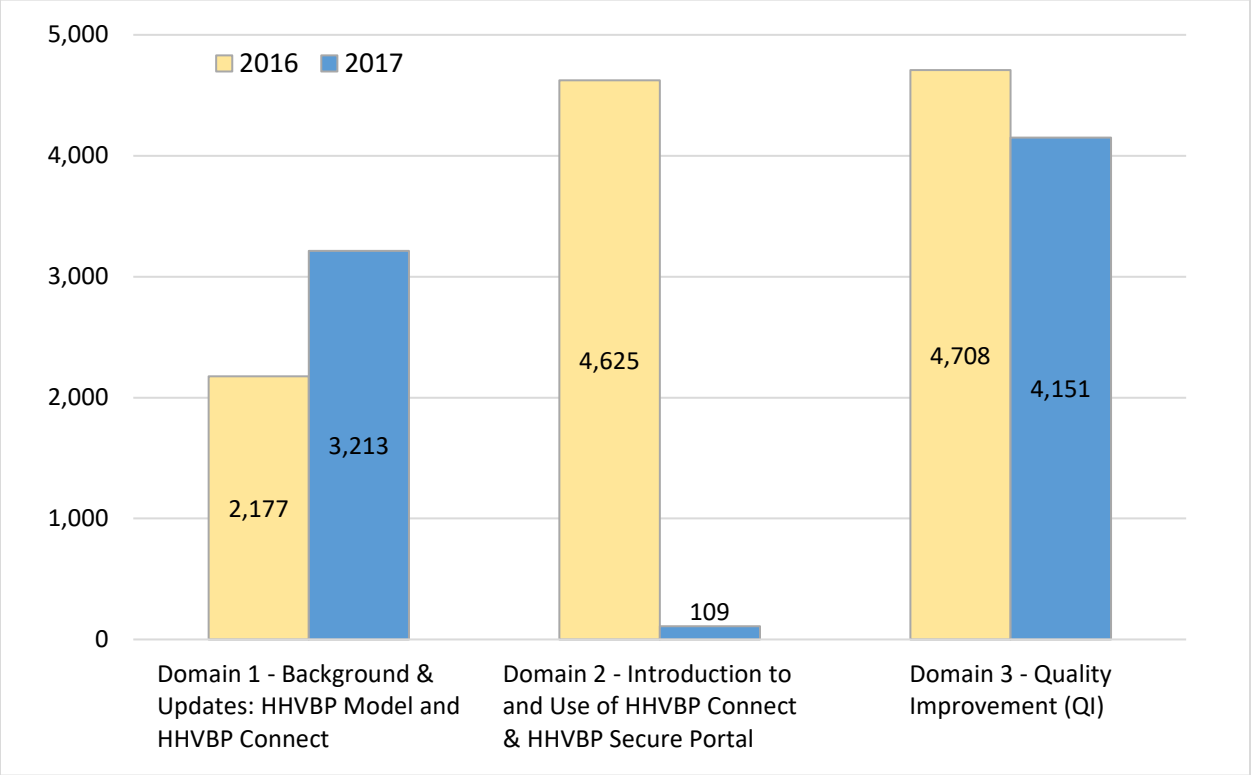
Exhibit C-14. HHVBP Connect Resource Domains and Downloads in 2017

	# of Downloaded Resources	# of Total Downloads	# of Downloads per Resource
Domain 1 – Background and Updates: HHVBP Model & HHVBP Connect	**42**	**3,213**	**76.4**
Monthly Updates – Newsletters & FAQs	*26*	*2,389*	*91.9*
Model Guides, Environmental Scans, & Background Information	*16*	*824*	*51.5*
Domain 2 – Introduction to and Use of HHVBP Connect & HHVBP Secure Portal	**2**	**109**	**54.5**
New Measure Submission	*2*	*109*	*54.5*
Introduction/Registration, User Manual, HHVBP Connect vs Secure Portal	*0*	*0*	*0.0*
Domain 3 – Quality Improvement	**71**	**4,151**	**58.5**
Specific HHVBP Measures	*33*	*2,248*	*68.1*
OASIS Measures	25	1,629	65.2
Claims Measures	3	238	79.3
HHCAHPS Measures	4	204	51.0
Self-Reported Measures	1	177	177.0
TPS Calculation & Payment Adjustments	*11*	*773*	*70.3*
Interim Performance Reports	*12*	*617*	*51.4*
Other Quality Improvement Resources	*15*	*513*	*34.2*
Organizational Assessment Tools & Plans	*0*	*0*	*0.0*
Total Downloads	***115***	***7,473***	***65.0***

Data include downloads by all HHVBP Connect users, approximately 97.8% of whom are HHAs.

