NATIONAL QUALITY FORUM

MEASURE WORKSHEET

This document summarizes the evaluation of the measure as it progresses through NQF's Consensus Development Process (CDP). The information submitted by measure developers/stewards is included after the Brief Measure Information, Preliminary Analysis, and Pre-meeting Public and Member Comments sections.

To navigate the links in the worksheet: Click to go to the link. ALT + LEFT ARROW to return

Purple text represents the responses from measure developers.

Red text denotes developer information that has changed since the last measure evaluation review.

Brief Measure Information

NQF #: 3449

Corresponding Measures:

De.2. Measure Title: Hospitalization for Ambulatory Care Sensitive Conditions for Dual Eligible Beneficiaries

Co.1.1. Measure Steward: Centers for Medicare and Medicaid Services

De.3. Brief Description of Measure: For dual eligible beneficiaries age 18 years and older, rates of hospital admissions for ambulatory care sensitive conditions (ACSC) per 1,000 beneficiaries for ACSC by chronic and acute conditions. This measure has three rates reported as both observed and risk-adjusted rates:

- Chronic Conditions Composite
- Acute Conditions Composite
- Total (Acute and Chronic Conditions) Composite

This rate is stratified and reported for three populations: (1) community-dwelling home and community-based services (HCBS) users; (2) community-dwelling non-HCBS users; or, (3) non-community-dwelling (institutionalized) population.

1b.1. Developer Rationale:

S.4. Numerator Statement: Chronic Composite: Number of acute inpatient hospital admissions in the measurement year for diabetes short term complications, diabetes long term complications, uncontrolled diabetes, low-extremity amputation, chronic obstructive pulmonary disease (COPD), asthma, hypertension, and heart failure.

Acute Composite: Number of acute inpatient hospital admissions in the measurement year for bacterial pneumonia, urinary tract infection, cellulitis and pressure ulcers.

Total Composite: Sum of acute and chronic composites

S.6. Denominator Statement: Dual eligible adults age 18 years and older

S.8. Denominator Exclusions: See the numerator details section for exclusions from the individual composite indicators

- Hospitalizations for obstetrics
- Hospice
- Acute hospital transfers

De.1. Measure Type: Composite

S.17. Data Source: Claims

S.20. Level of Analysis: Population: Regional and State

IF Endorsement Maintenance – Original Endorsement Date: Most Recent Endorsement Date:

IF this measure is included in a composite, NQF Composite#/title:

IF this measure is paired/grouped, NQF#/title:

De.4. IF PAIRED/GROUPED, what is the reason this measure must be reported with other measures to appropriately interpret results?

Preliminary Analysis: New Measure

Criteria 1: Importance to Measure and Report

1a. Evidence

1a. Evidence. The evidence requirements for a health outcome measure include providing empirical data that demonstrate a relationship between the outcome and at least one healthcare structure, process, intervention, or service; if these data not available, data demonstrating wide variation in performance, assuming the data are from a robust number of providers and results are not subject to systematic bias. For measures derived from patient report, evidence also should demonstrate that the target population values the measured outcome, process, or structure and finds it meaningful.

Evidence Summary

- This is a composite measure of hospitalizations for ambulatory care sensitive conditions for dual eligible beneficiaries.
- The developer notes that improvement on this outcome will require early identification of complications from acute or chronic conditions and initiation of treatment or referral to treatment.

Question for the Committee:

- *Is there at least one thing that the provider can do to achieve a change in the measure results?*

Guidance from the Evidence Algorithm

Box 1: The measure assesses a healthcare outcome →Box 2: The developer has provided empirical data that there is a relationship between the measured outcome and at least one healthcare outcome → Pass

The highest possible rating is pass.

Preliminary rating for evidence: ☒ **Pass** ☐ **No Pass**

1b. Gap in Care/Opportunity for Improvement and 1b. Disparities

Maintenance measures – increased emphasis on gap and variation

1b. Performance Gap. The performance gap requirements include demonstrating quality problems and opportunity for improvement.

- The developer notes significant variation across states in performance with regard to risk adjusted total rate of hospitalization for community-dwelling HCBS population, non-HCBS population, and institutionalized populations.

Disparities

- The developer noted that testing of the measure showed disparities by age (between older and younger dual eligible beneficiaries), gender, and type of LTSS (i.e., non-HCBS, HCBS, and institutional users) in the unadjusted results.

Questions for the Committee:

- Is there a gap in care that warrants a national performance measure?

Preliminary rating for opportunity for improvement: ☐ High ☒ Moderate ☐ Low ☐ Insufficient

RATIONALE:

1c. Composite – Quality Construct and Rationale

1c. Composite Quality Construct and Rationale. The quality construct and rationale should be explicitly articulated and logical; a description of how the aggregation and weighting of the components is consistent with the quality construct and rationale also should be explicitly articulated and logical.

- This is a composite measure of ambulatory sensitive conditions for dual-eligible beneficiaries. This measure is constructed from individual ambulatory care sensitive condition-specific measures. This composite measure provides an overall rate of hospitalization for ambulatory care sensitive conditions for dual eligible adults in the state, which could help states understand a more complete picture of the quality of outpatient care for dual eligible beneficiaries.
- The composite has three rates: chronic conditions, acute conditions and total (combined chronic and acute conditions).
- The component measures in the Chronic Composite are:
    - #0272 Diabetes Short-Term Complications Admission Rate (PQI 01)
    - #0274 Diabetes Long-Term Complications Admission Rate (PQI 03)
    - #0638 Uncontrolled Diabetes Admission Rate (PQI 14)
    - #0285 Lower-Extremity Amputation among Patients with Diabetes Rate (PQI 16)
    - #0275 Chronic Obstructive Pulmonary Disease (COPD) or Asthma in Older Adults Admission Rate (PQI 05)
    - #0283 Asthma in Younger Adults Admission Rate (PQI 15)
    - #0277 Congestive Heart Failure Admission Rate (PQI 08)
    - #0276 Hypertension Admission Rate (PQI 07) (this measure is no longer NQF endorsed)
- The component measures in the Acute Composite Component are:
    - #0279 Community Acquired Pneumonia Admission Rate (PQI 11)
    - #0281 Urinary Tract Infection Admission Rate (PQI 12)
    - Cellulitis Admission Rate
    - Pressure Ulcers Admission Rate
- All of the above individual measure components are included in the total composite.
- Each individual component measure is weighted equally, as each represents a potentially avoidable hospitalization.

Questions for the Committee:

- Are the quality construct and a rationale for the composite explicitly stated and logical?
- Is the method for aggregation and weighting of the components explicitly stated and logical?

Preliminary rating for composite quality construct and rationale:
☐ High ☒ Moderate ☐ Low ☐ Insufficient

Committee Pre-evaluation Comments:
Criteria 1: Importance to Measure and Report (including 1a, 1b, 1c)

1a. Evidence to Support Measure Focus: For all measures (structure, process, outcome, patient-reported structure/process), empirical data are required. How does the evidence relate to the specific structure,

process, or outcome being measured? Does it apply directly or is it tangential? How does the structure, process, or outcome relate to desired outcomes? For maintenance measures –are you aware of any new studies/information that changes the evidence base for this measure that has not been cited in the submission?For measures derived from a patient report: Measures derived from a patient report must demonstrate that the target population values the measured outcome, process, or structure.

- Yes. Evidence supplied
- None

1b. Performance Gap: Was current performance data on the measure provided? How does it demonstrate a gap in care (variability or overall less than optimal performance) to warrant a national performance measure? Disparities: Was data on the measure by population subgroups provided? How does it demonstrate disparities in the care?

- Yes. Gap provided
- population is duals but no measures beyond that

1c. Composite Performance Measure - Quality Construct (if applicable): Are the following stated and logical: overall quality construct, component performance measures, and their relationships; rationale and distinctive and additive value; and aggregation and weighting rules?

- Logical construct provided
- Yes, but doesn't weigh data such as "no shows" from clinic

Criteria 2: Scientific Acceptability of Measure Properties

2a. Reliability: Specifications **and** Testing

2b. Validity: Testing**;** Exclusions**;** Risk-Adjustment**;** Meaningful Differences**;** Comparability Missing Data

2c. For composite measures: empirical analysis support composite approach

Reliability

2a1. Specifications requires the measure, as specified, to produce consistent (reliable) and credible (valid) results about the quality of care when implemented. For maintenance measures – no change in emphasis – specifications should be evaluated the same as with new measures.

2a2. Reliability testing demonstrates if the measure data elements are repeatable, producing the same results a high proportion of the time when assessed in the same population in the same time period and/or that the measure score is precise enough to distinguish differences in performance across providers. For maintenance measures – less emphasis if no new testing data provided.

Validity

2b2. Validity testing should demonstrate the measure data elements are correct and/or the measure score correctly reflects the quality of care provided, adequately identifying differences in quality. For maintenance measures – less emphasis if no new testing data provided.

2b2-2b6. Potential threats to validity should be assessed/addressed.

Composite measures only:

2d. Empirical analysis to support composite construction. Empirical analysis should demonstrate that the component measures add value to the composite and that the aggregation and weighting rules are consistent with the quality construct.

Complex measure evaluated by Scientific Methods Panel? ☒ **Yes** ☐ **No**

Evaluators:

- Larry Glance
- Karen Joynt Maddox
- Marybeth Farquhar
- Eugene Nuccio
- Christie Teigland
- Steve Horner

Evaluation of Reliability and Validity (and composite construction, if applicable):

Summary of Methods Panel Review:

Subgroup members found the measure to be reliable and valid in their preliminary analyses. This measure was not discussed during their measure evaluation call.

Standing Committee Action Item(s):

- The Standing Committee can discuss reliability and/or validity, or accept the Scientific Methods Panel ratings. It is important to note that the appropriateness of inclusion or exclusion of social risk factors was not within scope for the Scientific Methods Panel ratings.

Questions for the Committee regarding reliability:

- Do you have any concerns that the measure can be consistently implemented (i.e., are measure specifications adequate)?
- The Scientific Methods Panel is satisfied with the reliability testing for the measure. Does the Committee think there is a need to discuss and/or vote on reliability?

Questions for the Committee regarding validity:

- Do you have any concerns regarding the validity of the measure (e.g., exclusions, risk-adjustment approach, etc.)?
- The Scientific Methods Panel is satisfied with the validity analyses for the measure. Does the Committee think there is a need to discuss and/or vote on validity?
    - Please note, the Scientific Methods Panel was not charged with reviewing the inclusion or exclusion of social risk factors in the risk adjustment model.

Questions for the Committee regarding composite construction:

- Do you have any concerns regarding the composite construction approach (e.g., do the component measures fit the quality construct and add value to the overall composite? Are the aggregation and weighting rules consistent with the quality construct and rationale while achieving the related objective of simplicity to the extent possible?)?
- The Scientific Methods Panel is satisfied with the composite construction. Does the Committee think there is a need to discuss and/or vote on the composite construction approach?

Preliminary rating for reliability: ☒ **High** ☐ **Moderate** ☐ **Low** ☐ **Insufficient**

Preliminary rating for validity: ☒ **High** ☐ **Moderate** ☐ **Low** ☐ **Insufficient**

Preliminary rating for composite construction: ☐ **High** ☒ **Moderate** ☐ **Low** ☐ **Insufficient**

Scientific Acceptability

Measure Number: 3449

Measure Title: Hospitalization for Ambulatory Care Sensitive Conditions for Dual Eligible Beneficiaries

Type of measure:

☐ Process ☐ Process: Appropriate Use ☐ Structure ☐ Efficiency ☐ Cost/Resource Use

☐ Outcome ☐ Outcome: PRO-PM ☐ Outcome: Intermediate Clinical Outcome ☒ Composite

Data Source:

☒ Claims ☐ Electronic Health Data ☐ Electronic Health Records ☐ Management Data

☐ Assessment Data ☐ Paper Medical Records ☐ Instrument-Based Data ☐ Registry Data

☐Enrollment Data ☒ Other

Level of Analysis:

☐ Clinician: Group/Practice ☐ Clinician: Individual ☐ Facility ☐ Health Plan

☐ Population: Community, County or City ☒ Population: Regional and State

☐ Integrated Delivery System ☐ Other

Measure is:

☒ New ☐ Previously endorsed (NOTE: Empirical validity testing is expected at time of maintenance review; if not possible, justification is required.)

RELIABILITY: SPECIFICATIONS

1. **Are submitted specifications precise, unambiguous, and complete so that they can be consistently implemented?** ☒ **Yes** ☐ **No**

   Submission document: "MIF_xxxx" document, items S.1-S.22

   ***NOTE**: NQF staff will conduct a separate, more technical, check of eCQM specifications, value sets, logic, and feasibility, so no need to consider these in your evaluation.*

   - One Scientific Methods Panel member noted a question about the rationale for the measure or who the responsible entity for measurement will be.
   - The developer clarified that the rationale is provided in 1c.3 of the measure submission form. This is a state-level composite measure that provides an overall rate of hospitalization for ambulatory care sensitive conditions tailored to the dual eligible population.
   - A summary of the Methods Panel member's concerns can be found under item 2 below.

2. **Briefly summarize any concerns about the measure specifications.**

   PANEL MEMBER 1: Rationale for why the measure is needed or who will use the measure results is not clear as described in the brief description. Who (what provider group) is responsible for improving (lowering?) the observed rate of the composite?

   Three measures are described: composite chronic; composite acute; composite total. My assumption is each of the measures that are used to create the composites is hospital-specific. Yet, the measure is described as "population: region/state". Shouldn't this composite be reported at the hospital/facility level? S.10 Stratification (reporting?) may address the level of reporting. Are the component measures stratified in this same way?

Also, are these component measures reported as risk adjusted or observed values? The description in risk adjustment (S.14) suggests the latter rather than the former.

RELIABILITY: TESTING

Submission document: "MIF_xxxx" document for specifications, testing attachment questions 1.1-1.4 and section 2a2

3. **Reliability testing level** ☒ **Measure score** ☐ **Data element** ☐ **Neither**
4. **Reliability testing was conducted with the data source and level of analysis indicated for this measure**
   ☒ **Yes** ☐ **No**
5. If score-level and/or data element reliability testing was NOT conducted or if the methods used were NOT appropriate, was **empirical VALIDITY testing** of patient-level data conducted?

   ☐ **Yes** ☐ **No**
6. **Assess the method(s) used for reliability testing**

   Submission document: Testing attachment, section 2a2.2

   - Reliability testing was conducted using a signal to noise analysis (using a nonparametric method developed by Morris) to evaluate reliability for each composite rate for each strata: (1) community-dwelling home and community-based services (HCBS) users, (2) community-dwelling non-HCBS users, or (3) non-community-dwelling (institutionalized) population.
   - Data used for testing obtained from all 50 states + DC (October 2014 – September 2015)
   - A summary of the Methods Panel members feedback is provided below. This feedback is intended to inform Standing Committee discussion.
     - **PANEL MEMBER 1:** Signal-to-noise variance is appropriate.
     - **PANEL MEMBER 2:** Signal to noise ratio
     - **PANEL MEMBER 3:** Used signal-to-noise ratio with a threshold of 0.70 to assess the ability of the measure to reliably distinguish performance between states.
     - **PANEL MEMBER 4:** Assessed using signal-to-noise ratio
7. **Assess the results of reliability testing**

   Submission document: Testing attachment, section 2a2.3

   - The results of the signal-to-noise ratio were:
     - Community-dwelling HCBS stratum: Mean reliability >0.89 for the acute, chronic, and total groups (ranging between 0.48-0.99)
     - Community-dwelling non-HCBS stratum: Mean reliability >0.94 for the acute, chronic, and total groups (ranging between 0.71-0.99)
     - Institutionalized stratum: Mean reliability >0.86 for the acute, chronic, and total groups (ranging between 0.34-0.99)
   - A summary of the Methods Panel members feedback is provided below. This feedback is intended to inform Standing Committee discussion
     - **PANEL MEMBER 1:** SNR values range from 0.89 – 0.92 for HCBS patients. Strong results.
     - **PANEL MEMBER 2:** High reliability with high SNR for each cohort
     - **PANEL MEMBER 3:** While the majority of the states meet the threshold for reliability, a few did not probably due to small sample size.
     - **PANEL MEMBER 4:** >90% of states (unit of analysis) had greater than 0.70, which is consistent with substantial reliability
8. Was the method described and appropriate for assessing the proportion of variability due to real differences among measured entities? NOTE: If multiple methods used, at least one must be appropriate.

   Submission document: Testing attachment, section 2a2.2

   ☒**Yes**

☐**No**

☐**Not applicable** (score-level testing was not performed)

9. Was the method described and appropriate for assessing the reliability of ALL critical data elements?
   Submission document: Testing attachment, section 2a2.2

   ☐**Yes**

   ☐**No**

   ☒**Not applicable** (data element testing was not performed)

10. **OVERALL RATING OF RELIABILITY** (taking into account precision of specifications and all testing results):

    ☒**High** (NOTE: Can be HIGH only if score-level testing has been conducted)

    ☐**Moderate** (NOTE: Moderate is the highest eligible rating if score-level testing has not been conducted)

    ☐**Low** (NOTE: Should rate LOW if you believe specifications are NOT precise, unambiguous, and complete or if testing methods/results are not adequate)

    ☐**Insufficient** (NOTE: Should rate INSUFFICIENT if you believe you do not have the information you need to make a rating decision)

11. **Briefly explain rationale for the rating of OVERALL RATING OF RELIABILITY and any concerns you may have with the approach to demonstrating reliability.**

    PANEL MEMBER 1: Reliability analysis was thorough and the results were compelling.

    PANEL MEMBER 2: No concerns

    PANEL MEMBER 3: Results showed high reliability for most of the states tested.

    PANEL MEMBER 4: >90% of states (unit of analysis) had reliability greater than 0.70, which is consistent with substantial reliability

VALIDITY: ASSESSMENT OF THREATS TO VALIDITY

12. **Please describe any concerns you have with measure exclusions.**

    Submission document: Testing attachment, section 2b2.

- One Methods Panel raised a concern with numerator exclusions that should be included in the exclusion list.
  - **PANEL MEMBER 1:** Denominator exclusions seem appropriate. However, there are numerator exclusions (e.g., nonacute inpatient stays) that are not, but should be, included in the exclusion list. S.8 may correct this problem.

13. **Please describe any concerns you have regarding the ability to identify meaningful differences in performance.**

    Submission document: Testing attachment, section 2b4.

- Methods Panel members did not identify any concern regarding the ability of the measure to identify meaningful differences in performance.
- A summary of Methods Panel members' feedback is provided below:
  - **PANEL MEMBER 1:** The tables showing the mean and 95% CI by state were compelling. How differences in state populations affect these distributions needs to be explored.
  - **PANEL MEMBER 2:** none
  - **PANEL MEMBER 3:** No concerns.

- **PANEL MEMBER 4:** None. >20% of states were classified as outliers for each of the composite measures – which is consistent with measures able to detect meaningful differences in performance

14. **Please describe any concerns you have regarding comparability of results if multiple data sources or methods are specified.**
Submission document: Testing attachment, section 2b5.

- One Methods Panel member raised a question about how compentent scores are calculated.

15. **Please describe any concerns you have regarding missing data.**

Submission document: Testing attachment, section 2b6.

- There was some concern that the developers did not report an analysis of missing data (although developers did that records were excluded from the measure if data elements are missing and stated that <100 records had missing values for state).
  - **PANEL MEMBER 1:** How missing values (component measures) are handled is not described.

16. **Risk Adjustment**

16a. **Risk-adjustment method** ☐ **None** ☒ **Statistical model** ☒ **Stratification**

16b. **If not risk-adjusted, is this supported by either a conceptual rationale or empirical analyses?**

☐ Yes ☐ No ☒ Not applicable

16c. **Social risk adjustment:**

16c.1 Are social risk factors included in risk model? ☐ Yes ☒ No ☐ Not applicable

16c.2 Conceptual rationale for social risk factors included? ☒ Yes ☐ No

16c.3 Is there a conceptual relationship between potential social risk factor variables and the measure focus? ☒ Yes ☐ No

- One Methods Panel member provided the following feedback on the conceptual relationship:
  - **PANEL MEMBER 4:** Measure focuses on population with social risk – dual eligible. Therefore, there is no need to adjust for social risk.

16d.**Risk adjustment summary:**

16d.1 All of the risk-adjustment variables present at the start of care? ☒ Yes ☐ No

16d.2 If factors not present at the start of care, do you agree with the rationale provided for inclusion? ☐ Yes ☐ No

16d.3 Is the risk adjustment approach appropriately developed and assessed?

- Methods Panel members disagreed on whether the risk adjustment approached was appropriately developed and assessed.

16d.4 Do analyses indicate acceptable results (e.g., acceptable discrimination and calibration)

- Methods Panel members disagreed on the analyses indicated acceptable results.

16d.5.Appropriate risk-adjustment strategy included in the measure?

- Methods Panel members disagreed on whether an appropriate risk-adjustment strategy was included in the measure.

