Home Health Value-Based Purchasing (HHVBP) Model

A Compilation of Resources on Risk Adjustment in the HHVBP Model

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Introduction

The HHVBP Model incentivizes Medicare-certified Home Health Agencies (HHAs) in nine states to provide higher quality and more efficient care within the Medicare Home Health Prospective Payment System (HH PPS). For each HHA participating in the HHVBP Model, HH PPS final claim payments are adjusted based on their performance on OASIS-based, claims-based, and HHCAHPS quality outcome measures as well as submission of three New Measures.

In response to the continued interest among participating HHAs to understand the processes involved in risk adjusting HHVBP Measures, the HHVBP Technical Assistance Team created this document to compile relevant information pertaining to risk adjustment within the HHVBP Model, including definitions, resources, and examples.

The following sections explain the concept of risk adjustment, why risk adjustment is important, and how each HHVBP Measure is defined, risk-adjusted, and interpreted.

What Is Risk Adjustment?

Risk adjustment is a statistical process that incorporates the underlying health 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. Note that the risk adjustment models used within the HHVBP Model are the same as the ones used for all HHAs (e.g., Home Health Compare).

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

Why Is Risk Adjustment Important?

Every HHA serves a different patient population, commonly referred to as a patient case-mix or patient mix. Some HHAs have patients with more chronic and complex needs, while others primarily serve patients who recover from more acute concerns, like orthopedic surgery. These patients have different expected health outcomes and different expected costs.

Risk adjustment takes differences in HHA patient characteristics into account. This process ensures that an HHA that serves more complex patients (i.e., patients who are less likely to improve than the national average) is not penalized for serving this patient population. Risk adjustment captures as many differences in patient characteristics that influence a health outcome as possible. Although not all factors can be accounted for due to the limitations of data collection, the risk adjustment models are rigorously designed to maximize fit given these limitations. Accounting for these differences in patient characteristics 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?

Each HHVBP measure has a tailored risk adjustment model based on the data that are collected. All but the three New Measures (i.e., Influenza Vaccination Coverage for Home Health Care Personnel, Herpes Zoster Vaccination, and Advance Care Plan) are risk-adjusted to ensure fair and meaningful comparisons of care quality across HHAs in the HHVBP Model. The New Measures are not risk adjusted because HHAs receive points simply for submitting data.

OASIS-based, claims-based, and HHCAHPS measures are risk-adjusted – New Measures are not risk-adjusted.

To understand the risk adjustment process for each measure, it is important to know how each measure is defined.

The six OASIS-based outcome measures are:

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

The calculations for OASIS-based outcome measures are based on home health episodes of patients who are covered by Medicare fee-for-service (FFS), Medicare Advantage, Medicaid FFS, and Medicaid managed care.

The two claims-based utilization measures are:

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

The calculations for claims-based utilization measures are based on home health episodes of patients who are covered by Medicare FFS only. Table A2 in the Appendix provides detailed definitions of the six OASIS-based and two claims-based measures. For further information, please refer to the document titled Home Health Outcome Measures Table OASIS-D and the *HHVBP Technical Specification Resource for Composite Outcome Measures* available on *HHVBP Connect*.

The five **HHCAHPS measures** are designed to capture the patient's care experience. These measures include three composite and two global measures:

1) Care of Patients – How often the home health team provided care in a professional way? (Composite)
2) Communications between Providers and Patients – *How well did the home health team communicate with patients?* (Composite)
3) Specific Care Issues – Did the home health team discuss medicines, pain, and home safety with patients? (Composite)
4) Rating of Care – How do patients rate the overall care from the home health agency? (Global)

5) Willingness to Recommend – Would patients recommend the home health agency to friends and family? (Global)

The calculations for HHCAHPS measures include patients who are 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 HHCAHPS measures. Exclusions are listed in Section IX titled *Data Processing and Coding* of the HHCAHPS Survey Protocols and Guidelines Manual.

How Are HHVBP Measures Risk Adjusted?

