

Expanded Home Health Value-Based Purchasing (HHVBP) Model

An Overview: Risk Adjustment Process and Use in the Expanded HHVBP Model

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Introduction

Beginning January 1, 2022, the Centers for Medicare & Medicaid Services (CMS) launched the expanded Home Health Value-Based Payment (HHVBP) Model to incentivize all Medicare-certified home health agencies (HHAs) in the 50 States, District of Columbia, and U.S. territories to provide higher quality and more efficient care within the Medicare Home Health Prospective Payment System (HH PPS). For each HHA participating in the expanded HHVBP Model, HH PPS final claim payments are adjusted based on their performance on applicable quality measures in the following categories: Outcome and Assessment Information Set (OASIS)-based, claims-based, and the Home Health Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey-based.

To help HHAs understand the processes involved in risk-adjusting the applicable quality measures in the expanded HHVBP Model, the HHVBP Technical Assistance (TA) Team created this document to provide relevant information pertaining to risk adjustment within the expanded Model, including definitions, resources, and examples. The following sections explain the concept of risk adjustment, why risk adjustment is important, and the process for risk adjustment, using the quality measures in the OASIS-based category as an example.

What is Risk Adjustment?

Risk adjustment is a statistical process that incorporates the underlying health and functional status of patients when looking at their health care outcomes. This is important when assessing health care service quality because some patients have more complex needs than others and not all patients are expected to improve to the same degree within the same amount of time. The risk adjustment methodology used within the expanded HHVBP Model is the same as used for the [Home Health Quality Reporting Program](#) (HH QRP).

Why is Risk Adjustment Important?

Patient case mix is a statistical profile of clinical and functional characteristics of the population served by an HHA. Risk adjustment is necessary to account for differences in patient case mix among different HHAs that affect performance on outcome measures. That is, age and pre-existing conditions impact how patients perform on outcome measures and risk adjustment accounts for the differing types of patients served by HHAs and enables comparison across HHAs. These same risk adjustment methods are employed in other quality measures, such as the hospital-based mortality measures, to prevent providers from avoiding the sickest patients and preferencing the healthiest.

Risk adjustment levels the playing field by allowing for a meaningful comparison of HHA performance.

Risk adjustment accounts for the differing types of patients served by HHAs and enables comparison across HHAs. Although not accounting for all factors due to the limitations of data collection, the risk adjustment methodology is rigorously designed to capture as many differences in the patient population served by different HHAs as possible. Accounting for these differences through the risk adjustment process recognizes the challenges HHAs face in serving the most complex home health patients.

How are Risk-Adjusted HHVBP Measures Defined?

There is a tailored risk adjustment methodology for each expanded HHVBP Model measure type to ensure fair and meaningful comparisons of care quality across HHAs. To understand the risk adjustment process for each quality measure, it is important to know the data source and patient population for the three (3) measure categories. Detailed definitions of the following OASIS, claims, and HHCAHPS survey-based measures are available in the Appendix, [Table A1](#).

OASIS-based measures

The five (5) OASIS-based outcome measures are:

1. Discharged to Community
2. Improvement in Dyspnea
3. Improvement in Management of Oral Medications
4. Total Normalized Composite (TNC) Change in Self-Care
5. Total Normalized Composite (TNC) Change in Mobility

The calculations for OASIS-based measures are based on home health quality episodes of patients covered by Medicare fee-for-service (FFS), Medicare Advantage, Medicaid FFS, and Medicaid managed care. For further information, please refer to the CMS technical specifications report, [Home Health Quality Measures – Outcomes](#), and the [HHVBP Model Technical Specifications Composite Outcome Measures](#) resource (available on the [Expanded HHVBP Model](#) webpage).

Claims-based measures

The two (2) claims-based utilization measures are:

1. Acute Care Hospitalization (ACH) During the First 60 Days of Home Health
2. Emergency Department (ED) Use without Hospitalization During the First 60 Days of Home Health

The calculations for claims-based utilization measures are based on home health stays for patients covered by Medicare FFS only.