16e**. Assess the risk-adjustment approach**

- The risk-adjustment models included 95 risk factors for the acute component measure, 83 risk factors for the chronic component measure, and 106 risk factors for the overall composite measure**.**
  - The modeling methodology employed a two-step design, first using logistic regression to model the log-odds of having any qualifying ACSC admission during the measurement period,

and the second using Poisson regression to model the total count of qualifying ACSC admissions experienced over the measurement period.
    - The developers did provide a conceptual rationale regarding the linkage between social risk factors and the measured outcome.
    - The developer states they did not include social risk factors due to the findings from a recent NQF report on admissions/readmissions. This is an erroneous interpretation of that report.
    - Model discrimination for stage one of the model was analyzed via the c-statistic. Values ranged from 0.661 to 0.851 in the development sample and from 0.661 to 0.854 in the validation sample.
    - To examine calibration of the modeling approach, developers developed risk-decile plots to compare observed vs. predicted values across rates/strata and also calculated observed-to-predicted ratios for various subgroup populations across rates/strata. Developers interpreted the results as demonstrating that the risk models are well-calibrated.
    - There was some concern by one Methods Panel member regarding potential overfitting of the model, as many of the clinical factors have odds-ratios incidence rate ratios with 95% confidence intervals that include 1.0.
- A summary of Methods Panel Feedback is provided below. This summary is intended to inform Standing Committee discussion.
    - **PANEL MEMBER 1:** With all of the clinical conditions identified as RFs, are the models over-fitted? Many of these IRR values show a 95% CI that are not significant. Why are these included in the prediction models? Observed/Predicted stratified by decile values look close. Hosemer-Lemeshow statistics not presented.
    - **PANEL MEMBER 2:** Adequate
    - **PANEL MEMBER 3:** Developer used a variety of approaches to develop the risk-adjusted model. All were appropriate.
    - **PANEL MEMBER 4:**
        - Two-step process using logistic regression and Poisson model. Logistic model predicts whether patient experiences outcome, and poisson model predicts number of outcomes in group that experiences at least one outcome. Probability of outcome times number of outcomes (conditional on experiencing outcome) is the number of outcomes.
        - Risk factors included comorbidities (CMS HCC), disability status, number of comorbidities
        - OE ratio is used to quantify performance
        - C statistic for component logistic regression models > 0.66 for all outcomes types across all populations – indicating acceptable discrimination
        - Calibration assessed using calibration plots and decile table – consistent with acceptable calibration

VALIDITY: TESTING

17. **Validity testing level: ☒ Measure score ☐ Data element ☐ Both**
18. **Method of establishing validity of the measure score:**

    ☐ **Face validity**

    ☒ **Empirical validity testing of the measure score**

    ☐ **N/A (score-level testing not conducted)**
19. **Assess the method(s) for establishing validity**

    Submission document: Testing attachment, section 2b2.2

- Empirical validity testing of both the overall composite measure score and the component measure scores was conducted.
- Calculated the Spearman rank correlation between each rate (acute, chronic, total) for each strata (HCBS, non-HCBS, institutionalized—a "within measure" analysis), and for selected rates/strata with four other measures (a similar dual-eligible FFS HCBS measure of hospitalization for ambulatory sensitive conditions and Medicare FFS readmission measures for AMI, heart failure, and COPD). Developers hypothesized that states that perform well on one rate (acute, chronic, and composite) are likely to perform well on the other rates, particularly for similar rates across each strata of beneficiaries (HCBS, non-HCBS, institutionalized).
- Calculated the Spearman rank correlation between each component rate (acute and chronic) with the 10 components of a similar dual-eligible FFS HCBS measure of hospitalization for ambulatory sensitive conditions and with two other measures of hospitalization (for cellulitis and pressure ulcer). This analysis was NOT conducted for each strata separately, and therefore does not represent testing for the measure as specified.
- A summary of the Methods Panel members assessment of the methods for establishing validity is presented below. Please note this is intended to inform Standing Committee discussion.
    - **PANEL MEMBER 1:** Correlations among HCBS, non-HCBS, and Institutional strata.
    - **PANEL MEMBER 2:** Convergent validity with other measures
    - **PANEL MEMBER 3:** Developer assessed validity of both composite measure score and component measure scores. Used Spearman rank correction to demonstrate convergent validity of the scores.
    - **PANEL MEMBER 4:** Convergent validity (1) within measures; (2) similar measures; and (3) Medicare FFS readmission measures. Predictive validity of risk adjustment models

20. **Assess the results(s) for establishing validity**

    Submission document: Testing attachment, section 2b2.3

    - Results of the Spearman rank correlation were as follows:
        - *Within measure rate correlations:* Correlations ranged from 0.19 to 0.93, although most can be classified as moderate (i.e., between 0.25 and .075). These results for the most part supported the developers' hypotheses.
        - *FFS dual eligible HCBS Ambulatory Care Sensitive Condition (ACSC) measure*:
            - Correlations ranged from 0.15 to 0.69, although most can be classified as moderate (i.e., between 0.25 and .075). These results for the most part supported the developers' hypotheses.
        - *Medicare FFS readmission measures*:
            - AMI: Correlations ranged from 0.17 to 0.71, with the weakest between the overall composite score and the readmission score in the institutionalized stratum.
            - Heart failure: Correlations ranged from 0.25 to 0.67, with the weakest between the overall composite score and the readmission score in the institutionalized stratum.
            - COPD: Correlations ranged from 0.25 to 0.71, with the weakest between the overall composite score and the readmission score in the institutionalized stratum.
            - These results for the most part supported the developers' hypotheses.
    - A summary of the Methods Panel members feedback is provided below:
        - **PANEL MEMBER 1:** Bi-variable correlations are in the right direction and substantial.
        - **PANEL MEMBER 2:** Reasonable convergence with other quality measures
        - **PANEL MEMBER 3:** Results are appropriate for both composite measure validity and component measure validity.
        - **PANEL MEMBER 4:**

- Convergent validity
- within measures – moderate to strong correlation
- similar measures – strong correlation
- Medicare FFS readmission measures – strong correlating
- Predictive validity of risk adjustment models
    - C statistic for component logistic regression models were > 0.66 for all outcomes types across all populations – indicating acceptable discrimination
    - Calibration assessed using calibration plots and decile table – consistent with acceptable calibration

21. **Was the method described and appropriate for assessing conceptually and theoretically sound hypothesized relationships?**

    Submission document: Testing attachment, section 2b1.

    ☒**Yes**

    ☐**No**

    ☐**Not applicable** (score-level testing was not performed)

22. **Was the method described and appropriate for assessing the accuracy of ALL critical data elements?** *NOTE that data element validation from the literature is acceptable.*

    Submission document*: Testing attachment, section 2b1.*

    ☐**Yes**

    ☐**No**

    ☒**Not applicable** (data element testing was not performed)

23. **OVERALL RATING OF VALIDITY taking into account the results and scope of all testing and analysis of potential threats.**
    - Ultimately, the Methods Panel gave this measure an overall rating of high for validity. Individual members scores ranged from moderate to high.
    - A summary of the Methods Panel members' rationale for their ratings can be found in item 24 below.

24. **Briefly explain rationale for rating of OVERALL RATING OF VALIDITY and any concerns you may have with the developers' approach to demonstrating validity.**

    PANEL MEMBER 1: Very thorough; very compelling.

    PANEL MEMBER 2: No concerns

    PANEL MEMBER 3: Developer did a nice job in report the study and the results with strong to moderate correlations reported.

    PANEL MEMBER 4: Predictive validity of risk adjustment model was very good based on calibration graphs and decile tables.

FOR COMPOSITE MEASURES ONLY: Empirical analyses to support composite construction

25. **What is the level of certainty or confidence that the empirical analysis demonstrates that the component measures add value to the composite and that the aggregation and weighting rules are consistent with the quality construct?**
    - The developer used the Cronbach's alpha statistic to assess internal consistency of the measure components. However, these were not calculated separately by rate/strata. Values ranged from 0.69 to 0.82. The developer also presented observed rates and overall percentages for each of the

individual components that formed the acute and chronic components of the measure, although this was done at the state level rather than by strata.

- Methods Panel members providing varying responses to this question. Responses ranged from moderate to high.
- A summary of Methods Panel members' feedback is provided under item 26 below.

26. **Briefly explain rationale for rating of EMPIRICAL ANALYSES TO SUPPORT COMPOSITE CONSTRUCTION**
    - **PANEL MEMBER 1:** If the component measures are reported as observed values and are stratified by the three groups that are reported for this measure, then everything should work. Question about how missing values (component measure) are handled is not addressed.
    - **PANEL MEMBER 2:** Components correlated though not identical
    - **PANEL MEMBER 3:** Correlations were moderate to strong between the acute, chronic and total rates within each stratum. This suggests that states that perform well on one rate are likely to perform well on the other rates. Strong relationship with benchmarks on other quality measures, which suggests the measure rates have good convergent validity. Results also indicate a strong correlation of the individual measure components with each composite at the state level.
    - **PANEL MEMBER 4:** Cronbach alpha range between 0.69 to 0.82, consistent with acceptable to good internal consistency.

ADDITIONAL RECOMMENDATIONS

27. **If you have listed any concerns in this form, do you believe these concerns warrant further discussion by the multi-stakeholder Standing Committee? If so, please list those concerns below.**
    - No additional concerns with identified.

Committee Pre-evaluation Comments:
Criteria 2: Scientific Acceptability of Measure Properties (including all 2a, 2b, and 2c)

2a1. Reliability-Specifications: Which data elements, if any, are not clearly defined? Which codes with descriptors, if any, are not provided? Which steps, if any, in the logic or calculation algorithm or other specifications (e.g., risk/case-mix adjustment, survey/sampling instructions) are not clear? What concerns do you have about the likelihood that this measure can be consistently implemented?

- No issues
- None

2a2. Reliability - Testing: Do you have any concerns about the reliability of the measure?

- Good SNR result
- No concerns

2b1. Validity -Testing: Do you have any concerns with the testing results?

- No concerns
- No concerns

2b4-7. Threats to Validity (Statistically Significant Differences, Multiple Data Sources, Missing Data): 2b4. Meaningful Differences: How do analyses indicate this measure identifies meaningful differences about quality? 2b5. Comparability of performance scores: If multiple sets of specifications: Do analyses indicate they produce comparable results? 2b6. Missing data/no response: Does missing data constitute a threat to the validity of this measure?

- None noted
- Access to care and patient choice regarding showing up

2b2-3. Other Threats to Validity (Exclusions, Risk Adjustment) 2b2. Exclusions: Are the exclusions consistent with the evidence? Are any patients or patient groups inappropriately excluded from the measure?2b3. Risk Adjustment: If outcome (intermediate, health, or PRO-based) or resource use performance measure: Is there a

conceptual relationship between potential social risk factor variables and the measure focus? How well do social risk factor variables that were available and analyzed align with the conceptual description provided? Are all of the risk-adjustment variables present at the start of care (if not, do you agree with the rationale provided)? Was the risk adjustment (case-mix adjustment) appropriately developed and tested? Do analyses indicate acceptable results? Is an appropriate risk-adjustment strategy included in the measure?

- Strong risk adjustment. Focus on duals, likely already an at risk population
- Perhaps v codes for homelessness and other factors influencing patient decision making

2c. Composite Performance Measure - Composite Analysis (if applicable): Do analyses demonstrate the component measures fit the quality construct and add value? Do analyses demonstrate the aggregation and weighting rules fit the quality construct and rationale?

- Yes
- Yes

Criterion 3. Feasibility

Maintenance measures – no change in emphasis – implementation issues may be more prominent

3. Feasibility is the extent to which the specifications including measure logic, require data that are readily available or could be captured without undue burden and can be implemented for performance measurement.

- This measure is calculated using claims data.
- All data elements are in defined fields in electronic claims.
- The American Hospital Association holds a copyright to the Uniform Bill Codes ("UB") contained in the measure specifications. Any use of these codes by states or other entities to calculate the measure requires a license from the AHA.

Questions for the Committee:

- Are the required data elements routinely generated and used during care delivery?
- Are the required data elements available in electronic form, e.g., EHR or other electronic sources?
- Is the data collection strategy ready to be put into operational use?

Preliminary rating for feasibility: ☐ **High** ☒ **Moderate** ☐ **Low** ☐ **Insufficient**

Committee Pre-evaluation Comments:
Criteria 3: Feasibility

3. Feasibility: Which of the required data elements are not routinely generated and used during care delivery? Which of the required data elements are not available in electronic form (e.g., EHR or other electronic sources)? What are your concerns about how the data collection strategy can be put into operational use?

- Claims based, no issues
- No

Criterion 4: Usability and Use

Maintenance measures – increased emphasis – much greater focus on measure use and usefulness, including both impact/improvement and unintended consequences

4a. Use (4a1. Accountability and Transparency; 4a2. Feedback on measure)

4a. Use evaluate the extent to which audiences (e.g., consumers, purchasers, providers, policymakers) use or could use performance results for both accountability and performance improvement activities.

4a.1. Accountability and Transparency. Performance results are used in at least one accountability application within three years after initial endorsement and are publicly reported within six years after initial endorsement (or the data on performance results are available). If not in use at the time of initial endorsement, then a credible plan for implementation within the specified timeframes is provided.

Current uses of the measure

Publicly reported? ☐ **Yes** ☒ **No**

Current use in an accountability program? ☐ **Yes** ☒ **No** ☐ **UNCLEAR**

OR

Planned use in an accountability program? ☒ **Yes** ☐ **No**

Accountability program details

This measure is planned for implementation in CMS Financial Alignment Initiative (FAI) core measure set for Medicare-Medicaid Plans (MMPs). This set of measures is used to monitor and evaluate the quality of care provided in MMPs participating in the FAI.

4a.2. Feedback on the measure by those being measured or others. Three criteria demonstrate feedback: 1) those being measured have been given performance results or data, as well as assistance with interpreting the measure results and data; 2) those being measured and other users have been given an opportunity to provide feedback on the measure performance or implementation; 3) this feedback has been considered when changes are incorporated into the measure

Feedback on the measure by those being measured or others

Measure specification and performance results from testing were presented to a Technical Expert Panel (TEP), a clinical workgroup, and risk-adjustment workgroup. Two health plans provided feedback on the measure specifications through a three-week public comment period hosted on CMS's online public comment system. Feedback obtained from the groups described above is as follows:

- The clinical workgroup provided feedback on conditions included in the numerator, exclusions, stratification, and how to handle admissions from non-acute inpatient facilities (SNFs and inpatient rehabilitation facilities).
- The risk-adjustment workgroup provided feedback on the specifications, risk factors and model development.
- The TEP provided feedback on the conditions to include in the numerator and whether immunocompromised populations should be excluded.
- Public commenters requested the measure be harmonized with existing measures and made suggestions for revisions to the specification.

Feedback received from the TEP, workgroup, and public comment were incorporated into the testing plan and final measure specifications. Measure performance results specific to each state were not provided back to state agencies. However, representatives from states participated in the TEP and workgroup.

Questions for the Committee:

- How have (or can) the performance results be used to further the goal of high-quality, efficient healthcare?
- How has the measure been vetted in real-world settings by those being measured or others?

Preliminary rating for Use: ☒ **Pass** ☐ **No Pass**

4b. Usability (4a1. Improvement; 4a2. Benefits of measure)

4b. Usability evaluate the extent to which audiences (e.g., consumers, purchasers, providers, policymakers) use or could use performance results for both accountability and performance improvement activities.

4b.1 Improvement. Progress toward achieving the goal of high-quality, efficient healthcare for individuals or populations is demonstrated.

Improvement results

This measure is not yet implemented, thus longitudinal data is not available.

4b2. Benefits vs. harms. Benefits of the performance measure in facilitating progress toward achieving high-quality, efficient healthcare for individuals or populations outweigh evidence of unintended negative consequences to individuals or populations (if such evidence exists).

Unexpected findings (positive or negative) during implementation

Not applicable. This measure is not yet implemented.

Potential harms

Not applicable. This measure is not yet implemented.

Additional Feedback:

n/a

Questions for the Committee:

- How can the performance results be used to further the goal of high-quality, efficient healthcare?
- Do the benefits of the measure outweigh any potential unintended consequences?

Preliminary rating for Usability and use: ☐ **High** ☐ **Moderate** ☐ **Low** ☒ **Insufficient**

RATIONALE:

This measure is a new measure, thus usability results are unavailable. Although the Use and Usability criterion is not met, the measure may be suitable for endorsement based on an assessment of the strength of the measure in relation to the other three evaluation criteria and the strength of the competing and related measures to drive improvement.

Committee Pre-evaluation Comments:
Criteria 4: Usability and Use

4a. Use - Accountability and Transparency: How is the measure being publicly reported? Are the performance results disclosed and available outside of the organizations or practices whose performance is measured? For maintenance measures - which accountability applications is the measure being used for? For new measures - if not in use at the time of initial endorsement, is a credible plan for implementation provided?4a2. Use - Feedback on the measure: Have those being measured been given performance results or data, as well as assistance with interpreting the measure results and data? Have those being measured or other users been given an opportunity to provide feedback on the measure performance or implementation? Has this feedback has been considered when changes are incorporated into the measure?

- Not currently being used, did get feedback
- Although it is an accountability measure, not certain how it will be applied

4b1. Usability – Improvement: How can the performance results be used to further the goal of high-quality, efficient healthcare? If not in use for performance improvement at the time of initial endorsement, is a credible rationale provided that describes how the performance results could be used to further the goal of high-quality, efficient healthcare for individuals or populations?4b2. Usability – Benefits vs. harms: Describe any actual unintended consequences and note how you think the benefits of the measure outweigh them.

- Looking at the HEDIS measure on ASC, has impacted performance at the health system level
- Penalize communities caring for duals

Criterion 5: Related and Competing Measures

Related or competing measures

- NQF did not identify competing measures.

Committee Pre-evaluation Comments: Criterion 5: Related and Competing Measures

5. Related and Competing: Are there any related and competing measures? If so, are any specifications that are not harmonized? Are there any additional steps needed for the measures to be harmonized?

Public and Member Comments

NQF received no public or member comments on this measure as of January 25, 2019.

Brief Measure Information

NQF #: 3449

Corresponding Measures:

De.2. Measure Title: Hospitalization for Ambulatory Care Sensitive Conditions for Dual Eligible Beneficiaries

Co.1.1. Measure Steward: Centers for Medicare and Medicaid Services

De.3. Brief Description of Measure: For dual eligible beneficiaries age 18 years and older, state-level observed and risk-adjusted rates of hospital admissions for ambulatory care sensitive conditions (ACSC) per 1,000 beneficiaries for ACSC by chronic and acute conditions. This measure has three rates reported as both observed and risk-adjusted rates:

- Chronic Conditions Composite
- Acute Conditions Composite
- Total (Acute and Chronic Conditions) Composite

The observed and risk-adjusted rates are stratified and reported for three populations: (1) community-dwelling home and community-based services (HCBS) users; (2) community-dwelling non-HCBS users; or, (3) non-community-dwelling (institutionalized) population.

This measure is planned for public reporting and quality improvement at the state level. This population health measure can help states understand the underlying quality of outpatient care, including home- and community-based services, provided to dual eligible beneficiaries for acute conditions, chronic conditions, and overall. The state-level measure can assess the quality of a breadth of outpatient services by providers that may not be linked to a single accountable healthcare facility.

1b.1. Developer Rationale:

S.4. Numerator Statement: Chronic Composite: Number of acute inpatient hospital admissions in the measurement year for diabetes short term complications, diabetes long term complications, uncontrolled diabetes, low-extremity amputation, chronic obstructive pulmonary disease (COPD), asthma, hypertension, and heart failure.

Acute Composite: Number of acute inpatient hospital admissions in the measurement year for bacterial pneumonia, urinary tract infection, cellulitis and pressure ulcers.

Total Composite: Sum of acute and chronic composites

S.6. Denominator Statement: Dual eligible adults age 18 years and older

S.8. Denominator Exclusions: See the numerator details section for exclusions from the individual composite indicators

- Hospitalizations for obstetrics
- Hospice
- Acute hospital transfers

De.1. Measure Type: Composite

S.17. Data Source: Claims

S.20. Level of Analysis: Population: Regional and State

IF Endorsement Maintenance – Original Endorsement Date: Most Recent Endorsement Date:

IF this measure is included in a composite, NQF Composite#/title:

IF this measure is paired/grouped, NQF#/title:

De.4. IF PAIRED/GROUPED, what is the reason this measure must be reported with other measures to appropriately interpret results?

1. Evidence and Performance Gap – Importance to Measure and Report

Extent to which the specific measure focus is evidence-based, important to making significant gains in healthcare quality, and improving health outcomes for a specific high-priority (high-impact) aspect of healthcare where there is variation in or overall less-than-optimal performance. ***Measures must be judged to meet all sub criteria to pass this criterion and be evaluated against the remaining criteria.***

1a. Evidence to Support the Measure Focus – See attached Evidence Submission Form

Del18a_Duals1_NQF_Evidence_FINAL_11.1.2018.docx

1a.1 For Maintenance of Endorsement: Is there new evidence about the measure since the last update/submission?

Do not remove any existing information. If there have been any changes to evidence, the Committee will consider the new evidence. Please use the most current version of the evidence attachment (v7.1). Please use red font to indicate updated evidence.

1a. Evidence (subcriterion 1a)

Measure Number (*if previously endorsed*)**:**

Measure Title: Hospitalization for Ambulatory Care Sensitive Conditions for Dual Eligible Beneficiaries

IF the measure is a component in a composite performance measure, provide the title of the Composite Measure here:

Date of Submission:

Instructions

- *Complete 1a.1 and 1a.2 for all measures. If instrument-based measure, complete 1a.3.*
- *Complete EITHER 1a.2, 1a.3 or 1a.4 as applicable for the type of measure and evidence.*
- *For composite performance measures:*
  - *A separate evidence form is required for each component measure unless several components were studied together.*
  - *If a component measure is submitted as an individual performance measure, attach the evidence form to the individual measure submission.*
- All information needed to demonstrate meeting the evidence subcriterion (1a) must be in this form. An appendix of *supplemental* materials may be submitted, but there is no guarantee it will be reviewed.
- If you are unable to check a box, please highlight or shade the box for your response.
- Contact NQF staff regarding questions. Check for resources at Submitting Standards webpage.

Note: The information provided in this form is intended to aid the Standing Committee and other stakeholders in understanding to what degree the evidence for this measure meets NQF's evaluation criteria.

1a. Evidence to Support the Measure Focus

The measure focus is evidence-based, demonstrated as follows:

- Outcome: 3 Empirical data demonstrate a relationship between the outcome and at least one healthcare structure, process, intervention, or service. If not available, wide variation in performance can be used as evidence, assuming the data are from a robust number of providers and results are not subject to systematic bias.

- Intermediate clinical outcome: a systematic assessment and grading of the quantity, quality, and consistency of the body of evidence 4 that the measured intermediate clinical outcome leads to a desired health outcome.
- Process: 5 a systematic assessment and grading of the quantity, quality, and consistency of the body of evidence 4 that the measured process leads to a desired health outcome.
- Structure: a systematic assessment and grading of the quantity, quality, and consistency of the body of evidence 4 that the measured structure leads to a desired health outcome.
- Efficiency: 6 evidence not required for the resource use component.
- For measures derived from patient reports, evidence should demonstrate that the target population values the measured outcome, process, or structure and finds it meaningful.
- Process measures incorporating Appropriate Use Criteria: See NQF's guidance for evidence for measures, in general; guidance for measures specifically based on clinical practice guidelines apply as well.

Notes

3. Generally, rare event outcomes do not provide adequate information for improvement or discrimination; however, serious reportable events that are compared to zero are appropriate outcomes for public reporting and quality improvement.

4. The preferred systems for grading the evidence are the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) guidelines and/or modified GRADE.

5. Clinical care processes typically include multiple steps: assess → identify problem/potential problem → choose/plan intervention (with patient input) → provide intervention → evaluate impact on health status. If the measure focus is one step in such a multistep process, the step with the strongest evidence for the link to the desired outcome should be selected as the focus of measurement. Note: A measure focused only on collecting PROM data is not a PRO-PM.

6. Measures of efficiency combine the concepts of resource use and quality (see NQF's Measurement Framework: Evaluating Efficiency Across Episodes of Care; AQA Principles of Efficiency Measures).

1a.1.This is a measure of: (*should be consistent with type of measure entered in De.1*)

Outcome

☒ Outcome: Hospitalizations due to ambulatory care sensitive conditions

☐Patient-reported outcome (PRO):

PROs include HRQoL/functional status, symptom/symptom burden, experience with care, health-related behaviors. (*A PRO-based performance measure is not a survey instrument. Data may be collected using a survey instrument to construct a PRO measure.)*

☐ Intermediate clinical outcome (*e.g., lab value*):

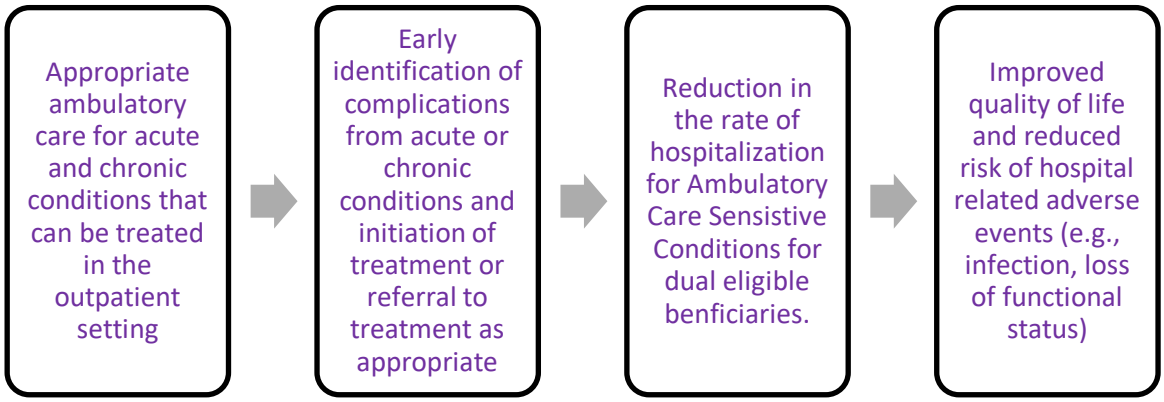
☐ Process:

☐ Appropriate use measure:

☐ Structure:

☐ Composite:

1a.2 LOGIC MODEL Diagram or briefly describe the steps between the healthcare structures and processes (e.g., interventions, or services) and the patient's health outcome(s). The relationships in the diagram should be easily understood by general, non-technical audiences. Indicate the structure, process or outcome being measured.