The risk adjustment methods vary by OASIS-based, claims-based, and HHCAHPS measures. Due to the similarities in methods, this section focuses on the risk adjustment process used for claims-based and OASIS-based measures. The risk adjustment process for HHCAHPS measures is different from the process described in the following paragraphs. Please refer to the document titled Patient-Mix Adjustment Factors for Home Health Care CAHPS Survey Results Publicly Reported on Home Health Compare in October 2019 on the official HHCAHPS website that outlines this process for HHCAHPS measures in detail.

Table A3 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.

In general, the Centers for Medicare and Medicaid Services (CMS) conducts the risk adjustment process in three stages for each quality outcome for claims-based and OASIS-based measures:

1) **Building the Prediction Model** – A statistical model is created to predict the outcome of a home health patient for a given quality outcome.
2) **Aggregating the Results to the Agency Level** – The observed and predicted rates for each home health outcome are aggregated for each agency.
3) **Applying the Risk Adjustment Algorithm** – The HHA's observed rate is adjusted by the difference between the national predicted and the HHA's predicted rates.

In **Stage 1 – Building the Prediction Model** – the prediction model for each quality outcome is constructed. This stage is the most complicated phase in the risk adjustment process. Note that "prediction" models are commonly referred to as "risk adjustment" models because they are used to risk adjust a given outcome measure. CMS updates these prediction models regularly. Building the prediction models involves a number of steps, including drawing a random sample, creating and computing potential risk factors that are related to the outcome measure. Please refer to Table A4 in the Appendix for a high-level technical description of the steps involved in developing prediction models for risk adjustment of OASIS-based and claims-based measures. In this stage, an observed value for each eligible episode of care is computed. The observed value of an episode of care identifies the patient's actual status at EOC compared to SOC/ROC. After identifying which (and to what degree) risk factors present at SOC/ROC are associated with the observed value of a given outcome at EOC, this information is used to generate a predicted value for each eligible episode of care for this outcome. Thus, the

predicted value of an episode of care represents the expected status at EOC based on the risk factors present at SOC/ROC.

In **Stage 2** – **Aggregating the Results to the Agency Level** – The episode-level observed and predicted values generated in Stage 1 are then aggregated to the agency level. Further details on how HHA observed and HHA predicted rates are computed are discussed in the following two sections. Each HHA receives two average values for each quality outcome measure – an observed rate and a predicted rate. The HHA's observed rate is the average of the observed values across all eligible episodes of care. Correspondingly, the HHA's predicted rate 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 rate. These three rates (i.e., HHA's observed, HHA's predicted, and national predicted rates) are used in the final stage of the risk adjustment process.

In **Stage 3** – **Applying the Risk Adjustment Algorithm** – the three rates calculated in Stage 2 for a given home health outcome are used to risk adjust the agency's performance yielding the HHA's risk-adjusted outcome. The formula used in this final stage is the following:

Risk-Adjusted Outcome = HHA Observed Rate + (National Predicted Rate – HHA Predicted Rate)

Note that the risk adjustment formula contains two values specific to the HHA (its observed and predicted rates) and one national constant applicable to all agencies (i.e., the national predicted value for that outcome). 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 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 Rates

For each HHA, an observed rate is created for every eligible quality episode of care for each measure. The episode's observed value identifies the patient's actual status at the end of care (EOC) compared to the start or resumption of care (SOC/ROC).

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

For four of the **OASIS-based** measures (Discharged to Community, Improvement in Management of Oral Medications, Improvement in Pain Interfering with Activity, and Improvement in Dyspnea), each eligible episode is either identified as an "successful" (i.e., a patient improved between SOC/ROC and EOC) or "failure" (i.e., a patient did not improve between SOC/ROC and EOC). The HHA observed rate is the number of "successful" episodes divided by the total number of eligible episodes. Section II of the Risk Adjustment Technical Steps and Risk Factors Specifications document provides a detailed description of how to calculate the HHA Observed Rate.