HHCAHPS survey-based measures

The HHCAHPS survey-based measures capture the patient's care experience. These measures consist of three (3) composite and two (2) global measures:

1. Care of Patients – Patients who reported that their home health team gave care in a professional way. (Composite)
2. Communications between Providers and Patients – Patients who reported that their home health team communicated well with them. (Composite)
3. Specific Care Issues – Patients who reported that their home health team discussed medicines, pain, and home safety with them. (Composite)
4. Rating of Care – Rating of care provided by the agency. (Global)
5. Willingness to Recommend – Willingness to recommend the agency to friends and family. (Global)

The calculations for HHCAHPS measures include patients covered by Medicare FFS, Medicare Advantage, Medicaid FFS, and Medicaid managed care. The document titled [Steps for Calculating Global Ratings and Composite Scores for the HHCAHPS Survey](#) provides a step-by-step guide to calculating the five (5) HHCAHPS measures. Exclusions are listed in Section IX titled *Data Processing and Coding* of the [HHCAHPS Survey Protocols and Guidelines Manual](#).

How are the Expanded HHVBP Model Measures Risk-Adjusted?

The risk adjustment methods vary by each measure type (i.e., OASIS-based, claims-based, and HHCAHPS survey-based measures) but use similar principles to produce risk-adjusted measures that allow for meaningful comparison of HHA performance. This section provides the steps in the risk adjustment process using the OASIS-based measures as an example. Risk adjustment resources and technical specifications for OASIS-based, claims-based, and HHCAHPS survey-based measures can be found in the Appendix, [Table A1](#).

[Table A1](#) in the Appendix provides a list of risk factors used to risk adjust OASIS-based, claims-based, and HHCAHPS measures as well as additional helpful information.

Risk adjustment process for OASIS-based measures

In general, CMS conducts the risk adjustment process in three (3) stages for each OASIS-based measure—Building the Prediction Model, Aggregating the Results to the Agency Level, and Applying the Risk Adjustment Algorithm.

Stage 1 – Building the Prediction Model. This stage involves constructing the prediction model for each measure. Note that “prediction” models are commonly referred to as “risk adjustment” models because of their use to risk-adjust a given measure. CMS updates these prediction models regularly. Building the prediction models involves several steps, including drawing a random national sample, and creating, then calculating potential risk factors that are related to the measure. Please refer to [Table A2](#) in the Appendix for a high-level description of the steps involved in developing prediction models.

In this stage, calculation of an *observed value* for each measure for each eligible episode takes place. The *observed value* of an episode of care compares the patient’s reported status at end of care (EOC) to the status reported at start or resumption of care (SOC/ROC). After identifying in the national sample which, and to what degree, risk factors present at SOC/ROC are associated with the *observed value* of a given measure at EOC, this information is used to generate a *predicted value* for each eligible episode of care for this measure. Thus, the *predicted value* of an episode of care represents the expected status at EOC based on the risk factors present at SOC/ROC and the experience of similar patients nationally.

Stage 2 – Aggregating the Results to the Agency Level. The episode-level measure *observed* and *predicted* values generated in Stage 1 are then aggregated to the agency level. Each HHA receives two (2) average values for each measure – an *observed value* and a *predicted value*. The HHA’s *observed value* is the average of the observed (i.e., reported, without risk adjustment) values across all its eligible episodes of care. Correspondingly, the HHA’s *predicted value* is the average of the predicted values across all its eligible episodes. In addition, the average of the predicted values from all eligible episodes of care nationally is calculated to generate the *national predicted value*. These three (3) values (i.e., HHA’s observed, HHA’s predicted, and National predicted) are used in the final stage of the risk adjustment process.