1a.3 Value and Meaningfulness: IF this measure is derived from patient report, provide evidence that the target population values the measured ***outcome, process, or structure*** and finds it meaningful. (Describe how and from whom their input was obtained.)

Not applicable. This measure is not derived from a patient report.

****RESPOND TO ONLY ONE SECTION BELOW -EITHER 1a.2, 1a.3 or 1a.4) ****

1a.2 FOR OUTCOME MEASURES including PATIENT REPORTED OUTCOMES - Provide empirical data demonstrating the relationship between the outcome (or PRO) to at least one healthcare structure, process, intervention, or service.

Appropriate access to care, high quality care coordination, a focus on chronic disease self-management and connection to community resources can reduce the probability that individuals with ambulatory care sensitive chronic and acute conditions (ACSCs) will develop complications or exacerbations that result in hospitalization. Because hospitalization poses several risks for older adults and adults with disability (who frequently develop serious conditions as a result of hospitalization such as delirium, infection and decline in functional ability (Gillick et al., 1982; Covinsky et al., 2011)), reducing the rate of hospitalization could significantly improve population health and quality of life. Measurement of hospitalization for ACSCs could provide important information to states as to how well a system of care helps adults with chronic and acute conditions prevent hospitalization.

Development of Ambulatory Care Sensitive Conditions (ACSCs):

ACSCs were originally designed to evaluate the potential impact of differences in socioeconomic status and resources on hospitalization rates. An early study by Billings et al. (1993) aimed to improve the understanding of the causes of any variation in hospital use and evaluating the effectiveness of programs designed to improve access to care. His team used a modified Delphi approach to define conditions for which timely and effective outpatient care can help to reduce the risks of hospitalization by either preventing the onset of an illness or condition, controlling an acute episodic illness or condition, or managing a chronic disease or condition. They found adults under the age of 65 years in low-income areas had substantially higher admission rates for ACSCs than those in high-income areas. The authors suggested that adults in low income areas are more likely to be affected by access problems, given higher rates of the uninsured and less experience in navigating the complexities of the fragmented health care delivery system. Since this early study, many more studies have examined the effect of income, insurance, and access on ACSC hospitalization and many more diagnoses have been classified in various research studies as potentially ACSC hospitalizations. Across studies, the list of potential ACSC now includes over 100 conditions. Below we describe the breadth of evidence on identifying ACSC hospitalizations for which there is evidence that access to high quality coordinated outpatient care can prevent a potential hospitalization.

Development of Prevention Quality Indicators (PQIs):

In 2001, the Agency for Healthcare Research and Quality's (AHRQ's) Evidence-Based Practice Center (EPC) at the University of California San Francisco (UCSF) and Stanford University developed the Prevention Quality Indicators (PQI) based on the original Healthcare Cost and Utilization Project (HCUP) Quality Indicators developed in the early 1990s (Davies et al., 2001). They reviewed the evidence on ACSC to date and used a multi-stakeholder review process. They selected sixteen ambulatory care sensitive conditions to be used as area-level quality indicators (dehydration, bacterial pneumonia, urinary tract infection, perforated appendix, angina, asthma, Chronic Obstructive Pulmonary Disease (COPD), Congestive Heart Failure (CHF), diabetes short term complications, uncontrolled diabetes, diabetes long term complications, lower extremity amputation in diabetics, hypertension, low birth weight, pediatric asthma and pediatric gastroenteritis).

In general, the AHRQ, UCSF, and Stanford research team (referred to hence forth as AHRQ team) found there was little published evidence for individual indicators, presumably due to the common usage of indicators within sets. Most studies have examined sets of ACSC conditions, without providing data stratified by indicator. In general, across studies the AHRQ team found condition prevalence, race and socioeconomic status were independent predictors of the rate of hospitalization for ACSC in the general population. At the individual condition level, self-reported health status, functional limitations, several chronic diseases, and a chronic disease risk score are associated with preventable hospitalizations among Medicare beneficiaries. Income was found to be a much less powerful predictor of hospitalization for chronic ACSC among Medicare beneficiaries after adjusting for health factors (Davies et al., 2001).

While many studies have been published about the association between access to care and ACSC hospitalization, AHRQ found few studies that tested true measures of access to care, as opposed to socioeconomic status. One study found that patient reported "difficulty in receiving medical care when needed" explained 50 percent of the variability in hospitalization rates for five chronic medical conditions. Having a regular source of care, and a higher primary care physician/population ratio, were also independently associated with avoidable hospitalization rates (Bindman et al., 1995). Other studies have shown that the physician to population ratio for family and general physicians is more strongly associated with avoidable hospitalization rates than measures that include internists, pediatricians, or all physicians. Beneficiaries in fair or poor health are at increased risk if they lived in a primary care shortage area (Change et al., 2011; Lin et al., 2016).

Expanding the Use of PQIs for Performance Measurement:

In 2009, AHRQ convened a multi-stakeholder panel of experts to review the evidence for all the AHRQ PQI and assess the appropriateness of using the PQI for quality improvement, public reporting, and pay for performance (Davies et al., 2009). This group used a Delphi and Nominal Panel method for soliciting feedback from panel members on the face validity of the PQI for different settings and uses. Overall, the panelists rated most of the indicators as appropriate for many settings and use. The table below summarized the panel recommendations regarding the use of the indicators for comparative reporting and pay for performance at the payer level. The panel also made recommendations for the provider, area and long-term care settings which are not listed below.

The results of the panel recommendations are presented in Table 1. The lowest rated indicators were perforated appendix and dehydration which panel members had major concerns regarding the use for comparative reporting and pay for performance. Based on these rating, these two conditions were dropped from the composite quality measure. A third condition, angina, was dropped from the list of AHRQ PQI in 2017 and therefore also not included in the quality measure.

Table 1: Panel Recommendations

Indicators	Comparative Reporting	Pay for Performance
COPD	♦♦	♦♦+
Asthma (<39)	♦♦+	♦♦+
Hypertension	♦♦+	♦♦
Angina[1]	♦♦	♦+
CHF	♦♦+	♦♦
Perforated Appendix[2]	♦+	♦+
Diabetes Short Term Complications	♦♦+	♦♦
Diabetes Long Term Complications	♦♦	♦♦
Lower Extremity Amputation in Diabetes	♦♦+	♦♦
Bacterial Pneumonia	♦♦	♦
UTI	♦♦	♦+
Dehydration[2]	♦+	♦

♦ Major concern regarding use

♦♦ Some concern

+One of the two panels reported a higher level of support for the measure than shown

[1] Angina was dropped from the list of AHRQ PQI in 2017 and is therefore not included in the composite.

[2] Dehydration and Perforated Appendix are not included in the composite due to the overall low rating from the panel.

Below we summarize the qualitative recommendations of the panelists regarding each of the conditions that are included in the proposed composite and pathways for payers and providers to influence hospitalization (Davies et al., 2009).

Chronic Composite:

- **Diabetes Related Indicators:** Payer and provider organizations may be able to reduce hospitalization for diabetes (short-term complications, long-term complications, and uncontrolled diabetes) by enhancing coverage for medication, supplied for blood glucose monitoring, and care coordination for diabetes patients. Ongoing patient education and promotion of self-management might also reduce rates of hospitalization for diabetes.
- **Chronic Obstructive Pulmonary Disease and Asthma:** Panelists cited several mechanisms by which health systems could reduce hospitalization for COPD and asthma including increase reimbursement for smoking cessation programs, medication, access to pulmonary rehabilitation, and oxygen therapy. Additionally, patient education and improved care coordination could reduce rates of hospitalization for COPD Asthma. Panelists also expressed concern that this rate may reflect some level of "social hospitalization" for situations where the provider feels the support in the home environment is insufficient for recovery.
- **Hypertension:** Payer and provider organizations may be able to reduce hypertension related hospitalizations through enhanced coverage of preventive primary care visits, patient education, and anti-hypertensive medication. Improved rates of blood pressure screening may also reduce rates of hospitalization.
- **Congestive Heart Failure:** Similar to the other chronic conditions, panelists cited enhanced coverage of medications, access to primary care, and patient education as the main mechanisms through which plans could mitigate hospitalization for CHF. They also suggested outreach to at-risk patients through teleconferencing and home visits had the potential to significantly reduce hospitalization.
- **Lower Extremity Amputation:** Minor problems in the lower extremities can be treated in outpatient care limiting the progression of the disease. Payer organizations may be able to enhance coverage of

medication, supplies for diabetes self-management and promote care coordination. There was a concern that patient factors such as diet, income and geographic limitations may limit the control the health care system has on admission rates.

Acute Composite:

- **Bacterial Pneumonia:** Panelists agreed that payers could influence hospitalization for bacterial pneumonia by ensuring access to immunizations and antibiotics. However, there was uncertainty about the degree to which increased access could reduce hospitalization in particularly high-risk populations.
- **Urinary Tract Infection:** Some panelists expressed concern about the lack of evidence directly linking care in the outpatient setting to hospitalization for Urinary Tract Infection (UTI). Others suggested that enhanced coverage of antibiotics and careful attention to inappropriate use of Foley/suprapubic catheters could impact rates of hospitalization.

Research on ACSCs in Dual Eligible Population:

CMS contracted with RTI to study hospitalization for ACSCs in the dual eligible beneficiaries who were receiving long term services and supports (LTSS) in nursing facilities and home and community-based services (HCBS) waiver programs. The study examined hospitalization for specific conditions selected by a technical expert panel (TEP) as potentially preventable or manageable in 1) a nursing facility[1] and 2) the community setting[2]. Similar to the AHRQ approach, the RTI team used a TEP to determine which ACSC are preventable and/or manageable in the community and nursing home setting. The RTI team summarized the evidence for each condition and engaged the TEP in a rating process. Based on this review two conditions were added to the acute composite. These were acute conditions where there was agreement among the TEP that the condition was either preventable or manageable in the community and nursing facility setting.

- **Cellulitis:** Panelists agreed most cases of cellulitis can be managed in the facility, and often cases can be managed in the community with antibiotic treatment. A systematic review and meta-analysis that included five randomized controlled trials (n=535) found that antibiotic prophylaxis significantly reduced the number of patients having recurrent cellulitis (risk ratio=0.46; 95% CI 0.26-0.79) (Oh et al., 2014). Additionally, outpatient parenteral antimicrobial therapy (OPAT) is becoming more widespread and is a suitable treatment option for certain patients who have cellulitis (Nazarko, 2008; Chapman 2013).
- **Pressure Ulcers:** Pressure ulcers can often be prevented, and existing ulcers should be treated and monitored so that they do not become severe enough to require hospitalization. A systematic review of 59 trials found that the use of foam alternatives to standard hospital foam mattresses reduced the incidence of pressure ulcers (RR=0.40; 95% CI 0.21–0.74) (McInnes et al., 2015). The use of repositioning to prevent pressure ulcers was also assessed by a systematic review published in 2014, which suggested that the method may be effective, but evidence was limited (Gillespie et al., 2014). A randomized controlled trial, published after the systematic review was conducted, included 942 participants and found that repositioning moderate- and high-risk residents at intervals of two to four hours was effective in preventing pressure ulcers (when cared for in this manner, 2% of participants developed superficial ulcers, and no full thickness ulcers were developed) (Bergstrom et al., 2014).

---

[1] Potentially preventable/manageable in a nursing facility: anemia, CHF, hyper and hypotension, hyper and hypoglycemia diabetes with ketoacidosis or hyperosmolar coma, dehydration/acute renal failure/hypokalemia/hyponatremia, constipation or fecal impaction/obstipation, diarrhea, c. difficile, gastroenteritis with nausea and vomiting, cellulitis, skin ulcers including pressure ulcers, pneumonia/bronchitis, UTI, falls and trauma, altered mental status/acute confusion/delirium, psychosis with severe agitation, organic brain syndrome, COPD, asthma, chronic bronchitis, weight loss, nutritional deficiencies with adult failure to thrive, seizures.

[2] Potentially preventable/manageable in a community setting: anemia, CHF, hyper and hypotension, hyper and hypoglycemia diabetes with ketoacidosis or hyperosmolar coma, dehydration/acute renal failure/hypokalemia/hyponatremia, constipation or fecal impaction/obstipation, cellulitis, skin ulcers including pressure ulcers, pneumonia/bronchitis, UTI, COPD, asthma, chronic bronchitis, weight loss, nutritional deficiencies with adult failure to thrive, and seizures.

The TEP also supported the inclusion of conditions recommended by AHRQ, including diabetes-related complications, hypertension, COPD, CHF, urinary tract infection, and pneumonia. Conditions from the RTI analysis which were not included in this proposed composite measure include anemia, dehydration, constipation, diarrhea, c. difficile, gastroenteritis, falls and trauma, altered mental state, psychosis, organic brain syndrome, weight loss, and seizures. These conditions were not included in the composite due to either a lack of consistent support from panel members that the conditions were manageable in the community or institutional setting or overall low prevalence.

Among this population of dual eligible beneficiaries receiving LTSS at home or in a nursing facility, 39 percent of the nearly 1 million hospitalizations in 2005 were found to be potentially preventable. Sixty-three percent of these hospitalizations originated from nursing facility stays covered by Medicaid, 19 percent from skilled nursing facility stays covered by Medicare and 18 percent from Medicaid HCBS waivers. Five highly prevalent conditions (pneumonia, CHF, urinary tract infections, dehydration, and COPD/asthma) accounted for 78 percent of the potentially avoidable hospitalizations across all settings. Pneumonia accounted for over 30 percent of potentially avoidable hospitalizations in both Medicare covered skilled nursing facility stays and Medicaid covered nursing facility stays (Walsh et al., 2012).

RTI also found that potentially avoidable hospitalization rates varied greatly by state and that state policy variables affect potentially avoidable hospitalization rates in the HCBS population. All LTSS settings saw almost a fourfold difference between the lowest and highest rate of potentially avoidable hospitalizations (from 158 per 1,000 person years to 591 per 1,000 person years). Differences in health status accounted for some of these hospitalizations; the mean number of chronic conditions by state varied from 1.9 to 3.3 (the percentage of individuals aged 85 years and older ranged from 20 percent to 47 percent of the study population). The report's multivariate analysis showed that HCBS waiver enrollees in states spending a higher proportion of Medicaid long-term care dollars on HCBS and covering Medicaid state-plan personal care services were at less risk of potentially avoidable hospitalizations compared to states without a personal care option or spending a smaller proportion of their long-term care dollars on HCBS.

Healthcare System Factors Associated with Hospitalization for ACSC

Evidence suggests that the healthcare system can influence hospitalizations for ACSC. Providing adequate resources for and access to outpatient care and ensure continuity of care are associated with decreased rates of hospitalization for ACSC. A cross-sectional analysis of older Medicare beneficiaries found that a higher level of primary care physician workforce was generally associated with favorable patient outcomes including lower mortality and fewer ACSC hospitalizations (Chang et al., 2011). Furthermore, the distribution of primary care physicians may also influence hospitalizations, as preventable hospitalizations are high in areas of the U.S. that have low primary care density and other healthcare resources (Lin et al., 2016). In addition to primary care and physician access, continuity of care is another factor that may impact the volume of ACSC hospitalizations. A cross-sectional analysis of community-dwelling Medicare beneficiaries found that greater continuity (regardless of provider specialty) was associated with lower expenditures and less use of high-cost services (Romaire et al., 2014). Lower continuity of care is also associated with higher rates of hospitalization among community-dwelling older Medicare beneficiaries with dementia, even after accounting for sociodemographic factors and comorbidity burden (Amjad et al., 2016). Healthcare systems should also be attuned to the needs of different subpopulations. The literature suggests that certain subpopulations may require more resources to prevent hospitalizations than others. In particular, elderly HCBS users have an increased probability of experiencing both a potentially preventable (i.e., ACSC) and non-potentially preventable hospitalization compared to nursing home residents, suggesting the need for more integration of medical and long-term care by their healthcare system (Wysocki et al., 2014).

References

AHRQ. (2007) Guide to Prevention Quality Indicators. Agency for Healthcare Research and Quality, Rockville, MD. Accessed July 31, 2013. Available at: http://www.qualityindicators.ahrq.gov/Downloads/Modules/PQI/V31/pqi_guide_v31.pdf.

Amjad, H., Carmichael, D., Austin, A.M., Chang, C.H. & Bynum, J.P. (2016) Continuity of care and health care utilization in older adults with dementia in fee-for-service Medicare. JAMA Internal Medicine, 176(9), 1371-1378.

Bergstrom, N., Horn, S.D., Rapp, M., Stern, A., Barrett, R., Watkiss, M., & Krahn, M. (2014) Preventing Pressure Ulcers: A Multisite Randomized Controlled Trial in Nursing Homes. Ontario Health Assessment Technology Series, 14(11), 1-32.

Billings, J., Zeitel, L., Lukomnik, J., Carey, T. S., Blank, A. E., & Newman, L. (1993) Impact of socioeconomic status on hospital use in New York City. Health Affairs, 12(1), 162-173.

Bindman A.B., Grumbach K, Osmond D, et al. (1995) Preventable hospitalizations and access to health care. JAMA, 274(4), 305-311

Chang, C.H., Stukel, T.A, Flood, A.B., and Goodman, D.C. (2011) Primary care physician workforce and Medicare beneficiaries' health outcomes. JAMA, 305(20), 2096-2104.

Chapman, A. (2013) Outpatient parenteral antimicrobial therapy. BMJ, 346:f1585.

Covinsky, K. E., Pierluissi, E., & Johnston, C. B. (2011) Hospitalization-associated disability. JAMA: The Journal of the American Medical Association,306(16), 1782-1793.

Davies SM, Geppert J, McClellan M, et al. Refinement of the HCUP Quality Indicators. Rockville (MD): Agency for Healthcare Research and Quality (US). (2001) Technical Reviews, No. 4. Accessed July 31, 2013. Available from: http://www.ncbi.nlm.nih.gov/books/NBK43831/.

Davies, S.M., McDonald, K.M, Schmidt, E., Schultz, E., Geppert J., & Romano P.S. (2009) Expanding Use of the Prevention Quality Indicators: Report of Clinical Expert Review Panel. Report prepared for AHRQ. Accessed July 31, 2013. Available at: http://www.qualityindicators.ahrq.gov/Downloads/Modules/PQI/PQI%20Summary%20Report.pdf.

Gillespie, B.M., Chaboyer, W.P., McInnes, E., Kent, B., Whitty, J.A., Thalib, L. (2014) Repositioning for pressure ulcer prevention in adults. The Cochrane Database of Systematic Reviews, (4):CD009958.

Gillick, M. R., Serrell, N. A., & Gillick, L. S. (1982) Adverse consequences of hospitalization in the elderly. Social Science & Medicine, 16(10), 1033-1038.

Lin, Y.H., Elberth, J.M., and Probst, J.C. (2016) Ambulatory care-sensitive condition hospitalizations among Medicare beneficiaries. American Journal of Preventive Medicine, 51(4), 493-501.

McInnes, E., Jammali-Blasi, A., Bell-Syer, S.E., Dumville, J.C., Middleton, V., Cullum, N. (2015) Support surfaces for pressure ulcer prevention. The Cochrane Database of Systematic Reviews, (9):CD001735.

Nazarko, L. (2008) Providing outpatient antibiotic therapy for cellulitis in primary care. British Journal of Community Nursing, 13(11), 520-524.

Oh, C.C., Ko H.C., Lee, H.Y., Safdar, N., Maki, D.G., & Chlebicki, M.P. (2014) Antibiotic prophylaxis for preventing recurrent cellulitis: a systematic review and meta-analysis. The Journal of Infection, 69(1), 26-34.

Romaire, M.A., Haber, S.G., Wensky, S.G., & McCall, N. (2014) Primary care and specialty providers: an assessment of continuity of care, utilization, and expenditures. Medical Care, 52(12), 1042-1049.

Walsh, E.G., Wiener, J.M., Haber, S., Bragg, A., Freiman, M., & Ouslander, J. G. (2012) Potentially Avoidable Hospitalizations of Dually Eligible Medicare and Medicaid Beneficiaries from Nursing Facility and Home- and Community-Based Services Waiver Programs. Journal of the American Geriatrics Society J Am Geriatr Soc, 60(5), 821-829.

Wysocki, A., Kane, R.L., Golberstein, E., Dowd, B., Lum, T., and Shipee, T. (2014) The association between long-term care setting and potentially preventable hospitalizations among older dual eligibles. Health Services Research, 49(3), 778-797.

1a.3. SYSTEMATIC REVIEW(SR) OF THE EVIDENCE (for INTERMEDIATE OUTCOME, PROCESS, OR STRUCTURE PERFORMANCE MEASURES, INCLUDING THOSE THAT ARE INSTRUMENT-BASED) If the evidence is not based on a systematic review go to section 1a.4) If you wish to include more than one systematic review, add additional tables.

What is the source of the systematic review of the body of evidence that supports the performance measure? A systematic review is a scientific investigation that focuses on a specific question and uses explicit, prespecified scientific methods to identify, select, assess, and summarize the findings of similar but separate studies. It may include a quantitative synthesis (meta-analysis), depending on the available data. (IOM)

☐ Clinical Practice Guideline recommendation (with evidence review)

☐ US Preventive Services Task Force Recommendation

☐ Other systematic review and grading of the body of evidence (*e.g., Cochrane Collaboration, AHRQ Evidence Practice Center*)

☐ Other

Source of Systematic Review: • **Title** • **Author** • **Date** • **Citation, including page number** • **URL**	
Quote the guideline or recommendation verbatim about the process, structure or intermediate outcome being measured. If not a guideline, summarize the conclusions from the SR.	
Grade assigned to the **evidence** associated with the recommendation with the definition of the grade	
Provide all other grades and definitions from the evidence grading system	
Grade assigned to the **recommendation** with definition of the grade	
Provide all other grades and definitions from the recommendation grading system	
Body of evidence: • Quantity – how many studies? • Quality – what type of studies?	
Estimates of benefit and consistency across studies	
What harms were identified?	
Identify any new studies conducted since the SR. Do the new studies change the conclusions from the SR?	

1a.4 OTHER SOURCE OF EVIDENCE

If source of evidence is NOT from a clinical practice guideline, USPSTF, or systematic review, please describe the evidence on which you are basing the performance measure.