The two OASIS-based composite measures, TNC Change in Mobility and TNC Change in Self-Care, assess the total amount of change – not just improvement – during the home health episode. Hence, the HHA observed rate for TNC Change in Mobility is the sum of the normalized change in mobility for all eligible episodes divided by the total number of eligible episodes of care. For more information on how CMS computes normalized change, please refer to the *HHVBP Composite Measure Calculation Steps* on *HHVBP Connect*. Similarly, the HHA observed rate for TNC Change in Self-Care is the sum of the normalized change in self-care for all eligible episodes divided by the total number of eligible episodes of care. The detailed steps involved in the measure specifications for these two composite measures are listed in the *HHVBP Technical Specification Resource for Composite Outcome Measures* document available on *HHVBP Connect*. Please also refer to the Appendix for a detailed account of how the two TNC measures are computed, including computational examples.

For the **claims-based** measures, ACH and ED Use, each eligible episode of care can be classified as follows: The patient was admitted to an acute care hospital unexpectedly, the patient used the ED (without hospitalization) unexpectedly, or the patient was neither admitted to an acute care hospital nor used the ED (without hospitalization) unexpectedly. Hence, the HHA observed rate for ACH is the sum of home health stays in which the patient was admitted to the hospital (numerator) divided by the number of home health stays that begin during the 12-month reporting period (denominator). The HHA observed rate for ED Use is the sum of home health stays in which the patient used the ED without hospitalization (numerator) divided by the number of home health stays for patients who have a Medicare FFS claim for outpatient ED use and no claims for acute care hospitalization in the 60 days following the start of the home health stay (denominator).

For the **HHCAHPS measures**, CMS generates five observed rates using the average of each HHA's most recent four quarters of data. Two of the five are global ratings (i.e., generated from a single question):

1) Overall Rating of Care (Question 20)
    - "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?"
2) Willingness to Recommend (Question 25)
    - "Would you recommend this agency to your family and friends if they needed home health care?"

To calculate each HHA's observed rate for "Overall Rating of Care", CMS calculates the proportion of survey respondents rating the HHA a 9 or 10 (numerator) to all eligible survey respondents. To calculate each HHA's observed rate for "Willingness to Recommend", CMS calculates the proportion of survey respondents answering this question with "Definitely Yes."

The last three of the five are composite measures that group related topics together:

3) Care of Patients (Questions 9, 16, 19 and 24)
4) Communications Between Providers and Patients (Questions 2, 15, 17, 18, 22 and 23)
5) Specific Care Issues (Questions 3, 4, 5, 10, 12, 13, and 14)

For further details on the questions included in the three composite HHCAHPS measures, please refer to the official HHCAHPS survey questionnaire available on the HHCAHPS website under Survey and Protocols. The construction of the composite measures is similar to the process involved in computing the two global ratings. However, given the composite measures are based on answers from *multiple* questions, the proportions of eligible answers are summed up and divided by the total number of questions included in the composite.[1]

A detailed description of how to calculate the HHA Observed Rates for each of the five HHCAHPS measures is included in the document titled Patient-Mix Adjustment Factors for Home Health Care CAHPS Survey Results Publicly Reported on Home Health Compare in October 2019.

Calculating National and HHA Predicted Rates

The **National Predicted Rate** is the average of the predicted values across all eligible episodes of care nationally, whereas the **HHA Predicted Rate** is the average of the predicted values across all eligible episodes of care for one HHA. The following paragraphs provide further information on how national and HHA predicted rates are calculated.