Between 2016 and 2017, the total number of resources downloaded dropped 35%, from 11,510 in 2016 to 7,473 in 2017. The reduction in total downloads between 2016 and 2017 (4,037) largely reflects the large decrease in Domain 2 downloads (4,516); downloads of Domain 1 resources increased, and downloads of Domain 3 resources remained largely unchanged (Exhibit C-15). These year-to-year changes across Domains reflect the HHVBP Model evolution, with HHAs using update and quality improvement resources (i.e., Domains 1 and 3), but no longer downloading introductory information (i.e., Domain 2).

Exhibit C-15. Total Number of Resource Downloads by Domain and Description of Changes across HHVBP Model Years, 2016 and 2017

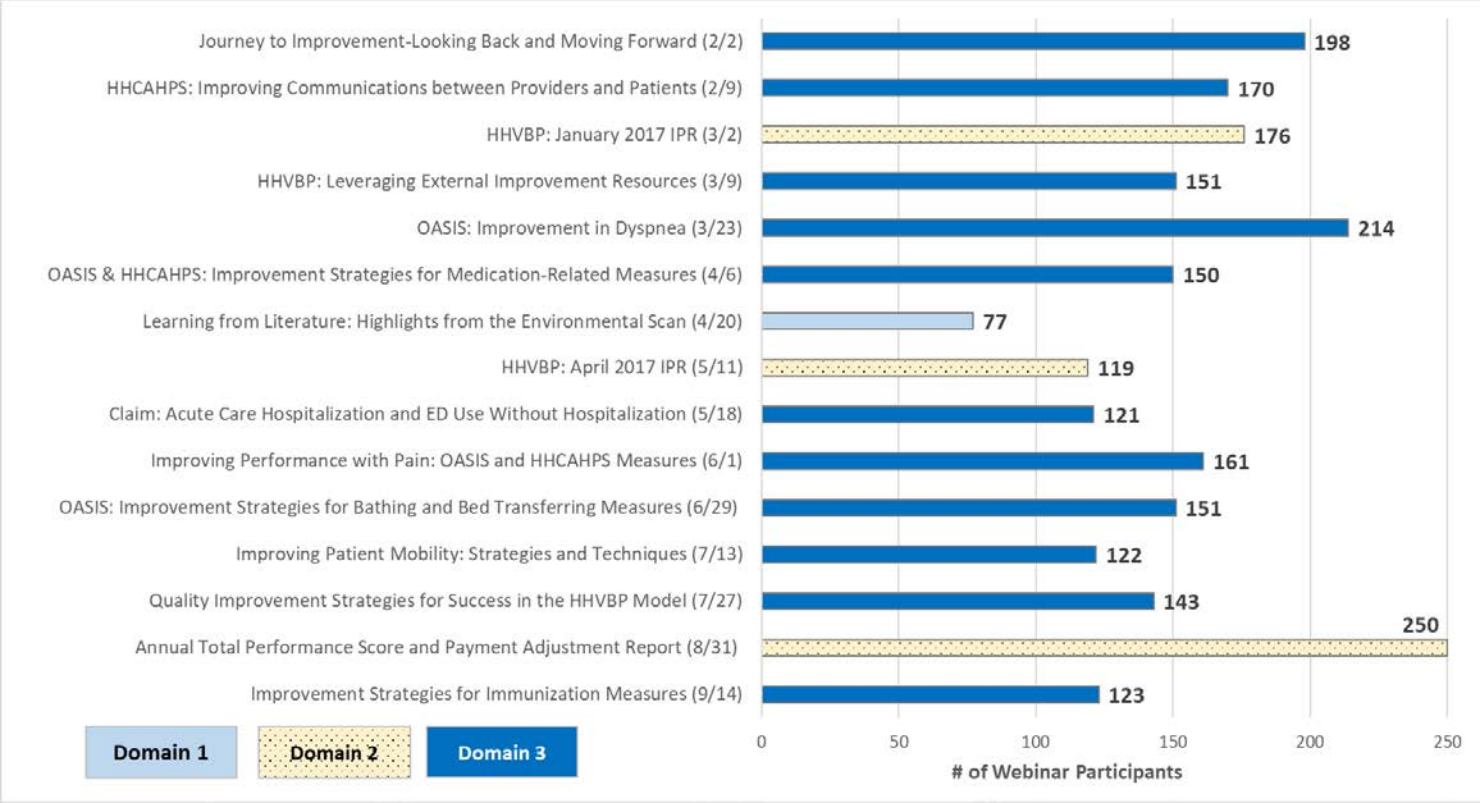


Data include downloads by all HHVBP Connect users, 97.8% of whom are HHAs.