1a.4.1 Briefly SYNTHESIZE the evidence that supports the measure. A list of references without a summary is not acceptable.

1a.4.2 What process was used to identify the evidence?

1a.4.3. Provide the citation(s) for the evidence.

1b. Performance Gap

Demonstration of quality problems and opportunity for improvement, i.e., data demonstrating:

- considerable variation, or overall less-than-optimal performance, in the quality of care across providers; and/or
- Disparities in care across population groups.

1b.1. Briefly explain the rationale for this measure *(e.g., how the measure will improve the quality of care, the benefits or improvements in quality envisioned by use of this measure)*

If a COMPOSITE (e.g., combination of component measure scores, all-or-none, any-or-none), SKIP this question and answer the composite questions.

1b.2. Provide performance scores on the measure as specified (current and over time) at the specified level of analysis. *(This is required for maintenance of endorsement. Include mean, std dev, min, max, interquartile range, scores by decile. Describe the data source including number of measured entities; number of patients; dates of data; if a sample, characteristics of the entities include.) This information also will be used to address the sub-criterion on improvement (4b1) under Usability and Use.*

This measure was tested using Medicare fee-for-services (FFS) claims and enrollment data from the CMS Integrated Data Repository (IDR) from October 2014 through September 2015. The data included 4,891,563 dual eligible beneficiaries age 18 years and older. The average age was 64, and this population was predominantly female (60 percent). Roughly 16 percent of the dual eligible beneficiary population used HCBS at least once in the measurement period and close to 12 percent used institutional care (skilled nursing care, custodial nursing care, or intermediate care) at least once in the measurement period. The number of dual eligible beneficiaries varied by state, with the largest number of beneficiaries in the most populated states. On average, there were 7,340 beneficiaries per state. The performance results presented below show the average performance and distribution of performance across 50 states and the District of Columbia. Measure performance is displayed as both unadjusted and risk-adjusted for each rate (acute, chronic, and total) across the three stratifications (HCBS, non-HCBS, and institutionalized.)

Overall, these results show opportunity for improvement across all three rates. Across all three risk-adjusted ACSC hospitalization rates and three strata, the maximum performance (worst performance) is at least twice the rate of the minimum performance (best performance). The gap in performance is most pronounced in the institutionalized population. Additional detail on the ability to distinguish statistically significant differences in performance is provided in the testing attachment (see Testing Attachment Question 2b4).

UNADJUSTED PERFORMANCE

State Unadjusted Rate of Hospitalization for Acute ACSC per 1000 Dual Eligible Beneficiaries:

Unadjusted Acute Rate for Community-Dwelling HCBS Population

Mean	Std Dev	Min	25th	50th	75th	Max
51	15	24	40	49	60	98

Unadjusted Acute Rate for Community-Dwelling Non-HCBS Population

Mean	Std Dev	Min	25th	50th	75th	Max
22	5	12	19	23	25	32

Unadjusted Acute Rate for Institutionalized Population

Mean	Std Dev	Min	25th	50th	75th	Max
59	19	13	48	55	68	120

State Unadjusted Rate of Hospitalization for Chronic ACSC per 1000 Dual Eligible Beneficiaries:

Unadjusted Chronic Rate for Community-Dwelling HCBS Population

Mean	Std Dev	Min	25th	50th	75th	Max
54	22	11	38	54	67	101

Unadjusted Chronic Rate for Community-Dwelling Non-HCBS Population

Mean	Std Dev	Min	25th	50th	75th	Max
43	11	22	36	45	51	64

Unadjusted Chronic Rate for Institutionalized Population

Mean	Std Dev	Min	25th	50th	75th	Max
39	12	20	30	38	49	62

State Unadjusted Rate of Hospitalization for Total ACSC per 1000 Dual Eligible Beneficiaries:

Unadjusted Total Rate for Community-Dwelling HCBS Population

Mean	Std Dev	Min	25th	50th	75th	Max
114	37	38	86	118	137	210

Unadjusted Total Rate for Community-Dwelling Non-HCBS Population

Mean	Std Dev	Min	25th	50th	75th	Max
71	15	37	60	73	82	98

Unadjusted Total Rate for Institutionalized Population

Mean	Std Dev	Min	25th	50th	75th	Max
105	31	40	84	99	127	199

RISK-ADJUSTED PERFORMANCE

State Risk-Adjusted Rate of Hospitalization for Acute ACSC per 1000 Dual Eligible Beneficiaries:

Adjusted Acute Rate for Community-Dwelling HCBS Population

Mean	Std Dev	Min	25th	50th	75th	Max	
52	10	29	47	52		58	73

Adjusted Acute Rate for Community-Dwelling Non-HCBS Population

Mean	Std Dev	Min	25th	50th	75th	Max
23	4	15	21	23	26	32

Adjusted Acute Rate for Institutionalized Population

Mean	Std Dev	Min	25th	50th	75th	Max
59	19	15	46	55	69	118

State Risk-Adjusted Rate of Hospitalization for Chronic ACSC per 1000 Dual Eligible Beneficiaries:

Adjusted Chronic Rate for Community-Dwelling HCBS Population

Mean	Std Dev	Min	25th	50th	75th	Max
53	12	18	45	53	61	88

Adjusted Chronic Rate for Community-Dwelling Non-HCBS Population

Mean	Std Dev	Min	25th	50th	75th	Max
44	7	26	39	44	48	57

Adjusted Chronic Rate for Institutionalized Population

Mean	Std Dev	Min	25th	50th	75th	Max
37	10	18	31	36	43	60

State Risk-Adjusted Rate of Hospitalization for Total ACSC per 1000 Dual Eligible Beneficiaries:

Adjusted Total Rate for Community-Dwelling HCBS Population

Mean	Std Dev	Min	25th	50th	75th	Max
105	18	63	95	108	117	145

Adjusted Total Rate for Community-Dwelling Non-HCBS Population

Mean	Std Dev	Min	25th	50th	75th	Max
67	9	42	61	67	74	81

Adjusted Total Rate for Institutionalized Population

Mean	Std Dev	Min	25th	50th	75th	Max
95	26	49	76	92	109	173

1b.3. If no or limited performance data on the measure as specified is reported in 1b2, then provide a summary of data from the literature that indicates opportunity for improvement or overall less than optimal performance on the specific focus of measurement.

Not applicable. Performance results provided in 1b.2.

1b.4. Provide disparities data from the measure as specified (current and over time) by population group, e.g., by race/ethnicity, gender, age, insurance status, socioeconomic status, and/or disability. *(This is required for maintenance of endorsement. Describe the data source including number of measured entities; number of patients; dates of data; if a sample, characteristics of the entities included.) For measures that show high levels of performance, i.e., "topped out", disparities data may demonstrate an opportunity for improvement/gap in care for certain sub-populations. This information also will be used to address the sub-criterion on improvement (4b1) under Usability and Use.*

Testing of the measure showed disparities by age (between older and younger dual eligible beneficiaries), gender, and type of LTSS (i.e., non-HCBS, HCBS, and institutional users) in the unadjusted results. Testing used Medicare FFS claims and enrollment data from the CMS Integrated Data Repository (IDR) from October 2014 through September 2015. The data included 4,891,563 dual eligible beneficiaries. The average age was 64 years, and this population was predominantly female (60 percent).

Age:

State-level composite unadjusted rates varied substantially by age group and composite type. Based on a two-sample t-test, the chronic and acute unadjusted composite rates had significant differences between the older (65 years and older) and younger (18 to 64 years) age groups (p-value = 0). For younger dual eligible beneficiaries (18 to 64 years), the average unadjusted performance was 21 per 1,000 beneficiaries for the acute rate, 39 for the chronic rate, and 64 for the total rate. For older dual eligible beneficiaries (age 65 years

and older), the average unadjusted performance was 39 per 1,000 beneficiaries for the acute rate, 50 for the chronic rate, and 98 for the total rate.

Gender:

State-level acute and chronic unadjusted composite rates are significantly greater for females compared with males. For female dual eligible beneficiaries, the average unadjusted performance was 33 per 1,000 beneficiaries for the acute rate, 46 for the chronic rate, and 85 for the total rate. Male dual eligible beneficiaries had an average unadjusted performance of 26 per 1,000 beneficiaries for the acute rate, 42 for the chronic rate, and 73 for the total rate. The variation by gender is much less than the variation by age, and it's quite possible that the variation in age distribution is impacting the rates by gender as well.

LTSS Status:

The acute and chronic unadjusted composite rates differ significantly by the type of LTSS that dual eligible beneficiaries use. Persons using LTSS (HCBS and institutional) have greater unadjusted acute composite rates, and persons using HCBS have greater unadjusted chronic rates compared to the community-dwelling non-HCBS population. For HCBS users, the average unadjusted performance was 51 per 1,000 beneficiaries for the acute rate, 54 for the chronic rate, and 114 for the total rate. For institutional users, the average unadjusted performance was 59 per 1,000 beneficiaries for the acute rate, 39 for the chronic rate, and 105 for the total rate. Non-HCBS users had an average unadjusted performance of 22 per 1,000 beneficiaries for the acute rate, 43 for the chronic rate, and 71 for the total rate. Between the two types of LTSS, HCBS users have greater unadjusted chronic ACSC rates, while institutional users have higher unadjusted acute rates.

1b.5. If no or limited data on disparities from the measure as specified is reported in 1b.4, then provide a summary of data from the literature that addresses disparities in care on the specific focus of measurement. Include citations. Not necessary if performance data provided in 1b.4

Not applicable. Performance data provided in 1b.4.

1c. Composite Quality Construct and Rationale

1c.1. A composite performance measure is a combination of two or more component measures, each of which individually reflects quality of care, into a single performance measure with a single score.

For purposes of NQF measure submission, evaluation, and endorsement, the following will be considered composites:

- Measures with two or more individual performance measure scores combined into one score for an accountable entity.
- Measures with two or more individual component measures assessed separately for each patient and then aggregated into one score for an accountable entity:
    - all-or-none measures (e.g., all essential care processes received, or outcomes experienced, by each patient);

1c.1. Please identify the composite measure construction: Two or more individual performance measure scores combined into one score.

1c.2. Describe the quality construct, including:

- the overall area of quality
- included component measures and
- the relationship of the component measures to the overall composite and to each other.

Overall area of quality: This is a measure of hospitalization for ambulatory care sensitive conditions (ACSC) for dual eligible beneficiaries. These are conditions which can be treated in the outpatient setting, potentially avoiding the need for hospitalization. Hospitalization for ambulatory care sensitive conditions could be reduced by improved access to ambulatory care and improved care coordination. The composite measure is

constructed from individual ambulatory care sensitive condition-specific measures (several of which are NQF endorsed) and adapted from the composite measures developed by the Agency for Healthcare Quality (AHRQ). The composite has three rates: Chronic, acute and total (combined chronic and acute conditions). Each rate of the composite measures overall quality of outpatient care to prevent hospitalization for chronic conditions, acute conditions and overall.

Included component measures:

The following measures represent subcomponents of the Hospitalization for Ambulatory Care Sensitive Conditions for Dual Eligible Beneficiaries measure. Additional information about how the process for constructing the composites is provided in the testing attachment question 2d2.1.

Chronic Composite Component Measures:

- #0272 Diabetes Short-Term Complications Admission Rate (PQI 01)
- #0274 Diabetes Long-Term Complications Admission Rate (PQI 03)
- #0638 Uncontrolled Diabetes Admission Rate (PQI 14)
- #0285 Lower-Extremity Amputation among Patients with Diabetes Rate (PQI 16)
- #0275 Chronic Obstructive Pulmonary Disease (COPD) or Asthma in Older Adults Admission Rate (PQI 05)
- #0283 Asthma in Younger Adults Admission Rate (PQI 15)
- #0277 Congestive Heart Failure Admission Rate (PQI 08)
- #0276 Hypertension Admission Rate (PQI 07) – Note, this is no longer an NQF endorsed measure

Acute Composite Component Measures:

- #0279 Community Acquired Pneumonia Admission Rate (PQI 11)
- #0281 Urinary Tract Infection Admission Rate (PQI 12)
- Cellulitis Admission Rate – Note, this is not an existing NQF endorsed measure
- Pressure Ulcers Admission Rate – Note, this is not an existing NQF endorsed measure

Total Composite: All of the above individual measure components are included in the total composite.

Relationship of the component measures to the overall composite and to each other:

Each component measure represents a unique event (i.e., hospitalization) which is counted toward the total composite score (i.e., total count of hospitalizations for ambulatory care sensitive conditions) per 1,000 dual eligible adults. The measure is count of hospitalizations, therefore a dual eligible adult may contribute more than one hospitalization to the numerator and those hospitalizations may be identified in different individual measure components. For example, a dual eligible adult with three hospitalizations in the year could have two hospitalizations for COPD (#0275) and one hospitalization for Congestive Heart Failure (#0277). The total number of hospitalizations this dual eligible adult would contribute to the numerator of the acute composite is three. This dual eligible adult would contribute zero hospitalizations to the numerator of the chronic composite and three hospitalizations to the numerator of the total composite.

1c.3. Describe the rationale for constructing a composite measure, including how the composite provides a distinctive or additive value over the component measures individually.

The composite measure provides an overall rate of hospitalization for ambulatory care sensitive conditions tailored to the dual eligible population, providing benefit over existing NQF endorsed measures which only look at hospitalization for specific ACSC conditions in a broader population. The overall rate of potentially avoidable hospitalizations for ACSC helps states understand the underlying quality of outpatient care provided to dual eligible beneficiaries for acute conditions, chronic conditions, and overall. Given the needs of this population, this measure provides an opportunity to understand and to improve the quality of outpatient care specifically for dual eligible beneficiaries. The state-level measure can assess the quality of a breadth of outpatient services by providers that may not be linked to a single accountable healthcare facility. Providers in

home care, outpatient services, and post-acute care have the capacity to improve (lower) these observed rates of hospitalization for ACSC conditions by managing these conditions in an outpatient setting.

1c.4. Describe how the aggregation and weighting of the component measures are consistent with the stated quality construct and rationale.

Each hospitalization for an ambulatory care sensitive condition is weighted equally and added together to construct the acute, chronic, and overall composites. Each hospitalization in the component measures represents a potential quality improvement opportunity. . The equal weight approach is consistent with the quality construct, which is the number of potentially avoidable hospitalizations due to ambulatory care sensitive conditions.

2. Reliability and Validity—Scientific Acceptability of Measure Properties

Extent to which the measure, as specified, produces consistent (reliable) and credible (valid) results about the quality of care when implemented. ***Measures must be judged to meet the sub criteria for both reliability and validity to pass this criterion and be evaluated against the remaining criteria.***

2a.1. Specifications The measure is well defined and precisely specified so it can be implemented consistently within and across organizations and allows for comparability. eMeasures should be specified in the Health Quality Measures Format (HQMF) and the Quality Data Model (QDM).

De.5. Subject/Topic Area *(check all the areas that apply):*

De.6. Non-Condition Specific *(check all the areas that apply):*

De.7. Target Population Category *(Check all the populations for which the measure is specified and tested if any):*

S.1. Measure-specific Web Page *(Provide a URL link to a web page specific for this measure that contains current detailed specifications including code lists, risk model details, and supplemental materials. Do not enter a URL linking to a home page or to general information.)*

Currently not available

S.2a. If this is an eMeasure, HQMF specifications must be attached. Attach the zipped output from the eMeasure authoring tool (MAT) - if the MAT was not used, contact staff. (Use the specification fields in this online form for the plain-language description of the specifications)

This is not an eMeasure **Attachment:**

S.2b. Data Dictionary, Code Table, or Value Sets *(and risk model codes and coefficients when applicable) must be attached. (Excel or csv file in the suggested format preferred - if not, contact staff)*

Attachment **Attachment:** FINAL_-_7.16.18_-_Duals1_valueset_07.16.18.xlsx

S.2c. Is this an instrument-based measure (i.e., data collected via instruments, surveys, tools, questionnaires, scales, etc.)? Attach copy of instrument if available.

No, this is not an instrument-based measure **Attachment:**

S.2d. Is this an instrument-based measure (i.e., data collected via instruments, surveys, tools, questionnaires, scales, etc.)? Attach copy of instrument if available.

Not an instrument-based measure

S.3.1. For maintenance of endorsement: Are there changes to the specifications since the last updates/submission. If yes, update the specifications for S1-2 and S4-22 and explain reasons for the changes in S3.2.

S.3.2. For maintenance of endorsement, please briefly describe any important changes to the measure specifications since last measure update and explain the reasons.

Not applicable

S.4. Numerator Statement *(Brief, narrative description of the measure focus or what is being measured about the target population, i.e., cases from the target population with the target process, condition, event, or outcome) DO NOT include the rationale for the measure.*

IF an OUTCOME MEASURE, state the outcome being measured. Calculation of the risk-adjusted outcome should be described in the calculation algorithm (S.14).

Chronic Composite: Number of acute inpatient hospital admissions in the measurement year for diabetes short term complications, diabetes long term complications, uncontrolled diabetes, low-extremity amputation, chronic obstructive pulmonary disease (COPD), asthma, hypertension, and heart failure.

Acute Composite: Number of acute inpatient hospital admissions in the measurement year for bacterial pneumonia, urinary tract infection, cellulitis and pressure ulcers.

Total Composite: Sum of acute and chronic composites

S.5. Numerator Details *(All information required to identify and calculate the cases from the target population with the target process, condition, event, or outcome such as definitions, time period for data collection, specific data collection items/responses, code/value sets – Note: lists of individual codes with descriptors that exceed 1 page should be provided in an Excel or csv file in required format at S.2b)*

IF an OUTCOME MEASURE, describe how the observed outcome is identified/counted. Calculation of the risk-adjusted outcome should be described in the calculation algorithm (S.14).

Chronic ACSC: Follow the steps below to identify the number of chronic ACSC acute inpatient admissions.

Step 1: Identify all acute inpatient admissions during the measurement year. To identify acute inpatient admissions:

1. Identify all acute and nonacute inpatient stays (Inpatient Stay Value Set).
2. Exclude nonacute inpatient stays (Nonacute Inpatient Stay Value Set).
3. Identify the discharge date for the stay.

Step 2: Acute-to-acute transfers (e.g. transfers from one hospital to another hospital): Keep the original discharge and drop the transfer's discharge. Organizations must identify "transfers" using their own methods and then confirm the acute inpatient care setting using the process in step 1.

Note non-acute-to-acute transfers should be included in the measure numerator.

Step 3: For the remaining acute inpatient discharges, identify discharges with any of the following:

- Primary diagnosis for diabetes short-term complications (i.e., ketoacidosis, hyperosmolarity or coma; Diabetes Short Term Complications Value Set).
- Primary diagnosis for diabetes with long-term complications (i.e., renal, eye, neurological, circulatory or unspecified complications; Diabetes Long Term Complications Value Set).
- Primary diagnosis for uncontrolled diabetes (Uncontrolled Diabetes Value Set).
- A procedure code for lower extremity amputation (Lower Extremity Amputation Procedures Value Set) and any diagnosis for diabetes (Diabetes Diagnosis Value Set).
    - Exclude any discharge with a diagnosis for traumatic amputation of the lower extremity (Traumatic Amputation of Lower Extremity Value Set) or toe amputation procedure (Toe Amputation Value Set).
- Primary diagnosis of COPD (COPD Diagnosis Value Set), excluding any discharge with a diagnosis for cystic fibrosis and anomalies of the respiratory system (Cystic Fibrosis and Respiratory System Anomalies Value Set).
- Primary diagnosis for asthma (Asthma Diagnosis Value Set), excluding any discharge with a diagnosis for cystic fibrosis and anomalies of the respiratory system (Cystic Fibrosis and Respiratory System Anomalies Value Set).

- Primary diagnosis for acute bronchitis (Acute Bronchitis Diagnosis Value Set) and diagnosis for COPD (COPD Diagnosis Value Set).
    - Exclude any discharge with a diagnosis for cystic fibrosis and anomalies of the respiratory system (Cystic Fibrosis and Respiratory System Anomalies Value Set).
- Primary diagnosis for heart failure (Heart Failure Diagnosis Value Set), excluding any discharges with a cardiac procedure (Cardiac Procedure Value Set).
- Primary diagnosis for hypertension (Hypertension Value Set), excluding any discharge with a cardiac procedure (Cardiac Procedure Value Set) or diagnosis of Stage I-IV kidney disease (Stage I-IV Kidney Disease Value Set) with a dialysis procedure (Dialysis Value Set).

Note: For criteria that include multiple events, codes must be on the same claim.

Acute ACSC: Follow the steps below to identify the number of acute ACSC acute inpatient admissions.

Step 1: Identify all acute inpatient discharges during the measurement year. To identify acute inpatient admissions:

1. Identify all acute and nonacute inpatient stays (Inpatient Stay Value Set).
2. Exclude nonacute inpatient stays (Nonacute Inpatient Stay Value Set).
3. Identify the discharge date for the stay.

Step 2: Acute-to-acute transfers (e.g. transfers from one hospital to another hospital): Keep the original discharge and drop the transfer discharge. Organizations must identify "transfers" using their own methods and then confirm the acute inpatient care setting using the process in step 1. Note non-acute-to-acute transfers should be included in the measure numerator.

Step 3: For the remaining acute inpatient discharges, identify discharges with the any of the following:

- Primary diagnosis of bacterial pneumonia (Bacterial Pneumonia Value Set), excluding any discharge with a diagnosis of sickle cell anemia, HB-S disease (Sickle Cell Anemia and HB-S Disease Value Set) or procedure or diagnosis for immunocompromised state (Immunocompromised State Value Set).
- Primary diagnosis of urinary tract infection (Urinary Tract Infection Value Set), excluding any discharge with a diagnosis of kidney/urinary tract disorder (Kidney and Urinary Tract Disorder Value Set) or procedure or diagnosis for immunocompromised state (Immunocompromised State Value Set).
- Primary diagnosis of cellulitis (Cellulitis Value Set) excluding any discharge with a procedure or diagnosis for immunocompromised state (Immunocompromised State Value Set).
- Primary diagnosis of pressure ulcer (Pressure Ulcer Value Set) excluding any discharge with a procedure or diagnosis for immunocompromised state (Immunocompromised State Value Set).

Note: For criteria that include multiple events, codes must be on the same claim.

Total ACSC: Count of inpatient stays with a discharge date during the measurement year for a chronic or acute ACSC. Sum the events from the Chronic ACSC and Acute ACSC categories to obtain a total ACSC.

S.6. Denominator Statement *(Brief, narrative description of the target population being measured)*

Dual eligible adults age 18 years and older within each state

S.7. Denominator Details *(All information required to identify and calculate the target population/denominator such as definitions, time period for data collection, specific data collection items/responses, code/value sets – Note: lists of individual codes with descriptors that exceed 1 page should be provided in an Excel or csv file in required format at S.2b.)*

IF an OUTCOME MEASURE, describe how the target population is identified. Calculation of the risk-adjusted outcome should be described in the calculation algorithm (S.14).