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

The exact formula to create predicted values differs by type of HHVBP measure. For all OASIS-based outcome measures with a binary outcome (i.e., Discharged to Community, Improvement in Management of Oral Medications, Improvement in Pain Interfering with Activity, and Improvement in Dyspnea), Section II of the Risk Adjustment Technical Steps and Risk Factors Specifications document provides a detailed description of how to calculate the HHA and National Predicted Rate using a logistic regression approach:

1) Episode-level predicted Quality Measure rate = $1/[1+e^{-X}]$
    - 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) = $B_0 + B_1*COVA + B_2*COVB + ... B_N*COV_N$
    - Where B_0 is the logistic regression constant, B_1 is the logistic regression coefficient for the first covariate, COVA is the episode-level rate for the first covariate, B_2 is the logistic regression coefficient for the second covariate, and COVB is the episode-level rate for the second covariate, etc. For further information on the regression coefficients, please refer to this supplemental document.

[1] Only valid responses are included in the HHCAHPS measures. The definition of valid responses for each HHCAHPS measure is explained in Section IX titled *Data Processing and Coding* of the HHCAHPS Survey Protocols and Guidelines Manual. In addition, further detail on the steps involved in calculating the five HHCAHPS measures are described in the document titled Steps for Calculating Global Ratings and Composite Scores for the HHCAHPS Survey.

A similar formula is used for claims-based measures and is further described in the zip file titled Claims Based ACH and ED Use Measures Technical Documentation and Risk-Adjustment.

The formula to generate the episode-level predicted rates for the TNC measures is slightly different because the risk adjustment models use Ordinary Least Squares (OLS) to predict the episode-level rate instead of logistic regressions used for the remaining OASIS-based and claims-based measures:

3) Episode-level predicted Rate 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)
4) $X = B_0 + B_1*COVA + B_2*COVB + ... B_N*COV_N$
    - Where B_0 is the OLS regression constant, B_1 is the OLS regression coefficient for the first covariate, COVA is the episode-level rate for the first covariate, B_2 is the OLS regression coefficient for the second covariate, and COVB is the episode-level rate for the second covariate, etc. The regression constant and regression coefficients are provided in the *HHVBP Technical Specification Resource for Composite Outcome Measures* document available on *HHVBP Connect*.

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

Note: The formulas used to risk adjust HHCAHPS measures do not align with those described in this section. For a detailed description of the risk adjustment models used for HHCAHPS measures, please refer to the document titled Patient-Mix Adjustment Factors for Home Health Care CAHPS Survey Results Publicly Reported on Home Health Compare in October 2019 available on the official HHCAHPS website.

How Can Risk-Adjusted HHVBP Measures be Interpreted?

The risk-adjustment process leads to improved risk-adjusted scores for HHAs with an above-average predicted score and a lower risk-adjusted score for those with a below-average predicted score. That is, an HHA that has a better observed than predicted value does better with its patients than would be predicted based on the prediction model for the quality measure outcome, as discussed in further detail in the following paragraphs.

The prediction models identified for different outcomes account for these different probabilities for improvement (or change) based on patient characteristics. HHAs with more clinically complex patients have lower predicted rates of success on some outcomes compared to agencies with less acute patients. However, because CMS adjusts their observed score by the difference between the national and their predicted rates, the risk adjustment adds this difference to their observed score resulting in the final risk-adjusted score. Using the risk adjustment formula introduced earlier in this document, **Table 1** illustrates three examples of how the risk adjustment calculation takes into account differences in

agency performance and the patient population the agency serves based on the following risk-adjustment formula:[2]

Risk-Adjusted Outcome = HHA Observed Rate + (National Predicted Rate – HHA Predicted Rate)

Table 1. Risk Adjustment Examples

Quality Outcome	HHA #1 ("Typical")	HHA #2 ("Complex")	HHA #3 ("Selective")
HHA Observed Rate	68.5	65.3	70.4
National Predicted Rate	70.2	70.2	70.2
HHA Predicted Rate	69.1	63.5	71.5
HHA Risk-Adjusted Rate	69.6	72.0	69.1

1) **HHA #1 ("Typical"): 69.6 = 68.5 + (70.2 – 69.1)**

This HHA does slightly worse than the national predicted value with its observed rate, but their patients are also predicted to do less well than the national predicted rate. The risk adjustment equation gives this agency a small boost to its observed rate of 68.5 by creating a risk-adjusted rate of 69.6.