HHVBP Connect Webinar Participation

In addition to resources available in the library, the HHVBP Technical Assistance Contractor hosted 15 webinars for HHAs on HHVBP Connect throughout 2017. Exhibit C-16 showcases the webinar topics, webinar date, and attendance by HHAs, listed by date of webinar. These data refer to live attendance to the online event and reflect HHAs only (i.e., does not include non-HHA participants). The webinar topics with the highest attendance was the Annual TPS and Payment Adjustment Report in August 2017 (250 participants). The average number of participants per webinar was 155; this is down from over 400 average participants per webinar across the same number of webinars (15) in 2016.

Exhibit C-16. HHVBP Connect Webinar Topics and Participation in 2017 by Domain



Data include HHAs only. Webinar participation refers to attendance during the live online event.

Analyses of HHVBP Connect Webinar Participation across HHA Characteristics

We analyzed the following HHA characteristics to understand the types of HHAs that were participating in HHVBP Connect webinars: ownership type, setting, and size cohort. We used the POS for ownership and setting values and the 2017 Preliminary TPS/payment Adjustment Report for size cohort. We assigned HHA characteristics to the CCNs that were self-reported by webinar participants. Invalid CCNs (i.e., CCNs with invalid values; corresponded to HHAs in non-HHVBP states, or did not have a FFS claim in 2017) were excluded from the analyses. Total HHAs included all HHAs that could have participated; this was defined as any HHA in the nine HHVBP states with at least one paid FFS claim in 2017.[29] Webinar participants included unique HHAs (defined by CCN) that participated in at least one webinar in 2017.

Nearly one-third (30.6%) of all HHAs in HHVBP states participated in at least one webinar in 2017 (N=649), a decrease from 2016 where 53% of HHAs participated in at least one webinar. Compared to all HHAs in the nine HHVBP states, HHA webinar participant rates were higher among non-profit HHAs, hospital-based HHAs, and large and entire state cohort HHAs (Exhibit C-17).

[29] This includes HHAs that closed before the end of 2017.

Exhibit C-17. HHA Characteristics among 2017 Webinar Participants

HHA Characteristic		Unique HHA Webinar Participants*	HHAs in All HHVBP States**	Webinar Participation Rate by HHA Characteristic
Total		**649**	**2,119**	**30.6%**
Ownership Type	For-profit	390	1,654	23.6%
	Non-profit	191	326	58.4%
	Government	68	139	49.4%
Setting	Freestanding	547	1,944	28.1%
	Hospital-based	102	175	58.5%
Size	Small Cohort	30	153	19.6%
	Large Cohort	340	962	35.3%
	Entire State Cohort	218	501	43.5%
CY 2019 Payment Adjustment Categories* **	[-5%, -3%]	9	60	15.0%
	(-3%, -1%]	133	403	33.0%
	(-1%, 0%]	171	383	44.7%
	(0%, 1%]	155	393	39.4%
	(1%, 3%]	110	327	33.6%
	(3%, 5%]	10	50	20.0%
	Missing (No Payment Adjustment)	61	503	12.1%

HHA characteristics from CY 2017.
**Unique HHA webinar participants represent each unique HHA that participated in at least one webinar in 2017.*
***Total number of HHAs in the nine HHVBP states with at least one paid FFS claim in 2017; includes HHAs that closed before the end of 2017.*
****CY 2019 Payment adjustments (announced to HHVBP HHAs in Fall 2018) determined by HHA performance in 2017.*

Exhibit C-17 also presents HHVBP Connect webinar participation in 2017 by the CY 2019 payment adjustment categories (which were determined by HHA performance in 2017). The participation rate among HHAs that received a TPS was higher than HHAs that did not receive a payment adjustment (36.4% vs. 12.1%). Participation varied across payment categories, with the lowest participation among HHAs that received the lowest and highest payment adjustments.

C.7.3.3 Participation in HHVBP Connect's "Chatter" Feature

The HHVBP Connect website's "Chatter" feature provides an interactive online community where HHAs are invited to "post status updates, share files and links with other users, 'like' posts and documents, 'follow' people and groups, and share tools, resources, and documents with other users and groups."[30]

The Technical Assistance Contractor tracked the "Chatter" feature via weekly dashboards throughout 2017. "Chatter" activity includes online posts and subsequent responses. We used the last dashboard of each month for our analyses (e.g., December 2017 login data is drawn from the December 31, 2017 dashboard). Users of the "Chatter" feature, who include both HHAs and HHVBP Technical Assistance Contractor staff, posted 131 times during 2017, with 11 posts per month on average. This is a decrease

[30] "HHVBP Connect Website Overview" Slides from February 11, 2016 Webinar.

from 2016, which had an average of 31 posts per month. Exhibit C-18 displays the monthly posts of the "Chatter" feature in 2016 and 2017.