Stage 3 – Applying the Risk Adjustment Algorithm. The three (3) values calculated in Stage 2 for a given measure are used to risk-adjust the agency’s performance yielding the HHA’s risk-adjusted value. The formula used in this final stage is the following:

$$\text{HHA}_{\text{Risk-Adjusted}} = (\text{HHA}_{\text{Observed}} - \text{HHA}_{\text{Predicted}}) + \text{National}_{\text{Predicted}}$$

- **HHA_{Risk-Adjusted}**: HHA’s risk-adjusted measure value.
- **HHA_{Observed}**: HHA’s average observed value for the measure.
- **HHA_{Predicted}**: HHA’s average predicted value for the measure. Predicted values are obtained from a regression model using a set of risk factors (described in Stage 1, above).
- **National_{Predicted}**: average predicted value across all eligible episodes in the nation.

The national predicted value for a given outcome constitutes the comparative standard representing the average of the expected status at EOC across all eligible episodes nationally. This benchmark is the basis for gauging if an HHA serves a patient population that is either more or less complex than the national average; the risk adjustment formula accounts for this difference accordingly. The section titled [“How can Risk-Adjusted HHVBP Measures be Interpreted?”](#) provides further information on how to interpret each component in the risk adjustment formula and their relation to one another.

Calculating HHA observed value (HHA_{Observed}) for OASIS-based measures

For each HHA, an observed value is created for every eligible quality episode of care for each quality measure. The episode’s observed value identifies the patient’s reported status at EOC compared to the SOC/ROC. For three (3) of the OASIS-based measures (Discharged to Community, Improvement in Management of Oral Medications, and Improvement in Dyspnea), each eligible episode is either identified as a “yes” (i.e., the conditions defined by the measure were met) or “no” (i.e., the conditions defined by the measure were not met). The **HHA observed value** is the number of “yes” episodes divided by the total number of eligible episodes. The [Risk Adjustment Technical Steps and Risk Factors Specifications](#) document provides additional detail on how to calculate the **HHA observed value**.

The observed value of an episode of care identifies the patient’s reported status at EOC compared to SOC/ROC.

For the remaining two (2) OASIS-based composite measures (TNC Self-Care and TNC Mobility), CMS assesses the total amount of change during the home health quality episode. The detailed steps involved in the measure specifications for these two (2) composite measures are listed in the [HHVBP Technical Specification Resource for Composite Outcome Measures](#) document, available on the [Expanded HHVBP Model webpage](#). In addition, the [HHVBP Model Composite Measure Calculation Steps](#) resource is available on the webpage.

Calculating National (National_{Predicted}) and HHA predicted (HHA_{Predicted}) values for OASIS-based measures

The **National predicted value** is the average of the predicted values across all eligible episodes of care nationally, whereas the **HHA predicted value** is the average of the predicted values across all eligible episodes of care for one HHA. The following paragraphs provide further information on the calculation of national and HHA predicted values.

For the three (3) OASIS-based outcome measures with a binary outcome (i.e., Discharged to Community, Improvement in Management of Oral Medications, and Improvement in Dyspnea), the [Risk Adjustment Technical Steps and Risk Factors Specifications](#) document provides programming logic for covariate definitions

and logistic regression coefficient values to calculate the National and HHA predicted values using the following formulas:

[1] Episode-level predicted Quality Measure value = $1/[1+e^{-X}]$

- Where e is the base of natural logarithms and X is a linear combination of the constant and the logistic regression coefficients times the covariate scores (from Formula [2], below).

[2] Quality Measure triggered (yes=1, no=0) = $B_0 + B_1*COV_1 + B_2*COV_2 + \dots B_N*COV_N$

- Where B_0 is the logistic regression constant, B_1 is the logistic regression coefficient for the first covariate, COV_1 is the episode-level value for the first covariate, B_2 is the logistic regression coefficient for the second covariate, and COV_2 is the episode-level value for the second covariate, etc.

The formulas to generate the episode-level predicted values for the two (2) TNC measures are slightly different. Because these measures are continuous (not binary), the risk adjustment models use ordinary least squares (OLS) to predict the episode-level value. The covariate definitions, regression constant and regression coefficients for the TNC measures are provided in the [HHVBP Technical Specification Resource for Composite Outcome Measures](#) document. The calculation of the National and HHA predicted values for the TNC measure includes the following formulas:

The predicted value of an episode of care represents the expected status at EOC.