2) **HHA #2 ("Complex"): 72.0 = 65.3 + (70.2 – 63.5)**

This HHA performs much worse than the national predicted rate, but better than what the prediction model indicates for their very challenging patients. Hence, their adjusted rate is considerably higher than their observed rate. This example illustrates how agencies who serve challenged patients can benefit from the risk adjustment process.

3) **HHA #3 ("Selective"): 69.1 = 70.4 + (70.2 – 71.5)**

This HHA reports a high observed rate, but their predicted rate suggests that their performance should be even higher given their patient population. When the risk adjustment formula is applied, HHA #3's risk-adjusted value is the lowest of the three agencies (69.1). This example illustrates that risk adjustment can reduce any advantage an agency might try to obtain by selectively choosing patients with less complex care needs.

Conclusion

This document was created to provide an overview of the processes involved in risk adjusting HHVBP Measures. The following appendix provides further detail, including links to relevant external resources in Table A1. Please contact the HHVBP Help Desk at HHVBPquestions@cms.hhs.gov if you have any questions or feedback regarding this resource.

[2] Since CMS does not use this 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 claims-based and OASIS-based measures only.

Appendix

Table A1. Risk Adjustment Resources at a Glance by HHVBP Measure Category

HHVBP Measure Category	Resource
Home Health Quality Outcome Measures	• Home Health Outcome Measures Table OASIS-D
OASIS-based Measures	• Risk Adjustment Technical Steps and Risk Factor Specifications. ○ The supplemental document on the updated prediction models for the OASIS-based outcome measures include the list of risk factors, model fit statistics, and the estimated risk factor coefficients. • The prediction models for Discharged to Community, Improvement in Dyspnea, Improvement in Management of Oral Medications, and Improvement in Pain Interfering with Activity were last updated in 2018 using quality episodes ending in CY2016. See the *Downloads* section at the bottom of the CMS Home Health Quality Measures Website. • The two composite measures, Total Normalized Composite (TNC) Change in Mobility and TNC Change in Self-Care were created in 2019 using quality episodes ending in CY2017. The Technical Specifications document titled *HHVBP Technical Specification Resource for Composite Outcome Measures* measure is available on *HHVBP Connect* and includes measure descriptions, specifications, exclusions, the list of risk factors, and the estimated risk factor coefficients for each composite.
Claims-based Measures	• 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 this set of materials from the *Downloads* section at the bottom of the CMS Home Health Quality Measures Website.
HHCAHPS Measures	• 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.

HHVBP Measure Category	Resource
	○ 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 Home Health Compare in October 2019 is available on the official HHCAHPS website and provides a detailed description of the risk adjustment process for HHCAHPS measures.

Table A2. Definition of OASIS-based and Claims-based Measures

Measure	Measure Description	Numerator	Denominator	Exclusions
Discharged to Community	Percentage of home health episode after which patients remained at home.	Number of home health episodes where the assessment completed at the discharge indicates the patient remained in the community after discharge.	Number of home health 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.	Home health quality episodes that end in patient death.
Improvement in Dyspnea	Percentage of home health quality episodes during which the patient became less short of breath or dyspneic.	Number of home health episodes of care where the discharge assessment indicates less dyspnea at discharge than at start or resumption of care.	Number of home health episodes of care ending with a discharge during the reporting period, other than those covered by generic or measure-specific exclusions.	Home health episodes of care for which the patient, at start or resumption of care, wasn't short of breath at any time, OR episodes that end in transfer to inpatient facility or death at home.
Improvement in Management of Oral Medications	Percentage of home health quality episodes during which the patient improved in ability to take their medicines correctly (by mouth).	Number of home health quality episodes where the value recorded on the discharge assessment indicates less impairment in taking oral medications correctly at discharge than at start (or resumption) of care.	Number of home health quality episodes ending with a discharge during the reporting period, other than those covered by generic or measure-specific exclusions.	Home health quality episodes for which the patient, at start/resumption of care, was able to take oral medications correctly without assistance or supervision, episodes that end with inpatient facility transfer or death, or patient is nonresponsive, or patient has no oral medications prescribed.
Improvement in Pain Interfering with Activity	Percentage of home health quality episodes during which the patient's frequency of	Number of home health episodes of care where the value recorded on the discharge assessment	Number of home health episodes of care ending with a discharge during the	Home health episodes of care for which the patient, at start or resumption of care, didn't have pain interfering with activity, OR episodes