Dual eligible adults age 18 years and older continuously enrolled in Medicaid and Medicare for at least 18 months (measurement year plus six months prior) within each state

S.8. Denominator Exclusions *(Brief narrative description of exclusions from the target population)*

- See the numerator details section for exclusions from the individual composite indicators
- Hospitalizations for obstetrics
- Hospice
- Acute hospital transfers

S.9. Denominator Exclusion Details *(All information required to identify and calculate exclusions from the denominator such as definitions, time period for data collection, specific data collection items/responses, code/value sets – Note: lists of individual codes with descriptors that exceed 1 page should be provided in an Excel or csv file in required format at S.2b.)*

- See the numerator details section for exclusions from the individual composite indicators
- Discharges for obstetrics. Exclude inpatient stays with newborn/obstetrics claim type code from the numerator (admission type code = 4 "Newborn").
- Discharges to hospice: Exclude inpatient stays for individuals receiving hospice care from the numerator, and exclude beneficiaries receiving hospice care at the start of the measurement period from the denominator (admission source code = F "Transfer from Hospice and is under a Hospice Plan of Care or Enrolled in a Hospice Program - The patient was admitted to this facility as a transfer from a hospice").
- Acute hospital transfers: See numerator details for details on excluding transfers from acute hospitals.

S.10. Stratification Information *(Provide all information required to stratify the measure results, if necessary, including the stratification variables, definitions, specific data collection items/responses, code/value sets, and the risk-model covariates and coefficients for the clinically-adjusted version of the measure when appropriate – Note: lists of individual codes with descriptors that exceed 1 page should be provided in an Excel or csv file in required format with at S.2b.)*

Stratification groups are defined based on use of LTSS services in the first month of the measurement year using enrollment data to divide the dual eligible population in each state into three mutually exclusive groups: (1) community-dwelling HCBS users; (2) community dwelling non-HCBS users; or, (3) non-community-dwelling (institutionalized) population. These designations come from the Medicare Modernization Act files that states send to CMS.

S.11. Risk Adjustment Type (Select type. Provide specifications for risk stratification in measure testing attachment)

Statistical risk model

If other:

S.12. Type of score:

Rate/proportion

If other:

S.13. Interpretation of Score *(Classifies interpretation of score according to whether better quality is associated with a higher score, a lower score, a score falling within a defined interval, or a passing score)*

Better quality = Lower score

S.14. Calculation Algorithm/Measure Logic (*Diagram or describe the calculation of the measure score as an ordered sequence of steps including identifying the target population; exclusions; cases meeting the target process, condition, event, or outcome; time period for data, aggregating data; risk adjustment; etc.)*

Calculation of Observed Rate

The number of observed discharges divided by the number of members in the eligible population within each state, multiplied by 1,000 within each stratification and for each ACSC category and Total ACSC.

Calculation of Risk-Adjusted Rate at the Reporting Level

Steps:

For each outcome type/subpopulation strata:

1. Apply the risk adjustment prediction model to calculate the expected number of ACSC admissions for all dual-eligible beneficiaries in the reporting level (i.e., state). This constitutes the denominator, termed the "expected" count.
2. Sum the actual ACSC admissions for all dual eligible beneficiaries in the reporting level. This constitutes the numerator, termed the "observed" count.
3. Divide the numerator by the denominator to find the reporting level's observed to expected (O/E) ratio.
4. Multiply this O/E ratio by the observed national rate to find the reporting level's risk-adjusted ACSC rate.

Explanation:

The risk-adjusted rate is calculated as the ratio of the number of observed to the number of expected ACSC admissions at the state reporting level, multiplied by the national observed ACSC admission rate. This approach conceptually provides a way to compare a particular reporting level's performance given its case mix to an average reporting level's performance with the same case mix. Hence, a lower observed-to-expected ratio indicates lower-than-expected ACSC admission rates, or better quality. A higher ratio indicates higher-than-expected ACSC admission rates, or worse quality. The observed number of ACSC admissions is calculated directly from the data by counting the total number of ACSC admissions across all eligible beneficiaries in a reporting level during the measure period. The expected number of ACSC admissions is obtained by using the coefficients estimated by the person-level risk-adjustment model described in the corresponding testing attachment. The estimated regression coefficients are subsequently multiplied by the patient characteristics. The results are then transformed and summed over all patients in the reporting level to get an expected value. This calculation transforms the ratio of observed over expected into a rate that is compared to the national observed ACSC admission rate.

S.15. Sampling *(If measure is based on a sample, provide instructions for obtaining the sample and guidance on minimum sample size.)*

IF an instrument-based performance measure (e.g., PRO-PM), identify whether (and how) proxy responses are allowed.

Not applicable

S.16. Survey/Patient-reported data *(If measure is based on a survey or instrument, provide instructions for data collection and guidance on minimum response rate.)*

Specify calculation of response rates to be reported with performance measure results.

Not applicable

S.17. Data Source *(Check ONLY the sources for which the measure is SPECIFIED AND TESTED).*

If other, please describe in S.18.

Claims

S.18. Data Source or Collection Instrument *(Identify the specific data source/data collection instrument (e.g. name of database, clinical registry, collection instrument, etc., and describe how data are collected.)*

IF instrument-based, identify the specific instrument(s) and standard methods, modes, and languages of administration.

Not applicable

S.19. Data Source or Collection Instrument *(available at measure-specific Web page URL identified in S.1 OR in attached appendix at A.1)*

No data collection instrument provided

S.20. Level of Analysis *(Check ONLY the levels of analysis for which the measure is SPECIFIED AND TESTED)*

Population: Regional and State

S.21. Care Setting *(Check ONLY the settings for which the measure is SPECIFIED AND TESTED)*

Home Care, Outpatient Services, Post-Acute Care

If other:

S.22. COMPOSITE Performance Measure - Additional Specifications *(Use this section as needed for aggregation and weighting rules, or calculation of individual performance measures if not individually endorsed.)*

Aggregation rules for the chronic, acute and total composites are described above in the numerator details.

2. Validity – See attached Measure Testing Submission Form

FINAL_-_6.28.18_-_Duals1_Testing_Appendix_6_28_18_CLEAN.docx,FINAL_-_7.13.18_-_DUALS1_NQF_Testing_-Composite-_7_11_18_CLEAN.docx

2.1 For maintenance of endorsement

Reliability testing: If testing of reliability of the measure score was not presented in prior submission(s), has reliability testing of the measure score been conducted? If yes, please provide results in the Testing attachment. Please use the most current version of the testing attachment (v7.1). Include information on all testing conducted (prior testing as well as any new testing); use red font to indicate updated testing.

2.2 For maintenance of endorsement

Has additional empirical validity testing of the measure score been conducted? If yes, please provide results in the Testing attachment. Please use the most current version of the testing attachment (v7.1). Include information on all testing conducted (prior testing as well as any new testing); use red font to indicate updated testing.

2.3 For maintenance of endorsement

Risk adjustment: For outcome, resource use, cost, and some process measures, risk-adjustment that includes social risk factors is not prohibited at present. Please update sections 1.8, 2a2, 2b1,2b4.3 and 2b5 in the Testing attachment and S.140 and S.11 in the online submission form. NOTE: These sections must be updated even if social risk factors are not included in the risk-adjustment strategy. You MUST use the most current version of the Testing Attachment (v7.1) -- older versions of the form will not have all required questions.

Composite Measure Testing (subcriteria 2a2, 2b1-2b6)

Measure Number (*if previously endorsed*)**:**
Composite Measure Title: Hospitalization for Ambulatory Care Sensitive Conditions for Dual Eligible Beneficiaries
Date of Submission: 8/1/2018

Composite Construction:

☒ Two or more individual performance measure scores crombined into one score

☐ All-or-none measures (e.g., all essential care processes received or outcomes experienced by each patient)

Measure Description and Intended Use:

For dual eligible beneficiaries age 18 and older, state-level rates of hospital admissions for ambulatory care sensitive conditions (ACSC) per 1,000 beneficiaries for ACSC by chronic and acute conditions. This measure has three rates reported as both observed and risk-adjusted rates:

- Chronic Conditions Composite
- Acute Conditions Composite

- Total (Acute and Chronic Conditions) Composite

This rate is stratified and reported for three populations: (1) community-dwelling home and community-based services (HCBS) users, (2) community-dwelling non-HCBS users, or (3) non-community-dwelling (institutionalized) population.

This measure is planned for public reporting and quality improvement at the state level. This population health measure can help states understand the underlying quality of outpatient care, including home- and community-based services, provided to dual eligible beneficiaries for acute conditions, chronic conditions, and overall. The state-level measure can assess the quality of a breadth of outpatient services by providers that may not be linked to a single accountable healthcare facility.

Instructions: Please contact NQF staff before you begin.

- If a component measure is submitted as an individual performance measure, the non-composite measure testing form must also be completed and attached to the individual measure submission.
- Measures must be tested for all the data sources and levels of analyses that are specified. *If there is more than one set of data specifications or more than one level of analysis, contact NQF staff* about how to present all the testing information in one form.
- Sections 1, 2a2, 2b1, 2b2, and 2b4 must be completed.
- For composites with outcome and resource use measures, section 2b3 also must be completed.
- If specified for multiple data sources/sets of specificaitons (e.g., claims and EHRs), section 2b5 also must be completed.
- Respond to all questions as instructed with answers immediately following the question. All information on testing to demonstrate meeting the subcriteria for reliability (2a2) and validity (2b1-2b6) and composites (2c) must be in this form. An appendix for *supplemental* materials may be submitted, but there is no guarantee it will be reviewed.
- If you are unable to check a box, please highlight or shade the box for your response.
- Maximum of 25 pages (*incuding questions/instructions;* minimum font size 11 pt; do not change margins). *Contact NQF staff if more pages are needed.*
- Contact NQF staff regarding questions. Check for resources at Submitting Standards webpage.
- For information on the most updated guidance on how to address social risk factors variables and testing in this form refer to the release notes for version 7.1 of the Measure Testing Attachment. and the 2017 Measure Evaluation Criteria and Guidance.

Note: The information provided in this form is intended to aid the Standing Committee and other stakeholders in understanding to what degree the testing results for this measure meet NQF's evaluation criteria for testing.

2a2. Reliability testing 10 demonstrates the measure data elements are repeatable, producing the same results a high proportion of the time when assessed in the same population in the same time period and/or that the measure score is precise. For instrument-based measures (including PRO-PMs) and composite performance measures, reliability should be demonstrated for the computed performance score.

2b1. Validity testing 11 demonstrates that the measure data elements are correct and/or the measure score correctly reflects the quality of care provided, adequately identifying differences in quality. For instrument based measures (including PRO-PMs) and composite performance measures, validity should be demonstrated for the computed performance score.

2b2. Exclusions are supported by the clinical evidence and are of sufficient frequency to warrant inclusion in the specifications of the measure; 12

AND

If patient preference (e.g., informed decision making) is a basis for exclusion, there must be evidence that the exclusion impacts performance on the measure; in such cases, the measure must be specified so that the information about patient preference and the effect on the measure is transparent (e.g., numerator category computed separately, denominator exclusion category computed separately). 13

2b3. For outcome measures and other measures when indicated (e.g., resource use):

- an evidence-based risk-adjustment strategy (e.g., risk models, risk stratification) is specified; is based on patient factors (including clinical and social risk factors) that influence the measured outcome and are present at start of care; 14,15 and has demonstrated adequate discrimination and calibration

OR

- rationale/data support no risk adjustment/ stratification.

2b4. Data analysis of computed measure scores demonstrates that methods for scoring and analysis of the specified measure allow for identification of statistically significant and practically/clinically meaningful 16 differences in performance;

OR

there is evidence of overall less-than-optimal performance.

2b5. If multiple data sources/methods are specified, there is demonstration they produce comparable results.

2b6. Analyses identify the extent and distribution of missing data (or nonresponse) and demonstrate that performance results are not biased due to systematic missing data (or differences between responders and nonresponders) and how the specified handling of missing data minimizes bias.

2c. For composite performance measures, empirical analyses support the composite construction approach and demonstrate that:

2c1. the component measures fit the quality construct and add value to the overall composite while achieving the related objective of parsimony to the extent possible; and

2c2.the aggregation and weighting rules are consistent with the quality construct and rationale while achieving the related objective of simplicity to the extent possible.

(*if not conducted or results not adequate, justification must be submitted and accepted)*

Notes

10. Reliability testing applies to both the data elements and computed measure score. Examples of reliability testing for data elements include, but are not limited to: inter-rater/abstractor or intra-rater/abstractor studies; internal consistency for multi-item scales; test-retest for survey items. Reliability testing of the measure score addresses precision of measurement (e.g., signal-to-noise).

11. Validity testing applies to both the data elements and computed measure score. Validity testing of data elements typically analyzes agreement with another authoritative source of the same information. Examples of validity testing of the measure score include, but are not limited to: testing hypotheses that the measures scores indicate quality of care, e.g., measure scores are different for groups known to have differences in quality assessed by another valid quality measure or method; correlation of measure scores with another valid indicator of quality for the specific topic; or relationship to conceptually related measures (e.g., scores on process measures to scores on outcome measures). Face validity of the measure score as a quality indicator may be adequate if accomplished through a systematic and transparent process, by identified experts, and explicitly addresses whether performance scores resulting from the measure as specified can be used to distinguish good from poor quality. The degree of consensus and any areas of disagreement must be provided/discussed.

12. Examples of evidence that an exclusion distorts measure results include, but are not limited to: frequency of occurrence, variability of exclusions across providers, and sensitivity analyses with and without the exclusion.

13. Patient preference is not a clinical exception to eligibility and can be influenced by provider interventions.

14. Risk factors that influence outcomes should not be specified as exclusions.

15. With large enough sample sizes, small differences that are statistically significant may or may not be practically or clinically meaningful. The substantive question may be, for example, whether a statistically significant difference of one percentage point in the percentage of patients who received smoking cessation counseling (e.g., 74 percent v. 75 percent) is clinically meaningful; or whether a statistically significant difference of $25 in cost for an episode of care (e.g., $5,000 v. $5,025) is practically meaningful. Measures with overall less-than-optimal performance may not demonstrate much variability across providers.

1. DATA/SAMPLE USED FOR ALL TESTING OF THIS MEASURE

Often the same data are used for all aspects of measure testing. In an effort to eliminate duplication, the first five questions apply to all measure testing. If there are differences by aspect of testing,(e.g., reliability vs. validity) be sure to indicate the specific differences in question 1.7.

1.1. What type of data was used for testing? (*Check all the sources of data identified in the measure specifications and data used for testing the measure. Testing must be provided for all the sources of data specified and intended for measure implementation.* ***If different data sources are used for different components in the composite, indicate the component after the checkbox. If different data sources are used for the numerator and denominator, indicate N [numerator] or D [denominator] after the checkbox.***)

Measure Specified to Use Data From: (*must be consistent with data sources entered in S.17*)	**Measure Tested with Data From:**
☐ abstracted from paper record	☐ abstracted from paper record
☒ claims	☒ claims
☐ registry	☐ registry
☐ abstracted from electronic health record	☐ abstracted from electronic health record
☐ eMeasure (HQMF) implemented in EHRs	☐ eMeasure (HQMF) implemented in EHRs
☒ other: enrollment data, Medicare Modernization Act (MMA) files	☒ other: enrollment data, MMA files

1.2. If an existing dataset was used, identify the specific dataset (*the dataset used for testing must be consistent with the measure specifications for target population and healthcare entities being measured; e.g., Medicare Part A claims, Medicaid claims, other commercial insurance, nursing home MDS, home health OASIS, clinical registry*).

This measure is calculated using Medicare fee-for-services (FFS) claims and enrollment data from the CMS Integrated Data Repository (IDR). The measure denominator (dual eligible beneficiaries) is identified using enrollment data. The numerator is defined using Medicare FFS claims from acute inpatient hospitals. We additionally explored stratification for long-term services and supports (LTSS) users using enrollment data to divide the dual eligible population into three mutually exclusive groups: (1) community-dwelling home and community-based services (HCBS) users, (2) community-dwelling non-HCBS users, or (3) non-community-dwelling (institutionalized) population. The stratifications were based on expert input and results of analysis described in section 2b.3. The stratification designations come from the Medicare Modernization Act (MMA) files that states send to CMS.

1.3. What are the dates of the data used in testing? October 2014 – September 2015

1.4. What levels of analysis were tested? (*testing must be provided for all the levels specified and intended for measure implementation, e.g., individual clinician, hospital, health plan*)

Measure Specified to Measure Performance of: (*must be consistent with levels entered in item S.20*)	**Measure Tested at Level of:**
☐ individual clinician	☐ individual clinician
☐ group/practice	☐ group/practice
☐ hospital/facility/agency	☐ hospital/facility/agency
☐ health plan	☐ health plan
☒ other: state	☒ other: state

1.5. How many and which measured entities were included in the testing and analysis (by level of analysis and data source)? (*identify the number and descriptive characteristics of measured entities included in the analysis (e.g., size, location, type); if a sample was used, describe how entities were selected for inclusion in the sample*)

State-level results are based on all 50 states, plus the District of Columbia (51 states).

The intended use of this measure is to allow CMS and states to evaluate the quality of care for FFS dual eligible beneficiaries across states; therefore, the data source was appropriate for the intended level of accountability.

1.6. How many and which patients were included in the testing and analysis (by level of analysis and data source)? (*identify the number and descriptive characteristics of patients included in the analysis (e.g., age, sex, race, diagnosis); if a sample was used, describe how patients were selected for inclusion in the sample*)

The data included 4,891,563 dual eligible beneficiaries. The average age was 64, and this population was predominantly female (60 percent). Roughly 16 percent of the dual eligible beneficiary population used HCBS at least once in the measurement population and close to 12 percent used institutional care (skilled nursing care, custodial nursing care, or intermediate care) at least once in the measurement period. To examine these populations in more detail, we created three mutually exclusive groups based on use of HCBS or institutional care at the beginning of the measurement period (October 2014). The community-dwelling non-HCBS user population resembled the community-dwelling HCBS user population on age and gender. Dual eligible beneficiaries living in institutions were generally older and had a greater proportion of females relative to their community-dwelling counterparts.

The number of dual eligible beneficiaries varied by state, with the largest number of beneficiaries in the most populated states. On average, there were 7,340 beneficiaries per state.

1.7. If there are differences in the data or sample used for different aspects of testing (e.g., reliability, validity, exclusions, risk adjustment), identify how the data or sample are different for each aspect of testing reported below.

Not applicable. There were no differences in the data used for different aspects of testing.

1.8 What were the social risk factors that were available and analyzed? For example, patient-reported data (e.g., income, education, language), proxy variables when social risk data are not collected from each patient (e.g. census tract), or patient community characteristics (e.g. percent vacant housing, crime rate) which do not have to be a proxy for patient-level data.

We did not analyze social risk factors for three reasons:

(1) This measure focuses exclusively on a population with social risk (i.e., dual eligible beneficiaries) and by its nature acknowledges the unique risk that this population faces. Measure developers often consider dual eligibility as a social risk factor in risk adjustment models. By defining a measure, risk-adjustment approach, and stratification approach specific to this population, the measure is acknowledging the unique risk that this population faces. Given that the denominator for this measure is limited to dual eligible beneficiaries, we have accounted for a social risk factor for this outcome. Therefore, it unclear whether adjusting for social risk within this population is appropriate.

(2) Patient-reported data and patient community characteristics were not available in the testing data source of administrative claims. Therefore, we were limited in the social risk factors that could be calculated from the existing data.

(3) Findings from a recent two-year National Quality Forum (NQF) effort indicated that the inclusion of a community-level SDS indicator did not improve the predictive capacity of risk-adjustment algorithms or meaningfully change the measure score of hospital-based care measures developed for Medicare beneficiaries (NQF, 2017). These Medicare hospital measures were endorsed without SDS indicators, although NQF directed the measure developers to evaluate whether SDS indicators should be included in the future as part of the annual update process. Hospitalization for Ambulatory Care Sensitive Conditions for Dual Eligible Beneficiaries

builds upon this process by limiting the measure to the dual eligible population and implementing stratification and risk adjustment specifically for this population.

However, the measure is stratified by use of long-term services and supports (LTSS). Using enrollment data, the dual eligible population was divided into three mutually exclusive groups based on their use of LTSS at the beginning of the measurement year: (1) community-dwelling home and community-based services (HCBS) users (referred to a HCBS), (2) community-dwelling non-HCBS users (referred to a non-HCBS), or (3) non-community-dwelling (institutionalized) population (referred to as institutionalized). These designations come from the Medicare Modernization Act (MMA) files that states send to CMS.

Reference:

National Quality Forum. 2017. All-Cause Admissions and Readmissions 2015–2017. Technical Report. Available at http://www.qualityforum.org/Publications/2017/04/All-Cause_Admissions_and_Readmissions_2015-2017_Technical_Report.aspx.

2a2. RELIABILITY TESTING

***Note**: If accuracy/correctness (validity) of data elements was empirically tested, separate reliability testing of data elements is not required – in 2a2.1 check critical data elements; in 2a2.2 enter "see section 2b2 for validity testing of data elements"; and skip 2a2.3 and 2a2.4.*

2a2.1. What level of reliability testing was conducted? (*may be one or both levels*)

***Note**: Current guidance for composite measure evaluation states that reliability must be demonstrated for the composite performance measure score.*

☒ **Performance measure score** (e.g., *signal-to-noise analysis*)

2a2.2. Describe the method of reliability testing and what it tests (*describe the steps—do not just name a method; what type of error does it test; what statistical analysis was used*)

This measure is a risk-adjusted composite measure of hospitalization for ambulatory care sensitive conditions with three rates (acute, chronic and total) reported in three stratifications (HCBS, non-HCBS, or institutionalized).

We evaluated reliability for the risk-adjusted composite rates (acute, chronic and total) for each stratification (HCBS, non-HCBS, and institutionalized) at the measure performance score level using a signal-to-noise analysis.

In signal-to-noise reliability analyses, we calculated the ratio of signal to noise, which is the ratio of the variation in state-level performance rates to the total variation of the measure (which includes random fluctuation). This type of assessment addresses whether differences in measure results between states were due to differences in their underlying performance or due to chance or other sources of variation. The signal variance characterizes the magnitude of differences in underlying performance between states, or the between-state variance. The total variation is calculated by summing the signal variance and other random variation – for example, due to sampling.

$$\text{Measure reliability} = \frac{\text{signal variance}}{\text{signal variance + noise variance}}$$

We estimated signal-to-noise ratio (SNR) reliability for this measure using a method developed by Morris that is based on the sample only, with no parametric distribution used to model the variability (Morris, 1983). Reliability was measured for each unit of analysis and increases with the sample size of observations available from that unit. In general, high signal-to-noise reliability implies that differences in states' measure results are meaningful to distinguish their performance.

Reference:

Morris, C. N. 1983. Parametric empirical Bayes inference: theory and applications. *Journal of the American Statistical Association*, 78(381): 47-55.

2a2.3. What were the statistical results from reliability testing? (e.*g., percent agreement and kappa for the critical data elements; distribution of reliability statistics from a signal-to-noise analysis*)

Tables 1 through 3 summarize the mean and range of the SNR statistic for this state-level risk-adjusted measure for three strata: community-dwelling HCBS users (HCBS), community-dwelling non-HCBS users (non-HCBS), and the non-community-dwelling (institutionalized) population. Detailed results for each of the 50 states and the District of Columbia (51 states) are presented in Appendix Tables A.1-A.3.