[1] Episode-level predicted value for TNC Measure = X

- Where X is a linear combination of the constant and the OLS regression coefficients times the covariate scores (from Formula [2], below)

[2] $X = B_0 + B_1*COV_1 + B_2*COV_2 + \dots B_N*COV_N$

- Where B_0 is the OLS regression constant, B_1 is the OLS regression coefficient for the first covariate, COV_1 is the episode-level value for the first covariate, B_2 is the OLS regression coefficient for the second covariate, and COV_2 is the episode-level value for the second covariate, etc.

To generate the **HHA predicted value**, the episode-level data are summarized to agency-level data. As a result, each HHA has an **HHA predicted value**, which is the average of all episode-level predicted values.

How can Risk-Adjusted HHVBP Measures be Interpreted?

Risk adjustment of the expanded HHVBP Model quality measures allows for direct comparison of the quality performance of HHAs that may serve different patient populations. Quality performance is defined as the difference between expected and observed outcomes, with expected outcomes derived from prediction models that consider individual patient characteristics. **Table 1** illustrates three (3) examples of how the risk adjustment calculation for an OASIS-based measure, Improvement in Dyspnea, considers differences in agency performance and the patient population the agency serves based on the following formula:¹

$$HHA_{Risk-Adjusted} = (HHA_{Observed} - HHA_{Predicted}) + National_{Predicted}$$

¹ CMS uses a different formula to risk-adjust HHCAHPS measures, the interpretation of risk-adjusted measures are not directly applicable to this set of measures. Thus, the narrative in this section applies to OASIS-based measures only.

Table 1. Risk adjustment examples

Quality Outcome	HHA #1 Average Complexity	HHA #2 High Complexity	HHA #3 Low Complexity
HHA _{Observed}	68.5	65.3	70.4
HHA _{Predicted}	69.1	63.5	71.5
(HHA _{Observed} – HHA _{Predicted})	(-0.6)	(1.8)	(-1.1)
National _{Predicted}	70.2	70.2	70.2
HHA _{Risk-Adjusted}	69.6	72.0	69.1

1. HHA #1 (“Average Complexity”): $69.6 = (68.5 - 69.1) + 70.2$

This HHA has a predicted value of 69.1, which is lower than the national predicted value of 70.2. This indicates that the HHA patient population is relatively more complex than the national average. The observed value for this agency, 68.5, is lower than its predicted value of 69.1 resulting in a difference of -0.6. The risk adjustment equation gives this agency a small boost to its observed value of 68.5, resulting in a risk-adjusted value of 69.6.

2. HHA #2 (“High Complexity”): $72.0 = (65.3 - 63.5) + 70.2$

This HHA has a predicted value of 63.5, which is much lower than the national predicted value of 70.2, indicating that its patient population is much more complex than the national average. The agency’s observed value, 65.3, is higher than its predicted value of 63.5, resulting in a difference of 1.8. Hence, their risk-adjusted value of 72.0 is considerably higher than their observed value and is the highest among these three (3) HHAs, even though their observed value was the lowest among the three (3). This example illustrates how risk adjustment levels the playing field for agencies who serve more complex patients.

3. HHA #3 (“Low Complexity”): $69.1 = (70.4 - 71.5) + 70.2$

This HHA has a predicted value of 71.5 that is higher than the national predicted value of 70.2. This indicates that its patient population is less complex than the national average. The agency’s observed value, 70.4, is lower than its predicted value of 71.5, resulting in a difference of -1.1. When the risk adjustment formula is applied, HHA #3’s risk-adjusted value of 69.1 is the lowest of the three (3) agencies. This example illustrates that risk adjustment can eliminate any advantage an agency could have from serving patients with less complex care needs.