Measure	Measure Description	Numerator	Denominator	Exclusions
	pain when moving around improved	indicates less frequent pain at discharge than at start or resumption of care.	reporting period, other than those covered by generic or measure-specific exclusions.	that end in transfer to inpatient facility or death at home.
Total Normalized Composite (TNC) Change in Mobility	Change in home health patients' mobility between start or resumption of care (SOC/ROC) and the end of care (EOC). This measure is a composite of three OASIS items related to mobility (i.e., M1840, M1850, and M1860).	Not Applicable	Number of home health episodes ending with a discharge during the reporting period, other than those covered by generic or measure-specific exclusions.	Home health quality episodes for which the patient was nonresponsive at SOC/ROC (M1700[1] = 04, or M1710[1] = NA, or M1720[1] = NA).
Total Normalized Composite (TNC) Change in Self-Care	Change in home health patients' self-care between start or resumption of care (SOC/ROC) and the end of care (EOC). This measure is a composite of six OASIS items related to self-care (i.e., M1800, M1810, M1820, M1830, M1845, and M1870).	Not Applicable	Number of home health episodes ending with a discharge during the reporting period, other than those covered by generic or measure-specific exclusions.	Home health quality episodes for which the patient was nonresponsive at SOC/ROC (M1700[1] = 04, or M1710[1] = NA, or M1720[1] = NA).
Acute Care Hospitalization During the First 60 Days of Home Health (ACH)	Percentage of home health stays in which patients were admitted to an acute care hospital during the 60 days following the start of the home health stay.	Number of home health stays for patients who have a Medicare FFS claim for an unplanned admission to an acute care hospital in the 60 days following the start of the home health stay.	Number of home health stays that begin during the 12-month observation period.	Home health stays that begin with a Low Utilization Payment Adjustment (LUPA) claim. Home health stays in which the patient receives service from multiple agencies during the first 60 days. Home health stays for patients who are not continuously enrolled in fee- for-service Medicare for the 6 months prior to the home health stay.

Measure	Measure Description	Numerator	Denominator	Exclusions
				Home health stays for patients who are not continuously enrolled in fee- for-service Medicare for the 60 days following the start of the home health stay or until death.
Emergency Department Use without Hospitalization During the First 60 days of Home Health (ED Use)	Percentage of home health stays in which patients used the emergency department but were not admitted to the hospital during the 60 days following the start of the home health stay.	Number of home health stays for patients who have a Medicare FFS claim for outpatient emergency department use and no claims for acute care hospitalization in the 60 days following the start of the home health stay.	Number of home health stays that begin during the 12-month observation period.	Home health stays that begin with a Low Utilization Payment Adjustment (LUPA) claim. Home health stays in which the patient receives service from multiple agencies during the first 60 days. Home health stays for patients who are not continuously enrolled in fee-for-service Medicare for the 6 months prior to the home health stay. Home health stays for patients who are not continuously enrolled in fee- for-service Medicare for the 60 days following the start of the home health stay or until death.