Table 1. Reliability estimates for the community-dwelling HCBS strata

Sample	Composite group	Average reliability score	Range of reliability scores (min-max)	N of states with SNR≥0.70
HCBS	Acute Group	0.89	(0.53-0.99)	48
	Chronic Group	0.90	(0.48-0.99)	48
	Total group	0.92	(0.60-0.99)	49

Source: Mathematica analysis of dual eligible beneficiaries in 50 states and the District of Columbia (51 states) with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

HCBS = home and community-based services; SNR = signal-to-noise ratio

Table 2. Reliability estimates for the community-dwelling non-HCBS strata

Sample	Composite group	Average reliability score	Range of reliability scores (min-max)	N of states with SNR≥0.70
Non-HCBS	Acute Group	0.94	(0.71-0.99)	51
	Chronic Group	0.96	(0.80-0.99)	51
	Total group	0.97	(0.83-0.99)	51

Source: Mathematica analysis of dual eligible beneficiaries in 50 states and the District of Columbia (51 states) with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

HCBS = home and community-based services; SNR = signal-to-noise ratio

Table 3. Reliability estimates for the institutionalized strata

Sample	Composite group	Average reliability score	Range of reliability scores (min-max)	N of states with SNR≥0.70
Institutionalized	Acute Group	0.93	(0.59-0.99)	50
	Chronic Group	0.86	(0.34-0.99)	46
	Total group	0.94	(0.63-0.99)	50

Source: Mathematica analysis of dual eligible beneficiaries in 50 states and the District of Columbia (51 states) with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

HCBS = home and community-based services; SNR = signal-to-noise ratio

2a2.4 What is your interpretation of the results in terms of demonstrating reliability? (i.*e., what do the results mean and what are the norms for the test conducted?*)

The SNR statistic (ranging from 0 to 1), summarizes the proportion of the variation between entity scores that is due to real differences in underlying entity characteristics (such as differences in population demographics or medical care) as opposed to background-level or random variation (e.g., due to measurement or sampling error). If SNR=0, there is no variation on the measure across entities, and all observed variation is due to sampling variation. In this case, the measure is not useful to distinguish between entities with respect to healthcare quality. Conversely, if SNR=1, all entity scores are free of sampling error, and all variation represents real differences between entities in the measure result. For the purposes of this discussion and the intended use of this measure to allow CMS and states to evaluate the quality of care for FFS dual eligible beneficiaries across states, we use a threshold of 0.70 to assess the ability of the measure to reliably distinguish performance between states.

Community-dwelling HCBS strata: For the HCBS strata, the risk-adjusted version of this measure was highly reliable in distinguishing performance between most states, in both acute, chronic and total composite groups. However, we observed SNR <0.70 for state 12, state 35, and state 45 in both the acute and chronic composite groups and for state 12 and state 35 for the total composite group. This was likely due to the relatively small sample size (less than 2,000 beneficiaries) within these states, rendering a relatively large within-state noise for the risk-adjusted measure rate.

Community-dwelling non-HCBS strata: For the non-HCBS strata, the risk-adjusted version of the measure was highly reliable in distinguishing performance between all states in all three composite groups.

Institutionalized strata: For the institutionalized population strata, the risk-adjusted version of this measure was highly reliable in distinguishing performance between most states in acute, chronic, and total composite groups. In the acute composite group, the SNR for the risk-adjusted measure rate was <0.70 for state 2. The SNR for state 2 also was <0.70 for the risk-adjusted measure in the total composite group. In the chronic composite group, the SNR for the risk-adjusted rate did not meet the 0.70 threshold for state 2, state 9, state 12, state 46, and state 51. This was also likely due to the relatively small sample size (less than 1,000 beneficiaries) within these states, rendering a relatively large within-state noise for the risk-adjusted measure rate.

2b1. VALIDITY TESTING

Note*: Current guidance for composite measure evaluation states that validity should be demonstrated for the composite performance measure score. If not feasible for initial endorsement, acceptable alternatives include assessment of content or face validity of the composite OR demonstration of validity for each component. Empirical validity testing of the composite measure score is expected by the time of endorsement maintenance.*

2b1.1. What level of validity testing was conducted?

☐ **Critical data elements** (*data element validity must address ALL critical data elements*)

☒ **Composite performance measure score**

☒ **Empirical validity testing**

☐ **Systematic assessment of face validity of performance measure score as an indicator** of quality or resource use (*i.e., is an accurate reflection of performance on quality or resource use and can distinguish good from poor performance*) **NOTE**: Empirical validity testing is expected at time of maintenance review; if not possible, justification is required.

☒ **Validity testing for component measures** *(check all that apply)*

Note*: applies to ALL component measures, unless already endorsed or are being submitted for individual endorsement.*

☒ **Endorsed (or submitted) as individual performance measures**

☐ **Critical data elements** (*data element validity must address ALL critical data elements*)

☒ **Empirical validity testing of the component measure score(s)**

☐ **Systematic assessment of face validity of component measure score(s) as an indicator** of quality or resource use (*i.e., is an accurate reflection of performance on quality or resource use and can distinguish good from poor performance*)

2b1.2. For each level of testing checked above, describe the method of validity testing and what it tests (*describe the steps—do not just name a method; what was tested, e.g., accuracy of data elements compared to authoritative source, relationship to another measure as expected; what statistical analysis was used)*

This measure is an adaptation of three existing AHRQ composite measures – the Prevention Quality Indicator Acute Conditions, Chronic Conditions and Total composites. The individual components that make up the AHRQ composite measure are NQF-endorsed and stewarded by AHRQ. Question 2d2.2 describes in greater detail how this measure deviates from the existing AHRQ measure and the rationale for those deviations.

We evaluated validity at two levels. First, we evaluated the composite performance measure score validity for each rate (acute, chronic, total) and each stratification (HCBS, non-HCBS, institutionalized) using the following analysis.

Empiric validity of the results was assessed using Spearman rank correlation to demonstrate convergent validity of the scores. Correlation was examined by each composite group (acute, chronic, and total) for each of the three strata (HCBS, non-HCBS, and institutionalized).

The comparisons conducted are categorized into three different groups:

1. **Within measure rate correlation:** Correlation between acute, chronic, and total rates within the measure and across the strata. We hypothesized that states that perform well on one rate should perform well on the other rates within the measure. All three measure rates represent an underlying quality construct of potentially avoidable hospitalization.
2. **FFS dual eligible HCBS Ambulatory Care Sensitive Condition (ACSC) measures**: Correlation of acute and chronic rates for each strata with acute and chronic benchmarks from a similar measure of Hospitalization for ACSC among dual eligible FFS HCBS users. This HCBS-specific measure was developed using the AHRQ Prevention Quality Indicators specification specifically for the FFS dual eligible HCBS user population. Additional information about this measure can be found here: https://www.medicaid.gov/medicaid/ltss/downloads/balancing/risk-adjust-hcbs-composite-vol1.pdf. We hypothesized that states that performed well on the dual eligible FFS HCBS measure of hospitalization for ACSC conditions would likewise perform well on the proposed measure of hospitalization for ACSC among dual eligible beneficiaries.
3. **Medicare FFS readmission measures**: Correlation of acute, chronic, and total rates for each strata with similar quality measure constructs in the Medicare FFS population, including 30-day readmission rates after acute myocardial infarction (AMI), heart failure (HF), and chronic obstructive pulmonary disease (COPD). We hypothesized that states that perform well at minimizing hospitalization for chronic ACSC will also perform well at minimizing readmission for AMI and ACSC conditions, such as HF and COPD. All the measures represent the underlying quality construct of potentially avoidable hospitalization that could be impacted by similar quality improvement efforts, such as improved access to ambulatory care and improved care coordination.

Second, we evaluated validity for the component measure scores. Validity for the component measure scores was demonstrated in two ways (1) use of existing NQF-endorsed measure components and (2) assessed by examining the correlation of the measure components to demonstrate convergent validity of the individual measure components at the state level.

The following NQF-endorsed measures that represent subcomponents of the *Hospitalization for Ambulatory Care Sensitive Conditions* measure:

Chronic Composite Component Measures:

#0272 Diabetes Short-Term Complications Admission Rate (PQI 01)

#0274 Diabetes Long-Term Complications Admission Rate (PQI 03)

#0638 Uncontrolled Diabetes Admission Rate (PQI 14)

#0285 Lower-Extremity Amputation among Patients with Diabetes Rate (PQI 16)

#0275 Chronic Obstructive Pulmonary Disease (COPD) or Asthma in Older Adults Admission Rate (PQI 05)

#0283 Asthma in Younger Adults Admission Rate (PQI 15)

#0277 Congestive Heart Failure (PQI 08)

#0276 Hypertension (PQI 07)

Acute Composite Component Measures:

#0279 Community Acquired Pneumonia Admission Rate (PQI 11)

#0281 Urinary Tract Infection Admission Rate (PQI 12)

In addition to the conditions included in these NQF-endorsed measures, two additional conditions, cellulitis and pressure ulcers, were added based on review of the literature and review with experts from our ACSC Clinical Advisory Workgroup comprised of subject matter experts on hospitalization for ACSC among the elderly and disabled population. Cellulitis and pressure ulcers are acute conditions that are not part of the AHRQ PQIs but are common among older adults and adults using home and community-based services.

The total composite is comprised of all the component measures listed above.

2b1.3. What were the statistical results from validity testing? (*e.g., correlation; t-test*)

Composite Performance Measure Score Validity

Table 4. State level Spearman rank correlation coefficients (r_s) among performance measure scores and other measures of quality

		HCBS strata			Non-HCBS strata			Institutionalized strata		
	Measure	**Acute**	**Chronic**	**Total**	**Acute**	**Chronic**	**Total**	**Acute**	**Chronic**	**Total**
Correlation Group 1: Within measure rate correlation	Acute ACSC for HCBS	1	0.39	0.72	0.72	0.53	0.67	0.67	0.32	0.57
	Chronic ACSC for HCBS	0.39	1	0.88	0.19	0.74	0.58	0.20	0.61	0.35
	Total ACSC for HCBS	0.72	0.88	1	0.48	0.77	0.74	0.45	0.61	0.53
	Acute ACSC for non-HCBS	0.72	0.19	0.48	1	0.43	0.74	0.59	0.32	0.53
	Chronic ACSC for non-HCBS	0.53	0.74	0.77	0.43	1	0.91	0.29	0.66	0.43
	Total ACSC for non-HCBS	0.67	0.58	0.74	0.74	0.91	1	0.46	0.63	0.54
	Acute ACSC for institutionalized	0.67	0.20	0.45	0.59	0.29	0.46	1	0.58	0.93
	Chronic ACSC for institutionalized	0.32	0.61	0.61	0.32	0.66	0.63	0.58	1	0.81
	Total ACSC for institutionalized	0.57	0.35	0.53	0.53	0.43	0.54	0.93	0.81	1
Correlation Group 2: FFS dual eligible HCBS ACSC measures	Dual eligible HCBS acute ACSC	0.69	NA	0.55	0.46	NA	0.51	0.35	NA	0.29
	Dual eligible HCBS chronic ACSC	NA	0.58	0.54	NA	0.62	0.55	NA	0.38	0.15
Correlation Group 3: Medicare FFS readmission measures	30-day AMI readmission	NA	0.69	0.59	NA	0.71	0.53	NA	0.53	0.17
	30-day HF readmission	NA	0.66	0.58	NA	0.67	0.52	NA	0.56	0.25
	30-day COPD readmission	NA	0.71	0.61	NA	0.64	0.51	NA	0.51	0.25

Source: Mathematica analysis of dual eligible beneficiaries in 50 states and the District of Columbia (51 states) with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

ACSC = ambulatory care sensitive condition

HCBS = home and community-based services

AMI = acute myocardial infarction

HF = heart failure

COPD = chronic obstructive pulmonary disease

NA = not applicable. We do not hypothesize a moderate-strong correlation between these measures.

Component Measure Validity

Table 5. State-level Spearman rank correlation coefficients (r_s) among ACSC, acute composite, and chronic composite results

	Chronic	Acute	Diabetes Short-Term Complications	Diabetes Long-Term Complications	Uncontrolled Diabetes	Lower-Extremity Amputation	Chronic Obstructive Pulmonary Disease	Asthma	Acute Bronchitis	Heart Failure	Hypertension	Bacterial Pneumonia	Urinary Tract Infection	Cellulitis	Pressure Ulcer
Chronic	1	0.58	0.37	0.74	0.80	0.54	0.83	0.74	0.34	0.92	0.84	0.25	0.78	0.54	0.43
Acute	0.58	1	-0.03	0.27	0.54	0.25	0.64	0.28	0.36	0.51	0.51	0.84	0.80	0.56	0.59
Diabetes Short-Term Complications	0.37	-0.03	1	0.26	0.42	0.49	0.24	0.24	0.10	0.33	0.30	-0.10	0.12	-0.09	0.23
Diabetes Long-Term Complications	0.74	0.27	0.26	1	0.62	0.72	0.37	0.62	0.09	0.75	0.75	-0.13	0.58	0.48	0.47
Uncontrolled Diabetes	0.80	0.54	0.42	0.62	1	0.53	0.67	0.54	0.35	0.75	0.83	0.23	0.68	0.38	0.54
Lower-Extremity Amputation	0.54	0.25	0.49	0.72	0.53	1	0.20	0.39	-0.04	0.63	0.57	0.02	0.43	0.18	0.56
Chronic Obstructive Pulmonary Disease	0.83	0.64	0.24	0.37	0.67	0.20	1	0.48	0.40	0.69	0.60	0.46	0.73	0.44	0.27
Asthma	0.74	0.28	0.24	0.62	0.54	0.39	0.48	1	0.28	0.68	0.60	-0.09	0.48	0.51	0.20
Acute Bronchitis	0.34	0.36	0.10	0.09	0.35	-0.04	0.40	0.28	1	0.23	0.36	0.21	0.33	0.29	0.34
Heart Failure	0.92	0.51	0.33	0.75	0.75	0.63	0.69	0.68	0.23	1	0.82	0.16	0.78	0.42	0.42
Hypertension	0.84	0.51	0.30	0.75	0.83	0.57	0.60	0.60	0.36	0.82	1	0.15	0.77	0.37	0.57
Bacterial Pneumonia	0.25	0.84	-0.10	-0.13	0.23	0.02	0.46	-0.09	0.21	0.16	0.15	1	0.47	0.26	0.38
Urinary Tract Infection	0.78	0.80	0.12	0.58	0.68	0.43	0.73	0.48	0.33	0.78	0.77	0.47	1	0.44	0.58
Cellulitis	0.54	0.56	-0.09	0.48	0.38	0.18	0.44	0.51	0.29	0.42	0.37	0.26	0.44	1	0.20
Pressure Ulcer	0.43	0.59	0.23	0.47	0.54	0.56	0.27	0.20	0.34	0.42	0.57	0.38	0.58	0.20	1

Source: Mathematica analysis of dual eligible beneficiaries in 50 states and the District of Columbia (51 states) with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

2b1.4. What is your interpretation of the results in terms of demonstrating validity? (i.*e., what do the results mean and what are the norms for the test conducted?*)

Composite Performance Measure Score Validity

The correlation coefficients of the composite measure validity analysis indicate varying levels of convergent validity among the composite groups. For the purposes of this discussion and the intended use of this measure to allow CMS and states to evaluate the quality of care for FFS dual eligible beneficiaries across states, correlation was considered high (strong) if the correlation coefficient, r_s = 0.75 to 1, moderate if r_s = 0.25 to 0.75, and low (weak) if r_s = 0 to 0.25.

As hypothesized, correlations were moderate to strong between the acute, chronic, and total rates within each strata. This suggests that states that perform well on one rate are likely to perform well on the other rates.

- Within the HCBS strata, a correlation of 0.39 suggested moderate correlation between the acute and chronic composite groups. However, both acute and chronic composite groups demonstrated strong correlations with the total composite rate in the HCBS strata, with correlations of 0.72 and 0.88 respectively.
- Within the non-HCBS strata, the acute and chronic composite groups correlated with each other moderately (r_s = 0.43). The acute composite group had a moderate to high degree of correlation with the total composite rate (r_s = 0.74), while the chronic group correlated with the total composite rate strongly (r_s = 0.91).
- Within the institutionalized strata, the acute and chronic composite groups correlated with each other moderately (r_s = 0.58); however, both groups correlated strongly with the total composite rate (r_s = 0.93 and 0.81, respectively).

As hypothesized, correlations were even stronger between similar rates across strata. This suggests that states that perform well at reducing hospitalization for one population do well at reducing hospitalization for other populations.

Beyond the within measure correlations, we saw a strong relationship with benchmarks on other measures of quality. This suggests the measure rates have good convergent validity.

- The correlation between the acute composite and the acute dual eligible FFS HCBS measure composite ranged from 0.349 to 0.693 across strata and was strongest in the HCBS population (r_s = 0.693) which is most similar to target population of the dual eligible FFS HCBS measure. The weakest correlation was seen with the institutionalized strata (r_s = 0.349) which is expected given the significant differences between the community-dwelling HCBS population and the institutionalized population, and the quality improvement activities to prevent hospitalization in these two settings.
- The correlation between the chronic composite and the chronic dual eligible FFS HCBS measure ranged from 0.378 to 0.579 across strata and was also strongest in the HCBS population. Similar to the results of the acute composite, the correlation was strongest in the HCBS strata (r_s = 0.579) and weakest in the institutionalized strata (r_s = 0.378).
- There were moderate to strong correlations between the Medicare FFS condition-specific readmission measures and the chronic composite across strata (r_s ranged from 0.507 to 0.706). Similar to the results above, the correlations were weakest for the institutionalized population, likely due to the significantly different population and setting.

Component Measure Validity

Our results indicate a strong correlation of the individual measure components with each composite at the state-level (Table 5). Of particular note is the moderate correlation of the two non-NQF-endorsed measure components (hospitalization for cellulitis and pressure ulcers) with other NQF-endorsed measures of hospitalization for acute ACSC (hospitalization for bacterial pneumonia and urinary tract infection). With one exception, all correlations for the new conditions with other acute conditions were above 0.40, indicating

moderate correlation (pressure ulcers and bacterial pneumonia had a correlation of 0.22, slightly lower than correlations among the other acute conditions). The strong correlation between the individual measure components supports the convergent validity of the individual measure components and justifies the grouping as composite rates.

_____

2b2. EXCLUSIONS ANALYSIS

Note: *Applies to the composite performance measure, as well all component measures unless they are already endorsed or are being submitted for individual endorsement.*

NA ☐ no exclusions— *skip to section* 2b4

2b2.1. Describe the method of testing exclusions and what it tests (*describe the steps—do not just name a method; what was tested, e.g., whether exclusions affect overall performance scores; what statistical analysis was used*)

This measure has two level of exclusions: exclusions applied to the individual measure components and exclusions applied to the overall composite rates.

The exclusions for the numerators of the individual measure components, which are already NQF-endorsed were not re-tested.

We tested the following exclusion for the two new measure components (cellulitis and pressure ulcer measure components).

- **Hospitalization for immunocompromised conditions:** Discussion with advisory panels suggested that individuals with diagnosis of sickle cell anemia, HB-S disease or procedure or diagnosis for immunocompromised conditions (e.g., organ transplant and HIV) are at higher risk of infection and therefore are more likely to be hospitalized at a low threshold of illness. Since there was already an exclusion for these conditions in the NQF-endorsed bacterial pneumonia and urinary tract infection measure components, the measurement team decided that excluding this population from all the acute indicators was appropriate. Results of testing the impact of this exclusion on the number of numerator cases identified for both the cellulitis and pressure ulcer measure components is described below.

The exclusions at the overall composite rate included:

- **Hospice:** Exclude inpatient stays for individuals receiving hospice care from the numerator, and exclude beneficiaries receiving hospice care at the start of the measurement period from the denominator.
- **Transfers from acute hospital**: Exclude admissions which are transfers from acute facilities. The first inpatient stay at an acute facility is included, but the inpatient stay after a transfer from another acute facility is excluded. This exclusion ensures that each hospitalization episode (i.e., a continuous stay in one or more hospitals with no discharge to the community or other non-acute facility) is only counted once in the measure numerator.
- **Hospitalization for obstetrics**: Exclude inpatient stays with newborn/obstetrics claim type code from the numerator. The obstetrics exclusion was not tested due to the extremely low number of cases (151 out of 5.5 million inpatient stays). Conceptually, it seemed unlikely that obstetrics stays would be identified as a hospitalization for an ambulatory care sensitive condition. Given this rationale and the low frequency of occurrence, it seemed unlikely that this exclusion would have a meaningful impact on rates.

These exclusions align with other versions of the composite measure currently in use (see question 2d.2.2 for additional details on how this composite measure differs from other measures of hospitalization for ACSC currently in use).

To understand the impact of exclusions, a sensitivity analysis was conducted to estimate the effect of the certain exclusion on the number of beneficiaries in the denominator and in the overall measure rate.

The overall prevalence of the exclusion was calculated and the measure rate was calculated two ways: 1) with the exclusion applied and 2) without the exclusion applied.

2b2.2. What were the statistical results from testing exclusions? (*include overall number and percentage of individuals excluded, frequency distribution of exclusions across measured entities, and impact on performance measure scores*)

Immunocompromised Conditions

Table 6. Rate of exclusions for immunocompromised conditions in cellulitis and pressure ulcer measure components

Exclusion for immunocompromised condition	N	Percent of total ACSC composite numerator cases (N=426,153)
Hospitalizations for cellulitis with immunocompromised state	2,739	1%
Hospitalizations for pressure ulcer with immunocompromised state	5,126	1%

Source: Mathematica analysis of dual eligible beneficiaries in 50 states and the District of Columbia (51 states) with at least 18 months of FFS and dual eligible enrollment from October 1, 2013 through September 30, 2015.

Hospice

A total of 2,849 beneficiaries (<1 percent) were excluded from the measure denominator for all three rates due to the hospice exclusions. Table 7 below shows the impact of the exclusion on the rate of hospitalization per 1,000 beneficiaries.

Table 7. State-level composite rate distribution with and without discharges during hospice

Composite rate	Exclusion tested	Number of beneficiaries	Rate of hospitalization per 1,000 beneficiaries					
			Average	Min	25th	Median	75th	Max
Acute Rate	Including Hospice	5,365,592	30.1	17.3	26.5	28.9	35.3	42.4
	Excluding Hospice	5,362,743	30.0	17.4	26.5	28.8	35.2	42.2
Chronic Rate	Including Hospice	5,365,592	44.3	23.9	36.6	46.2	52.8	64.6
	Excluding Hospice	5,362,743	44.0	23.8	36.5	46.1	52.3	64.1
Total Rate	Including Hospice	5,365,592	80.2	47.8	68.8	82.1	94.1	108.9
	Excluding Hospice	5,362,743	79.9	47.7	68.5	81.8	93.3	108.3

Source: Mathematica analysis of dual eligible beneficiaries in 50 states and the District of Columbia (51 states) with at least 18 months of FFS and dual eligible enrollment from October 1, 2013 through September 30, 2015.

Transfers from Acute Hospitals:

A total of 4,473 numerator cases (1%) were excluded from the total ACSC composite numerator cases.