Exhibit C-18. HHVBP Connect "Chatter" Activity by All HHVBP Connect Users in 2016 and 2017, by Month

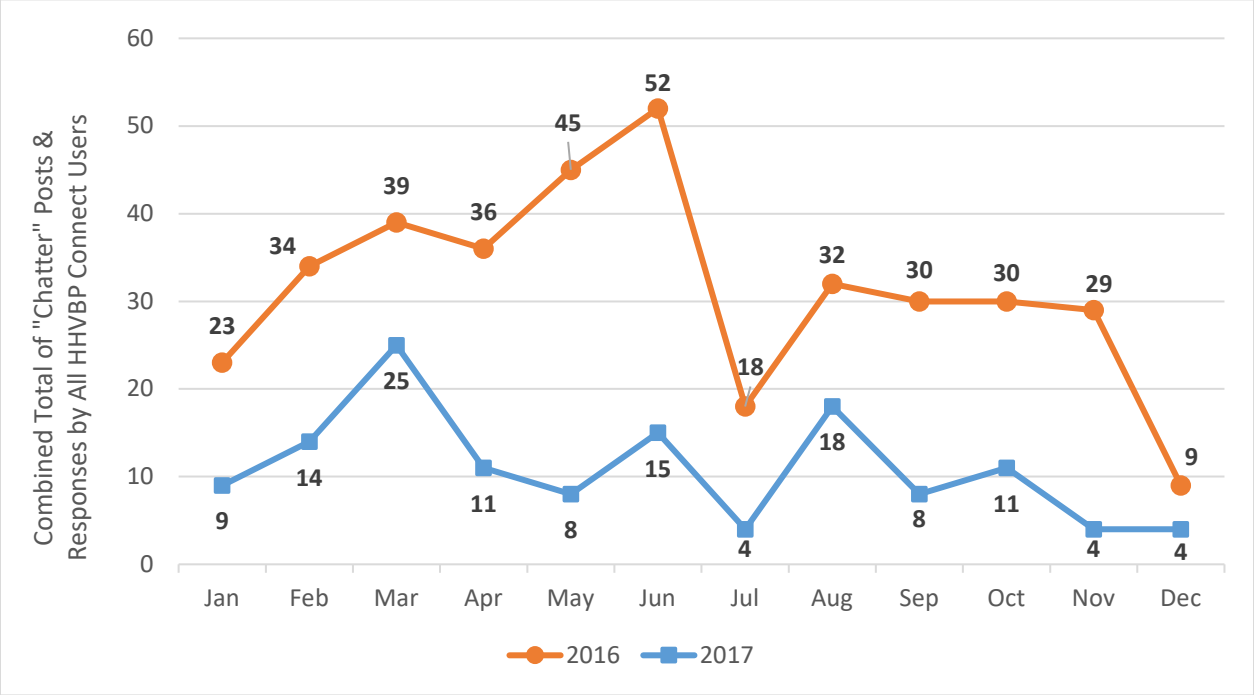


Exhibit C-19 below summarizes the "Chatter" activity between the Technical Assistance Contractor and HHAs in 2016 and 2017. This activity was captured through a manual count of HHVBP Connect "Chatter" activity in order to learn which posts were made by HHAs versus non-HHAs. The manual count yielded very similar results to the dashboard results displayed in Exhibit C-18, however, the totals do show a slight variation.

In 2017, HHVBP Technical Assistance staff accounted for the majority of the "Chatter" feature activity (89 of the 121 posts and responses). Their posts and responses were focused primarily on the promotion of upcoming online events (e.g., a webinar) or newly available resources (e.g., an updated FAQ document), responding to HHA questions, and referrals to the HHVBP Help Desk. This content and number of posts by HHVBP Technical Assistance staff were similar to 2016. However, responses from HHVBP Technical Assistance staff decreased from 2016 to 2017 (87 versus 20, respectively), which is reflective of the decrease in HHA activity from 2016 to 2017 (219 vs. 32, respectively).

Exhibit C-19. "Chatter" Posts and Responses by Technical Assistance Contractor and HHAs in 2016 and 2017

	2016	2017	Percent Change
HHVBP Technical Assistance Staff Total	**163**	**89**	**-45%**
Posts	*76*	*69*	*-9%*
Responses	*87*	*20*	*-77%*
HHA Users Total	**219**	**32**	**-85%**
Posts	*29*	*11*	*-62%*
Responses	*190*	*20*	*-89%*
Total	**382**	**121**	**-68%**