Table A3. Risk Factors Used to Risk Adjust by HHVBP Measure Category

Measure Category	Risk Factors Description		Additional Information
OASIS-based	Each risk factor is based on episode-level information collected at SOC/ROC via the current OASIS instrument (i.e., OASIS-D as of January 1, 2019). Although the initial set of risk factors is constant across the five OASIS-based measures, the prediction models vary by measure in terms of the number of risk factors included according to statistical significance and each risk factor's coefficient. The six OASIS-based measures are risk-adjusted using risk factors that fall into the following 35 initial main categories: 1) Age 2) Gender 3) Payment Source 4) SOC/ROC and Admission Source 5) Post-acute Care Facility 6) IV Therapies 7) Risk for Hospitalization	14) Urinary Status 15) Bowel Incontinence 16) Cognitive Function 17) Confusion 18) Anxiety 19) Depression Screening 20) Behavioral Symptoms 21) Disruptive Behavior Frequency 22) Grooming 23) Upper Body Dressing 24) Lower Body Dressing 25) Bathing 26) Surgical Wound 27) Dyspnea 28) Urinary Status 29) Bowel Incontinence 30) Cognitive Function 31) Confusion 32) Anxiety 33) Depression Screening 34) Behavioral Symptoms 35) Homecare Condition Codes	The prediction models for Discharged to Community, Dyspnea, and Pain Interfering with Activity were last updated in 2018 using quality episodes ending in CY2016. For further information, please refer to the resources provided in the "Downloads" section at the bottom of the CMS Home Health Quality Measures Website: • The Risk Adjustment Technical Steps and Risk Factor Specifications document provides a detailed description of the process to update prediction models used to risk adjust OASIS-based outcome measures, including pseudo code to compute risk factors. • This supplemental document on the updated prediction models for the OASIS-based outcome measures includes the list of risk factors, model fit statistics, and the estimated risk factor coefficients. • The two composite measures, Total Normalized Composite (TNC) Change in Mobility and TNC Change in Self-Care were created in 2019 using quality episodes ending in CY2017. The Technical

Measure Category	Risk Factors Description		Additional Information
	8) Availability of Assistance and Living Arrangement 9) Pain 10) Pressure Ulcers 11) Stasis Ulcers 12) Surgical Wound 13) Dyspnea		Specifications document, including measure descriptions, specifications, exclusions, the list of risk factors, and the estimated risk factor coefficients for each composite measure is available on *HHVBP Connect*.
Claims-based	Based on data collected from Medicare fee-for-service claims and therefore use a different set of risk factors for risk adjustment. The prediction models were generated based on home health stays from Medicare claims data in CY 2013. These risk factors fall into the five categories: 1) Prior Care Setting 2) Health Status 3) Demographics 4) Enrollment status 5) Interaction terms		For additional information, please refer to the zip file titled Claims Based AC and ED Use Measures Technical Documentation and Risk-Adjustment from the *Downloads* section at the bottom of the CMS Home Health Quality Measures Website.
HHCAHPS	The following eight patient-characteristics are used in the risk adjustment process: 1) Patient Age 2) Level of Education 3) Self-Reported Health Status 4) Self-Reported Mental/Emotional Status 5) Presence of Schizophrenia or Dementia 6) Residence Status (Does the patient live alone?) 7) Use of Proxy (Was the survey conducted by a proxy respondent?)		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. The document titled Patient-Mix Adjustment Factors for Home Health Care CAHPS Survey Results Publicly Reported on Home Health Compare in October 2019 is available on the official HHCAHPS website and

Measure Category	Risk Factors Description	Additional Information
	8) Survey Language (Was the survey conducted in a language other than English?) Unlike claims-based and OASIS-based measures, CMS recalculates the risk adjustment models for the HHCAHPS measures every quarter.	provides a detailed description of the risk adjustment process for HHCAHPS measures.

Table A4. Description of Steps Involved in Building the Prediction Model

Step	Description
1	Create a "development" sample by randomly selecting a subset of episodes from the target population.
2	Create and compute potential risk factors that are related to the quality outcome measures.
3	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	Create a "validation" sample by randomly selecting another, non-duplicative subset of episodes from the target population to validate the "development" sample.
7	Compute and compare the results of applying the prediction models to the development and validation samples.
8	Present analytic results for the prediction model to a Technical Expert Panel for an independent final review prior to implementation.
9	Create and post the final set of technical specifications on the CMS Quality Measure Website.