Table 8. State-level composite rate distribution with and without transfers from acute hospitals

Composite rates	Exclusion tested	Number of beneficiaries	Rate of hospitalization per 1,000 beneficiaries					
			Average	Min	25th	Median	75th	Max
Acute Rate	Including Acute Transfers	5,365,592	30.1	17.3	26.6	28.9	35.3	42.4
	Excluding Acute Transfers	5,365,592	29.9	17.3	26.5	28.7	34.9	41.5
Chronic Rate	Including Acute Transfers	5,365,592	44.4	24.0	37.2	46.3	52.8	64.6
	Excluding Acute Transfers	5,365,592	44.3	23.9	36.6	46.2	52.6	64.5
Total Rate	Including Acute Transfers	5,365,592	80.3	47.8	69.6	82.1	94.1	108.9
	Excluding Acute Transfers	5,365,592	80.2	47.5	68.8	81.9	92.3	108.8

Source: Mathematica analysis of dual eligible beneficiaries in 50 states and the District of Columbia (51 states) with at least 18 months of FFS and dual eligible enrollment from October 1, 2013 through September 30, 2015.

2b2.3. What is your interpretation of the results in terms of demonstrating that exclusions are needed to prevent unfair distortion of performance results? (*i.e., the value outweighs the burden of increased data collection and analysis. Note: **If patient preference is an exclusion**, the measure must be specified so that the effect on the performance score is transparent, e.g., scores with and without exclusion*)

Immunocompromised Conditions: Removing numerator cases for pressure ulcer and cellulitis for patients with an immunocompromised state had a minimal impact on the number of denominator cases and reduced the number of numerator cases in the acute composite by 1 percent respectively for each condition, and cumulatively by 2 percent (see Table 7).

Hospice: We found that excluding beneficiaries enrolled in hospice care reduced denominator cases by 2,849 beneficiaries (<1 percent) (see Table 8). The minimal impact of the hospice exclusion on the number of beneficiaries included in the measure and the measure composite performance rate is expected because the denominator is defined as individuals who are alive for the entire measurement year (i.e., individuals who die in hospice during the measurement year are not included in the measure denominator). The hospice exclusion therefore only applies to the limited number of people who entered hospice after the start of the measurement period, had an ACSC admission during hospice enrollment, but did not die during the measurement period.

Transfers from Acute Hospitals: We found that excluding transfers from acute hospitals reduced average state-level composite rates by 0.1 – 0.2 events per 1,000 beneficiaries (see Table 8). However, it is conceptually appropriate to exclude transfers from acute hospitals to ensure each hospitalization episode for an ACSC is only counted once in the measure numerator.

2b3. RISK ADJUSTMENT/STRATIFICATION FOR OUTCOME OR RESOURCE USE MEASURES

***Note:** Applies to all outcome or resource use component measures, unless already endorsed or are being submitted for individual endorsement.*

***If not an intermediate or health outcome, or PRO-PM, or resource use measure, skip to section** 2b4.*

2b3.1. What method of controlling for differences in case mix is used? *(check all that apply)*

☐ **Endorsed (or submitted) as individual performance measures**

☐ **No risk adjustment or stratification**

☒ **Statistical risk model with** 95 risk factors for acute composite, 83 risk factors for chronic composite, and 106 risk factors for the total composite **risk factors**

☐ **Stratification by risk categories**

☐ **Other,**

2b3.1.1 If using statistical risk models, provide detailed risk model specifications, including the risk model method, risk factors, coefficients, equations, codes with descriptors, and definitions.

Risk Model Method: The statistical methodology employed a two-step process using a person-level sample. In the first step, logistic regression was used to model the log-odds of having any qualifying ACSC admission during the measurement period. A subsequent Poisson regression – limited to the sample of dual eligible beneficiaries with at least one qualifying ACSC admission – modeled the total count of qualifying ACSC admissions experienced over the measurement period.

Risk Factors: Age and sex; CMS hierarchical condition category (HCC) condition indicators and condition interactions; disability-by-condition interactions; and total number of conditions.

Coefficients, codes, descriptors, definitions: See Appendix B and C for complete list of risk factors, codes descriptors, definitions and coefficients for each stratification.

Equations: For each state k, $O_k = \sum_{i \in k} n_i$, $E_k = \sum_{i \in k} p_i$, where n_i is the number of actual hospital inpatient admissions for ACSC for dual eligible beneficiary i in state k and p_i is the number of predicted hospital inpatient admissions for ACSC for patient i, calculated using the formula $p_i = p_{1i} \times p_{2i}$, where p_{1i} is the predicted probability of any admission for ACSC and p_{2i} is the predicted unconditional count of admissions for ACSCs. In particular, p_{1i} and p_{2i} are calculated using the formulas below:

$$p_{1i} = \frac{exp\left(\sum_j b_j \cdot x_{ji}\right)}{1 + exp\left(\sum_j b_j \cdot x_{ji}\right)},$$

$$p_{2i} = exp\left(\sum_j c_j \cdot x_{ji}\right),$$

where b_j and c_j are the coefficient estimates for risk factor j from the logistic and Poisson regression models, respectively, and x_{ji} is the patient i's value for risk factor j.

Calculate the national benchmark rate Y by taking the sum of all hospital inpatient admissions for ACSCs in the entire 51-state sample and dividing by the total number of beneficiaries. The risk-adjusted performance measure (r_k) for each state k is equal to

$$r_k = \frac{O_k}{\mathrm{E_k}} \times Y.$$

2b3.2. If an outcome or resource use component measure is not risk adjusted or stratified, provide rationale and analyses to demonstrate that controlling for differences in patient characteristics (case mix) is not needed to achieve fair comparisons across measured entities.

Not applicable. This measure is risk-adjusted.

2b3.3a. Describe the conceptual/clinical and statistical methods and criteria used to select patient factors (clinical factors or social risk factors) used in the statistical risk model or for stratification by risk (*e.g., potential factors identified in the literature and/or expert panel; regression analysis; statistical significance of p<0.10; correlation of x or higher; patient factors should be present at the start of care*) **Also discuss any "ordering" of risk factor inclusion;** for example, are social risk factors added after all clinical factors?

Conceptual Method for Selecting Patient Factors Used in the Model

The choice of risk factors was guided by Andersen's Behavioral Model of Health Services Use (Andersen, 1995), which frames the determinants of health care utilization into the following: (1) factors including demographic characteristics such as age and sex that predispose individuals to use care; (2) factors such as income and distance to a clinic that enable individuals to seek care (e.g., income); and (3) factors such as the presence of chronic conditions or functional limitations that drive individuals to need care. Andersen's model also treats health care utilization as a measure of "realized access" to care, signifying that individuals were able to overcome any perceived barriers to care receipt.

We used the following three criteria to assess the appropriateness for potential inclusion as predictors in the risk-adjustment model:

(1) Likely predictive importance - Assessed by reviewing the related health services literature.

(2) Feasibility for testing - Our assessment was limited to measures that can be constructed by using claims and encounter files or easily accessible, publicly available data sets (e.g., the Area Resource File). The project team assessed whether constructing the predictor was possible with existing data and feasible, given time and resource constraints.

(3) Appropriate accountability incentives – Assessment of whether the inclusion of a measure was consistent with the aim of rewarding accountable entities for good performance on the measure in a dynamic context.

Table 9 shows the candidate predictors for inclusion rated by the three assessment criteria. The subsequent model development and testing was limited to the following variables that the project team rated "high" across all three categories (highlighted in bold in Table 9 below): sex, age, eligibility category, and the presence of chronic conditions. We did not include race in the model in keeping with guidance from "A Blueprint for the CMS Measures Management System," which outlines that the inclusion of race can potentially mask important disparities across racial or ethnic groups (Centers for Medicare & Medicaid Services 2016). This decision also aligns with a related measure, the Healthcare Effectiveness Data and Information Set (HEDIS) measure, Hospitalization for Preventable Conditions (HEDIS-HPC), and related measures' risk-adjustment algorithms, which do not include race or ethnicity as predictors (Agency for Healthcare Research and Quality, 2001; Bohl et al., 2015).

Table 9. Candidate risk factors by assessment criteria

Predictor	Likely predictive importance	Feasibility for testing	Appropriate accountability incentives
Predisposing variables			
Sex	High	High	High
Age	High	High	High
Enabling variables			
Area-level SES	Low[1]	Medium	High
Eligibility category (original reason for Medicare entitlement)	High	High	High
Need variables			
Chronic conditions	High	High	High
Realized access variables			
Prior hospitalizations (total and/or stratified by ACSC status)	High	High	Low[2]
Pharmacy-based risk groupers	High	Low[3]	High

Source: Author assessment.

Note: Bold font indicates variables that were included in the final model specification.

[1] Findings from a recent two-year National Quality Forum (NQF) effort indicated that the inclusion of area-level SES indicators did not improve the predictive capacity of risk-adjustment algorithms of hospital-based care measures developed for Medicare beneficiaries (NQF, 2017).

[2] Including the prior year's measure performance typically increases the predictive capacity of a risk-adjustment model, but at the cost of rewarding poorly performing entities with a lower bar for expected performance in future years. As a result, we excluded prior hospital-based care utilization from consideration.

[3] Prescription groupers were excluded under this criterion because extracting and cleaning the requisite pharmacy data would require significant additional resources and time.

Statistical Methods to Select Patient Factors Used in the Model

We began with a graphical inspection of the outcome measure and its bivariate relationships with potential risk factors. This exercise informed our decisions about the likely appropriateness of various link functions for the regression modeling. Moreover, it facilitated the process of identifying the correct functional form of the relationships between individual risk factors and the outcome. Two notable findings emerged about the outcome set: (1) it exhibited an extremely high prevalence of zero values across the various outcome and subpopulation strata (91.8 percent to 98.0 percent) and (2) it exhibited a high concentration among a relatively few number of "superutilizing" dual eligible beneficiaries. Specifically, for dual eligible beneficiaries with at least one ACSC admission, more than 5 percent had three or more ACSC admissions during the measure period. We accounted for each of these findings in the model development work, as discussed below.

We began by using an existing risk-adjustment specification as a baseline model (Model 1) in alignment with a similar measure of hospitalization of ACSC used nationally in Medicare Advantage plans the HEDIS Hospitalization for Potentially Preventable Complications (HEDIS-HPC). This specification included many (but not all) of the HCC condition flags, in addition to a series of interaction terms among these categories (e.g., diabetes and congestive heart failure). The AHRQ Prevention Quality Indicators risk-adjustment model only included age and gender, so it was not selected as a baseline model.

We tested two refinements to the baseline model that reflected well-established clinical findings relevant to the dual eligible population. First, we incorporated a more sophisticated treatment of disability into the modeling, in recognition that the dual eligible population has a higher prevalence of disability relative to the target population for the HEDIS-HPC measure (i.e., Medicare Advantage beneficiaries age 65 and older). Disability is uniquely predictive of health care risk, with certain conditions exerting greater morbidity effects for disabled versus nondisabled populations (Pope et al., 2011). As a result, we hypothesized that the predictive capacity of the baseline model would improve with the addition of interaction terms across disability status and certain chronic conditions. The HCC version 22 software provides an empirically validated set of disability by chronic condition interaction terms designed to speak to this particular concern. Our first augmented specification added these disability–chronic condition interaction terms into the baseline model specification (Model 2).[3] Model 3 added a series of indicators reflecting a dual eligible beneficiary's total number of HCC conditions, in the spirit of well-validated chronic condition count indices such as the Charlson and Elixhauser indices (Charlson et al., 1987; Elixhauser et al., 1998). Guided by an exploratory analysis of the relationship between the total condition count and the number of ACSC hospitalizations, the total condition count was quantified as a series of categorical variables: zero conditions (reference), 1 to 2 conditions, 3 to 5 conditions, 6 to 10 conditions, and more than 10 conditions.

[3] Note that disability was entered via the disability-by-condition interaction terms only, and not via a main effect, in order to align with the sociodemographic variables used in HEDIS-HPC. Similarly, there are several condition-by-condition interactions in the HEDIS-HPC predictor sets that do not include one of the associated main effects, a convention that we preserve in the algorithm. As a sensitivity test we assessed the predictive performance of Model 3 relative to a specification adding in all main effects. Reassuringly, the predictive performance across the two specifications is almost identical, with Model 3 slightly outperforming the expanded specification.

We compared the three models by using the Akaike Information Criteria (AIC) and Bayesian Information Criteria (BIC), both of which are penalized-likelihood tests that are often used for comparing fit across models, including non-logistic models such as ours. Hosmer-Lemeshow statistics were not informative for this two-step risk-adjustment approach. In the first step (logistic), the Hosmer-Lemeshow statistic is not informative due to the large sample size. In the second step (Poisson), the Hosmer-Lemeshow statistic is not applicable to the count-based outcome. When interpreting AIC and BIC, the overall value is meaningless but is useful in comparison with other models. When comparing AIC and BIC values, smaller indicates a better model. Their underlying assumptions differ in a complementary way, such that their consideration as a pair is considered better practice than using either in isolation (Dziak et al., 2015). Lower values indicate a better predictive power for both AIC and BIC. Table 10 shows AIC and BIC values across the three model specifications.

Table 10. Model fit statistics for the HCBS users with ACSC admissions

Composite rates	Criterion	Model 1	Model 2	Model 3
Acute	AIC (smaller is better)	105,371	105,277	104,947
Acute	BIC (smaller is better)	106,227	106,262	105,975
Chronic	AIC (smaller is better)	87,560	87,469	87,187
Chronic	BIC (smaller is better)	88,288	88,325	88,086
Total	AIC (smaller is better)	152,398	152,133	151,587
Total	BIC (smaller is better)	153,372	153,235	152,733

Source: Mathematica analysis of dual eligible beneficiaries in 50 states and the District of Columbia (51 states) with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Sample: Model development half sample of the HCBS users (n = 329,323).

Note: Results are from a two-step approach, with a logit model to predict whether an admission with acute ACSCs occurred during the measure period (October 1, 2014 through September 30, 2015), and a Poisson model to predict the number of admissions during this period. Model 1 covariates: HEDIS risk factors. Model 2 covariates: Model 1 covariates plus disability interaction terms. Model 3 covariates: Model 2 covariates plus categorical variables characterizing the number of chronic conditions.

AIC = Akaike Information Criteria

BIC = Bayesian Information Criteria

ACSC = ambulatory care sensitive conditions

HCBS = home and community-based services

Table 11. Model fit statistics for the non-HCBS users with ACSC admissions

Composite rates	Criterion	Model 1	Model 2	Model 3
Acute	AIC (smaller is better)	304,531	304,463	303,328
Acute	BIC (smaller is better)	305,519	305,599	304,513
Chronic	AIC (smaller is better)	388,376	388,252	386,640
Chronic	BIC (smaller is better)	389,216	389,240	387,677
Total	AIC (smaller is better)	561,646	561,399	559,437
Total	BIC (smaller is better)	562,769	562,670	560,758

Source: Mathematica analysis of dual eligible beneficiaries in 50 states and the District of Columbia (51 states) with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Sample: Model development half sample of the non-HCBS users (n = 1,695,276).

Note: Results are from a two-step approach, with a logit model to predict whether an admission with acute ACSCs occurred during the measure period (October 1, 2014 through September 30, 2015), and a Poisson model to predict the number of admissions during this period. Model 1 covariates: HEDIS risk factors. Model 2 covariates: Model 1 covariates plus disability interaction terms. Model 3 covariates: Model 2 covariates plus categorical variables characterizing the number of chronic conditions.

AIC = Akaike Information Criteria

BIC = Bayesian Information Criteria

ACSC = ambulatory care sensitive conditions

HCBS = home and community-based services

Table 12. Model fit statistics for institutionalized beneficiaries with ACSC admissions

Composite rates	Criterion	Model 1	Model 2	Model 3
Acute	AIC (smaller is better)	89,055	89,065	88,928
Acute	BIC (smaller is better)	89,877	90,011	89,916
Chronic	AIC (smaller is better)	53,372	53,363	53,276
Chronic	BIC (smaller is better)	54,072	54,185	54,140
Total	AIC (smaller is better)	114,633	114,630	114,429
Total	BIC (smaller is better)	115,568	115,689	115,529

Source: Mathematica analysis of dual eligible beneficiaries in 50 states and the District of Columbia (51 states) with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Sample: Model development half sample of the institutionalized beneficiaries (n = 216,291).

Note: Results are from a two-step approach, with a logit model to predict whether an admission with acute ACSCs occurred during the measure period (October 1, 2014 through September 30, 2015), and a Poisson model to predict the number of admissions during this period. Model 1 covariates: HEDIS risk factors. Model 2 covariates: Model 1 covariates plus disability interaction terms. Model 3 covariates: Model 2 covariates plus categorical variables characterizing the number of chronic conditions.

AIC = Akaike Information Criteria

BIC = Bayesian Information Criteria

ACSC = ambulatory care sensitive conditions

HCBS = home and community-based services

The values were similar across models, with Model 3 slightly outperforming the others. Guided by a recommendation from the ACSC Clinical Advisory Workgroup to incorporate *all* sets of clinically motivated risk factors, we chose Model 3 as our final model and adopted its use for all outcome and subpopulation strata.

To avoid "overfitting", we assessed model performance by splitting the analytic sample into two randomly selected half-samples: one served as the development sample supporting our model building and exploration work; the other served as the validation sample against which we assessed the final model's performance. The model performs well on the validation sample, providing assurance that the model will generalize well to other samples and is not primarily driven by idiosyncratic fluctuations in the current analytic data.

References:

Andersen, R. M. 1995. Revisiting the behavioral model and access to medical care: does it matter? *Journal of Health and Social Behavior,* 36(1): 1–10.

Agency for Healthcare Research and Quality. 2001. AHRQ quality indicators—guide to prevention quality indicators: hospital admission for ambulatory care sensitive conditions. Rockville, MD: Agency for Healthcare Research and Quality. Available at https://www.ahrq.gov/downloads/pub/ahrqqi/pqiguide.pdf.

Bohl, A., J. Ross, and D. Ayele. 2015. Risk adjustment of HCBS composite measures, volume 1. Cambridge, MA: Mathematica Policy Research. Available at https://www.medicaid.gov/medicaid/ltss/downloads/balancing/risk-adjust-hcbs-composite-vol1.pdf.

Centers for Medicare & Medicaid Services. 2016. A blueprint for the CMS measures management system. Version 11.2. Available at https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/MMS/Downloads/Blueprint112.pdf.

Charlson, M. E., P. Pompei, K. L. Ales, and C. R. MacKenzie. 1987. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *Journal of Chronic Disease,* 40(5): 373–383.

Dziak, J. J., D. L. Coffman, S. T. Lanza, and R. Li. 2015. Sensitivity and specificity of information criteria." *PeerJ Preprints,* 1103, version 2.

Elixhauser, A., C. Steiner, D. R. Harris, and R. M. Coffey. 1998. Comorbidity measures for use with administrative data. *Medical Care,* 36(1): 8–27.

National Quality Forum. (2017). "All-Cause Admissions and Readmissions 2015–2017." Technical Report. April 2017. Available at http://www.qualityforum.org/Publications/2017/04/All-Cause_Admissions_and_Readmissions_2015-2017_Technical_Report.aspx.

Pope, G. C., J. Kauttner, M. J. Ingber, S. Freeman, R. Sekar, and C. Newhart. 2011. Evaluation of the CMS-HCC risk adjustment model. Final Report. Submitted to the Centers for Medicare & Medicaid Services. Available at https://www.cms.gov/Medicare/Health-Plans/MedicareAdvtgSpecRateStats/downloads/evaluation_adj_model_2011.pdf.

2b3.3b. How was the conceptual model of how social risk impacts this outcome developed? Please check all that apply:

☐ **Published literature**

☐ **Internal data analysis**

☒ **Other (please describe)**

No social risk factors were evaluated in the risk-adjustment analysis for three reasons:

1) The focus of this measure is a population with increased social risk (e.g., dual eligible adults) who are primarily low income. Measure developers often consider dual eligibility as a social risk factor in risk adjustment models. By defining a measure, risk-adjustment approach, and stratification approach specific to this population, the measure is acknowledging the unique risk that this population faces. Given that the denominator for this measure is limited to dual eligible beneficiaries, we have accounted for a social risk factor for this outcome. Therefore, it unclear whether adjusting for social risk within this population is appropriate.
2) Our assessment was limited to risk factors that can be constructed by using claims and encounter files or easily accessible, publicly available data sets (e.g., the Area Resource File). Patient-reported data and patient community characteristics were not available in the testing data source of administrative claims. Therefore, we were limited in the social risk factors that could be calculated from the existing data.
3) Findings from a recent two-year National Quality Forum (NQF) effort indicated that the inclusion of a community-level SDS indicator did not improve the predictive capacity of risk-adjustment algorithms

or meaningfully change the measure score of hospital-based care measures developed for Medicare beneficiaries (NQF, 2017). These Medicare hospital measures were endorsed without SDS indicators, although NQF directed the measure developers to evaluate whether SDS indicators should be included in the future as part of the annual update process. Hospitalization for Ambulatory Care Sensitive Conditions for Dual Eligible Beneficiaries builds upon this process by limiting the measure to the dual eligible population and implementing stratification and risk adjustment specifically for this population.

Reference:

National Quality Forum. (2017). "All-Cause Admissions and Readmissions 2015–2017." Technical Report. April 2017. Available at http://www.qualityforum.org/Publications/2017/04/All-Cause_Admissions_and_Readmissions_2015-2017_Technical_Report.aspx.

2b3.4a. What were the statistical results of the analyses used to select risk factors?

No social risk factors were evaluated in the risk-adjustment analysis.

2b3.4b. Describe the analyses and interpretation resulting in the decision to select social risk factors (e.g. prevalence of the factor across measured entities, empirical association with the outcome, contribution of unique variation in the outcome, assessment of between-unit effects and within-unit effects.) Also describe the impact of adjusting for social risk (or not) on providers at high or low extremes of risk.

Not applicable. No social risk factors were analyzed.

2b3.5. Describe the method of testing/analysis used to develop and validate the adequacy of the statistical model or stratification approach (*describe the steps—do not just name a method; what statistical analysis was used*)

Provide the statistical results from testing the approach to controlling for differences in patient characteristics (case mix) below.

If stratified, skip to 2b3.9

2b3.6. Statistical Risk Model Discrimination Statistics (*e.g., c-statistic, R-squared*)**:**

The discrimination of the risk model can be assessed by the degree of the model in predicting the occurrence of any ACSC admission during the measure period, given a beneficiary's conditions on all risk factors. Specifically, we evaluated this using the c-statistics on both development and validation samples. The c-statistic takes value between 0 and 1, with higher values indicating better model discrimination.

As shown in Table 13, the risk model exhibited a strong model discrimination, with all c-statistics more than 0.660 across all outcome types and subpopulations. In addition, c-statistics of the risk-adjustment model are shown to be close between the development and validation samples, which demonstrated that the risk model would maintain good model discrimination when applied to a different data set.

Table 13 Risk-adjustment model discrimination statistic, by outcome type and subpopulation

Type of ACSCs	Subpopulation	C-statistic on development sample	C-statistic for on validation sample
Acute	HCBS	0.747	0.743
Chronic	HCBS	0.851	0.854
Total	HCBS	0.789	0.789
Acute	Non-HCBS	0.747	0.746
Chronic	Non-HCBS	0.828	0.827
Total	Non-HCBS	0.790	0.789
Acute	Institutionalized	0.661	0.660
Chronic	Institutionalized	0.797	0.789
Total	Institutionalized	0.703	0.698

Source: Mathematica analysis of dual eligible beneficiaries in 50 states and the District of Columbia (51 states) with at least 18 months of FFS and dual eligible enrollment from October 1, 2013 through September 30, 2015.