Conclusion

The information presented in this document provides an overview of the processes involved in risk adjusting expanded HHVBP Model quality measures. Please contact the HHVBP Model Help Desk at HHVBPquestions@lewin.com for any questions or feedback regarding this resource.

Appendix

Table A1. Resources at a Glance by Expanded HHVBP Model Measure Category

HHVBP Measure Category	Resource
OASIS-based Measures	<ul style="list-style-type: none"> • Home Health Quality Measures – Outcomes. This CMS technical specifications report includes titles and definitions for OASIS and claims-based measures; it is available in the <i>Downloads</i> section of the CMS Home Health Quality Measures Website. (Effective 1/1/2020) • Risk Adjustment Technical Steps and Risk Factor Specifications. Describes methods for risk-adjustment of OASIS-based home health outcome measures (not including TNC composites); it is available in the <i>Downloads</i> section of the CMS Home Health Quality Measures Website. (Effective 10/18/2021) • HHVBP Model Technical Specifications Composite Outcome Measures. The Technical Specifications document includes measure descriptions, specifications, exclusions, the list of risk factors, and the estimated risk factor coefficients for the two composite measures, Total Normalized Composite (TNC) Change in Mobility and TNC Change in Self-Care each composite. This is available on the Expanded HHVBP Model webpage. (Effective 10/20/2021)
Claims-based Measures	<ul style="list-style-type: none"> • Home Health Quality Measures – Outcomes. This CMS technical specifications report includes titles and definitions for OASIS and claims-based measures. It is available in the <i>Downloads</i> section of the CMS Home Health Quality Measures Website. (Effective 1/1/2020) • The prediction models for claims-based measures, Emergency Department Use Without Hospitalization and Acute Care Hospitalization, were generated based on home health stays from Medicare claims data in CY 2013. • For further information on the risk adjustment process for the two claims-based measures, please download the Claims Based AC and ED Use Measures Technical Documentation and Risk Adjustment set of materials from the <i>Downloads</i> section at the bottom of the CMS Home Health Quality Measures Website.
HHCAHPS Measures	<ul style="list-style-type: none"> • CMS recalculates the risk adjustment models for the HHCAHPS measures every quarter. The page titled Archived Publicly Reported Data on the HHCAHPS website provides the list of coefficients used to risk-adjust the HHCAHPS measures in addition to state and national averages, and HHA-level data for each quarter. <ul style="list-style-type: none"> ○ Under Survey and Protocols, the HHCAHPS website provides various survey materials, including the HHCAHPS questionnaire and the Protocols and Guidelines Manual. ○ Steps for Calculating Global Ratings and Composite Scores for the HHCAHPS Survey ○ HHCAHPS Survey Protocols and Guidelines Manual ○ The document titled Patient-Mix Adjustment Factors for Home Health Care CAHPS Survey Results Publicly Reported on Care Compare in January 2022 is available on the official HHCAHPS website and provides a detailed description of the risk adjustment process for HHCAHPS measures.

Developing, testing, and publishing a prediction model used for risk adjustment generally follows this process. For an example, please refer to the [Risk Adjustment Technical Steps and Risk Factor Specification](#) document.

Table A2. Summary of Process Involved in Building a Prediction Model

Step	Description
1	Create “development” and “validation” samples by randomly selecting subsets of episodes from the target (national) population.
2	Create and compute potential risk factors that are related to the quality outcome measures.
3	Using the development sample, compute a series of ordinary least squares or logistic regression calculations to identify which risk factors are statistically related to a quality outcome measure.
4	Complete a clinical review of statistically related risk factors for each prediction model for each quality outcome measure to validate from a clinical perspective.
5	Re-compute the prediction model (see Step 3) if any risk factor from a prediction model is rejected by the clinical review panel.
6	Compute and compare the results of applying the prediction models to the development and validation samples. Adjust model if the development and validation samples yield inconsistent results.
7	Present analytic results for the prediction model to a Technical Expert Panel for an independent final review prior to implementation.
8	Create and post the final set of technical specifications on the CMS Quality Measure Website.