2b3.7. Statistical Risk Model Calibration Statistics (*e.g., Hosmer-Lemeshow statistic*):

This analysis is not applicable. The risk-adjustment model is constructed using a two-step approach, hence we did not assess the model calibration using any single calibration statistic. Instead, we assessed the overall calibration of the model via risk decile plots and calibration curves, of which results are presented in the section below (2b3.8).

2b3.8. Statistical Risk Model Calibration – Risk decile plots or calibration curves:

To assess overall calibration of the preferred model specification, we used the validation sample to compute the mean predicted and observed outcome values at each decile in the predicted risk distribution. As seen in Table 14 and Figure 1, the predicted and observed outcomes are similar in magnitude at each decile, scaling proportionately as predicted risk thresholds increase. Similar patterns hold for all outcome and subpopulation strata combinations, as shown in Appendix D, Tables D.1 to D.9. This similarity between predicted and observed values within each decile across the entire distribution indicates that the model is well-calibrated.

Table 14. Decile table generated from the two-step risk-adjustment model for the HCBS users with acute ACSC admissions

Decile	Number of dual eligible beneficiaries	Observed mean admissions rate for acute ACSCs	Predicted mean admissions rate for acute ACSCs
1 (lowest)	32,933	5	7
2	32,932	10	12
3	32,932	14	17
4	32,933	22	22
5	32,932	30	29
6	32,932	41	38
7	32,933	52	48
8	32,932	64	62
9	32,932	91	86
10 (highest)	32,932	170	179

Source: Mathematica analysis of dual eligible beneficiaries in 50 states and the District of Columbia (51 states) with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: The measure result is reported as a rate per 1,000 beneficiaries.

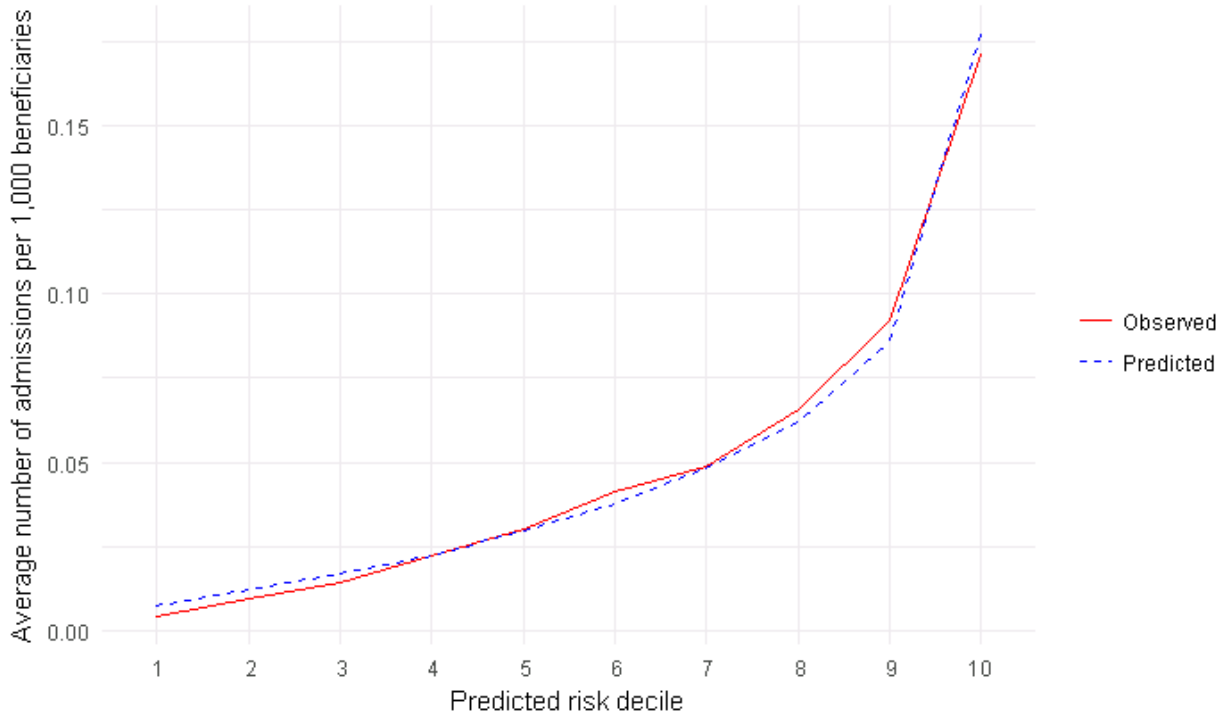
Deciles are classified on the basis of the predicted number of admissions for acute ACSCs from the risk-adjustment model.

Sample: Model validation half sample of the HCBS users (n = 329,323).

ACSC = ambulatory care sensitive conditions.

HCBS = home and community-based services

Figure 1. Two-step approach (logit + Poisson) decile plot for the HCBS users with acute ACSC admissions



Source: Mathematica analysis of dual eligible beneficiaries in 50 states and the District of Columbia (51 states) with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: Deciles are classified on the basis of the predicted number of admissions for acute ACSCs from the risk-adjustment model. Analysis of decile plot using a negative binomial model indicated that the two-step approach using negative binomial and Poisson models are similar in their ability to generate well-calibrated predictions across the three sub-populations. A Poisson model was selected to be consistent with the approach used in the HEDIS measure.

Sample: Model development half sample of the HCBS users (n = 329,323).

ACSC = ambulatory care sensitive conditions.

HCBS = home and community-based services

We calculated a series of observed versus expected (O/E) ratios to assess how well the model performed for important subgroups. A ratio of 1 indicates that the expected (which is synonymous with adjusted or predicted) values are approximately equivalent to the observed (which is synonymous with unadjusted) values for a subgroup, the desired finding. A ratio greater than 1 indicates that the observed values are greater than the predicted values, reflecting underprediction of the model. Conversely, a ratio less than 1 indicates that the observed values are less than the predicted values, reflecting overprediction of the model. Subgroup-specific prediction errors can exert potentially serious unintended consequences. For example, a model that underpredicts events for dual eligible beneficiaries with multiple comorbidities would inadvertently penalize accountable entities for serving this vulnerable subgroup. Taken as a whole, the results in Table 15 (and in Appendix D, Tables D.10 to D.18) provide reassurance that the model does not suffer from major subgroup-specific prediction errors.[4] There is, however, one absolute deviation that is meaningfully different than 1, which is for the age group 18 to 39 (absolute deviation = 0.11). Unfortunately, there is no easy way to remedy this finding by using statistical modeling. As such, it will be important to monitor whether the risk-adjustment

[4] The model estimates more chronic ACSC admissions than observed for the HCBS users with no chronic conditions (O/E = 0.79). But the results indicate good O/E balance for all other scenarios.

algorithm underpredicts events for this age group once the measure is implemented in real-world settings. If the underprediction persists in data, it may be advisable to consider an explicit adjustment to the person-level risk scores of individuals in this age group.

Table 15. Predictive performance by key dual eligible beneficiary characteristics

Dual eligible beneficiary characteristic	Observed-to-expected ratio
Sex	
Female	1.00
Male	0.99
Age group	
18–39	1.11
40–64	1.01
65–74	1.00
75 or older	0.98
Number of chronic conditions	
None	1.08
1–2	0.96
3–5	1.01
6–10	1.00
11+	0.99

Source: Mathematica analysis of dual eligible beneficiaries in 50 states and the District of Columbia (51 states) with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: Expected values are generated from the risk-adjustment model. Observed values are the unadjusted, actual measurements.

Sample: Model validation half sample of the HCBS users (n = 329,323).

ACSC = ambulatory care sensitive conditions.

HCBS = home and community-based services

2b3.9. Results of Risk Stratification Analysis:

In addition to risk adjustment, this measure is stratified by use of institutional care and home and HCBS. Residents of nursing facilities (i.e., skilled and custodial) have greater access to medical care on site. If their hospitalization rates are high (after risk adjustment), it is presumably due to problems in care coordination or care within those specific facilities, not problems in ambulatory care. Individuals who are currently using HCBS may have different rates of ACSC hospitalization because they are more likely to be frail or disabled, but also may be more likely to have access to timely care. Home health care providers and personal care providers who see dual eligible beneficiaries on a regular basis are more likely to identify an acute condition such as a pressure ulcer or dehydration early compared to adults who are not receiving HCBS.

After initial review of the data, we determined that identifying the source of the admission from Medicare FFS claims data was unreliable. The source of the admissions (e.g., if the person came from inpatient rehabilitation or skilled nursing facility) was not routinely documented and it was not possible to differentiate the exact type of facility where the admission originated. Instead, we used an approach to stratification that was simpler to implement and less prone to variation in coding practices in hospitals—we stratified the population based on use of LTSS (either HCBS or institutional care) during any given month. We started by defining mutually exclusive groups based on LTSS use in the beginning of the measurement period (October 2014).

Approximately 14 percent of the sample were community-dwelling HCBS users[5] (N=692,768) and 10 percent were residing in an institution (Medicaid paid institutional care, Medicare skilled nursing care, or intermediate care; N=476,969). The remaining 76 percent resided in the community and did not use HCBS services (N=3,721,826) (see Table 17).

Not surprisingly, these groups differed with regard to the conditions that contributed to hospitalization for ACSC. In the non-HCBS population, COPD was the second leading condition, while in the HCBS population, it was urinary tract infection. For both populations, heart failure led, and bacterial pneumonia was the third most common condition. For the institutional population, urinary tract infections and bacterial pneumonia were by far the most common conditions. This is reflective of the increasing frailty of the population and susceptibility to acute infections as they progress through LTSS services.

We also examined the consistency and overlap of the groups throughout the analytic period. The vast majority of LTSS users (94 percent of institutional and 92 percent of HCBS, respectively) continuously used the same type of LTSS for all 12 months. If the populations were defined based on the last month of the year, these groups grew by 12 to 15 percent. Depending on the definition of the groups, roughly 3 percent of the LTSS users switched between HCBS and institutional care (in any direction) during the analytic time period. The group of non-LTSS users was also stable. Of those dual eligible beneficiaries who begin the year without LTSS use, 96 percent of those continued to have no LTSS use throughout the year. Based on this analysis, we felt it was reasonable to assign these strata using status at the start of the measurement period.

Table 16. Descriptive statistics of analytic sample

Descriptive Statistic	Overall	Community-Dwelling HCBS User	Community-Dwelling Non-HCBS User	Institutional Dwelling
Sample Size	4,891,563	692,768	3,721,826	476,969
Age (mean)	63.6	62.2	62.2	76.4
Age 65 and older (percent)	52.0%	--	--	--
Male (percent)	40.0%	41.4%	40.6%	33.6%
Any HCBS use (percent)	15.9%	100.0%	1.8%	3.4%
Any Institution use (percent)	11.8%	4.9%	1.8%	100.0%
Risk-adjusted acute ACSC rate per 1,000	28.0	49.8	22.5	64.1
Risk-adjusted chronic ACSC rate per 1,000	42.4	55.7	44.9	41.5
Risk-adjusted total ACSC rate per 1,000	70.4	105.6	67.4	105.5

Source: Mathematica analysis of dual eligible beneficiaries in 50 states and the District of Columbia (51 states) with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: HCBS, Community Non-HCBS, and Institutional groups are mutually exclusive and defined by status in October 2014.

2b3.10. What is your interpretation of the results in terms of demonstrating adequacy of controlling for differences in patient characteristics (case mix)? (i.e., what do the results mean and what are the norms for the test conducted)

This risk-adjustment algorithm employs clinically valid risk factors to estimate predicted risk scores at the dual eligible beneficiary level. The risk scores exhibit appropriate predictive validity, as assessed by a series of calibration tests (e.g., balanced O/E ratios within each subgroup of key patient characteristics on the validation sample (Table 16), well-calibrated decile table (Table 15)). These person-level scores can be aggregated up to a different level of reporting—for example, the state level, as detailed in this report—and subsequently

[5] HCBS status based on payment information from MMA files.

translated into performance scores that account for differences across entities in their respective dual eligible populations' sociodemographic and health profiles.

2b3.11. Optional Additional Testing for Risk Adjustment (*not required, but would provide additional support of adequacy of risk model, e.g., testing of risk model in another data set; sensitivity analysis for missing data; other methods that were assessed*)

After the exploratory data analysis, we assessed model performance by splitting the analytic sample into two randomly selected half-samples. One served as the development sample supporting our model building and exploration work; the other served as the validation sample against which we assessed the final model's performance. This approach is standard practice to avoid "overfitting" a risk-adjustment model, which takes place when a model fits both the true underlying relationships between variables as well as idiosyncratic data fluctuations specific to the particular sample. Finding that our model performs well on the validation sample (for example, a well-calibrated model tested on the validation sample, demonstrated in Table 15 and Figure 1) provides assurance that the model will generalize well to other samples and is not primarily driven by idiosyncratic fluctuations in the current analytic data. In addition, Table E.1 and Table E.2 (provided in the appendix) exhibited relatively stable coefficient estimates for risk factors on the development sample, validity sample, and full analytic sample. This supports the suggestion that the risk-adjustment model would have robust performance on another data set.

2b4. IDENTIFICATION OF STATISTICALLY SIGNIFICANT & MEANINGFUL DIFFERENCES IN PERFORMANCE

Note: *Applies to the composite performance measure.*

2b4.1. Describe the method for determining if statistically significant and clinically/practically meaningful differences in performance measure scores among the measured entities can be identified (*describe the steps—do not just name a method; what statistical analysis was used? Do not just repeat the information provided related to performance gap in 1b)*

We calculated the state-level risk-adjusted rates for acute, chronic, and total ACSC admissions for dual eligible beneficiaries across all three stratifications.

For each state, we calculated the 95 percent confidence interval of the measure result, and compared it to the overall measure rate when considering all beneficiaries across states in the measure calculation. We counted the number of states whose measure rates are statistically significantly lower/higher/not distinguishable from the overall measure rate.

2b4.2. What were the statistical results from testing the ability to identify statistically significant and/or clinically/practically meaningful differences in performance measure scores across measured entities? (e.g., *number and percentage of entities with scores that were statistically significantly different from mean or some benchmark, different from expected; how was meaningful difference defined*)

The following table presents state-level risk-adjusted rates for this measure.

Table 17. Summary of risk-adjusted measure rates (per 1,000) by strata across states

		Number of beneficiaries	Number of admissions	Avg.	SD	Min	10th percentile	25th percentile	50th percentile	75th percentile	90th percentile	Max
HCBS	Acute	658,646	32,835	52.0	9.5	28.8	39.4	47.4	51.9	57.9	63.5	72.6
	Chronic	658,646	36,774	53.0	12.3	18.3	38.3	45.3	52.8	60.7	67.0	88.4
	Total	658,646	69,609	105.4	17.6	63.0	78.1	95.2	108.0	117.4	124.7	144.9
Non-HCBS	Acute	3,390,553	76,628	23.1	4.0	15.3	18.5	20.5	22.7	26.1	28.7	32.4
	Chronic	3,390,553	152,125	43.7	7.1	25.7	35.2	38.8	43.9	48.4	51.9	56.9
	Total	3,390,553	228,753	66.8	9.4	41.9	53.5	61.0	67.2	74.4	77.8	81.3
Institut-ionalized	Acute	432,583	27,616	58.5	19.0	14.8	36.3	46.4	54.5	69.4	78.2	117.5
	Chronic	432,583	18,287	36.9	10.0	17.6	25.0	30.6	35.7	43.4	48.6	60.0
	Total	432,583	45,903	95.2	26.4	48.7	65.8	76.4	92.1	109.3	127.5	172.9

Source: Mathematica analysis of dual eligible beneficiaries in 50 states and the District of Columbia (51 states) with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Based on calculation of 95 percent confidence intervals for each state rate in each strata, we identified the number of states with performance significantly above the national average performance and states with performance that was statistically indistinguishable from the national average performance. The results of this analysis are summarized below. Additional information about the rate for each state with information about state names blinded is available in Appendix F.

HCBS Strata

HCBS beneficiaries – Acute composite:

- **19/51 (37.3 percent)** of states exhibit significantly higher measure rates than average performer (based on 95 percent confidence intervals).
- **25/51 (49.0 percent)** of states had indistinguishable rates from the average performance.

HCBS beneficiaries – Chronic composite:

- **13/51 (25.5 percent)** of states exhibit significantly higher measure rates than average performer (based on 95 percent confidence intervals).
- **20/51 (39.2 percent)** of states had indistinguishable rates from the average performance.

HCBS beneficiaries – Total composite:

- **17/51 (33.3 percent)** of states exhibit significantly higher measure rates than average performer (based on 95 percent confidence intervals).
- **20/51 (39.2 percent)** of states had indistinguishable rates from the average performance.

Non-HCBS Strata

Non-HCBS beneficiaries – Acute composite:

- **19/51 (37.3 percent)** of states exhibit significantly higher measure rates than average performer (based on 95 percent confidence intervals).
- **16/51 (31.4 percent)** of states had indistinguishable rates from the average performance.

Non-HCBS beneficiaries – Chronic composite:

- **19/51 (37.3 percent)** of states exhibit significantly higher measure rates than average performer (based on 95 percent confidence intervals).
- **11/51 (21.5 percent)** of states had indistinguishable rates from the average performance.

Non-HCBS beneficiaries – Total composite:

- **18/51 (35.3 percent)** of states exhibit significantly higher measure rates than average performer (based on 95 percent confidence intervals).
- **16/51 (31.4 percent)** of states had indistinguishable rates from the average performance.

Institutionalized Strata

Institutionalized beneficiaries – Acute composite:

- **11/51 (21.6 percent)** of states exhibit significantly higher measure rates than average performer (based on 95 percent confidence intervals).
- **16/51 (31.4 percent)** of states had indistinguishable rates from the average performance.

Institutionalized beneficiaries – Chronic composite:

- **11/51 (21.6 percent)** of states exhibit significantly higher measure rates than average performer (based on 95 percent confidence intervals).
- **18/51 (35.3 percent)** of states had indistinguishable rates from the average performance.

Institutionalized beneficiaries – Total composite:

- **11/51 (21.6 percent)** of states exhibit significantly higher measure rates than average performer (based on 95 percent confidence intervals).
- **13/51 (25.5 percent)** of states had indistinguishable rates from the average performance.

2b4.3. What is your interpretation of the results in terms of demonstrating the ability to identify statistically significant and/or clinically/practically meaningful differences in performance across measured entities? *(i.e., what do the results mean in terms of statistical and meaningful differences?)*

We found that the performance on this measure across the 50 states and the District of Columbia covered a wide range with meaningful variation. In all strata and for all rates, half or more of the states showed rates that were statistically significantly different from the national average performance. Overall, the measure indicates both statistically significant and practically meaningful differences in performance for the institutionalized strata.

2b5. COMPARABILITY OF PERFORMANCE SCORES WHEN MORE THAN ONE SET OF SPECIFICATIONS

Note: *Applies to all component measures, unless already endorsed or are being submitted for individual endorsement.*

If only one set of specifications, this section can be skipped.

Note*: This item is directed to measures that are risk-adjusted (with or without social risk factors)* ***OR*** *to measures with more than one set of specifications/instructions (e.g., one set of specifications for how to identify and compute the measure from medical record abstraction and a different set of specifications for claims or eMeasures). It does not apply to measures that use more than one source of data in one set of specifications/instructions (e.g., claims data to identify the denominator and medical record abstraction for the numerator).* ***Comparability is not required when comparing performance scores with and without social risk factors in the risk adjustment model. However, if comparability is not demonstrated for measures with more than one set of specifications/instructions, the different specifications (e.g., for medical records vs. claims) should be submitted as separate measures.***

2b5.1. Describe the method of testing conducted to compare performance scores for the same entities across the different data sources/specifications (*describe the steps—do not just name a method; what statistical analysis was used*)

No applicable. Only one set of specifications provided.

2b5.2. What were the statistical results from testing comparability of performance scores for the same entities when using different data sources/specifications? (*e.g., correlation, rank order*)

No applicable. Only one set of specifications provided.

2b5.3. What is your interpretation of the results in terms of the differences in performance measure scores for the same entities across the different data sources/specifications? (i*.e., what do the results mean and what are the norms for the test conducted?*)

No applicable. Only one set of specifications provided.

2b6. MISSING DATA ANALYSIS AND MINIMIZING BIAS

Note: *Applies to the overall composite measure.*

2b6.1. Describe the method of testing conducted to identify the extent and distribution of missing data (or nonresponse) and demonstrate that performance results are not biased due to systematic missing data (or differences between responders and nonresponders) and how the specified handling of missing data minimizes bias (*describe the steps—do not just name a method; what statistical analysis was used*)

There is no evidence of systematic missing data in the dataset. The datasets used to conduct these analyses have minimal missing data due to the broad denominator and the large population of interest. We examined three sources of missing data: 1) Missing (i.e., unobserved) input data, 2) missing data elements, and 3) missing component measures (zero denominator) for composite indicators.

Input data and the data elements for this measure are rarely missing because inpatient claims and enrollment data for this population are tied to payment and systematically captured.

Missing component measures would only occur if a state did not have a dual eligible population. Because the measure denominator is based on a population, we did not encounter a missing denominator or missing component measures. Given these factors, there is no evidence that the performance results may be biased.

Although it is possible that claims or enrollment records are missing from the CMS Integrated Data Repository (IDR), of those records we found, few had missing data elements. In these cases, we excluded records with missing data elements from analysis.

2b6.2. What is the overall frequency of missing data, the distribution of missing data across providers, and the results from testing related to missing data? (*e.g., results of sensitivity analysis of the effect of various rules for missing data/nonresponse; if no empirical sensitivity analysis, identify the approaches for handling missing data that were considered and pros and cons of each*)

Less than 100 records were missing state information. These records with missing data elements were excluded from analysis.

2b6.3. What is your interpretation of the results in terms of demonstrating that performance results are not biased due to systematic missing data (or differences between responders and nonresponders) and how the specified handling of missing data minimizes bias**?** (i.*e., what do the results mean in terms of supporting the selected approach for missing data and what are the norms for the test conducted; if no empirical analysis, provide rationale for the selected approach for missing data*)

There is no systematic bias due to missing data.

2c. EMPIRICAL ANALYSIS TO SUPPORT COMPOSITE CONSTRUCTION APPROACH

Note: *If empirical analyses do not provide adequate results—or are not conducted—justification must be provided and accepted in order to meet the must-pass criterion of Scientific Acceptability of Measure Properties. Each of the following questions has instructions if there is no empirical analysis.*

2d1. Empirical analysis demonstrating that the component measures fit the quality construct, add value to the overall composite, and achieve the object of parsimony to the extent possible.

2d1.1 Describe the method used (*describe the steps—do not just name a method; what statistical analysis was used; if no empirical analysis, provide justification)*

Internal Consistency: We tested the construction of the acute, chronic and total composite rates within this measure in the dual eligible population. Cronbach's alpha statistic or internal consistency coefficients measure the extent to which the components (e.g., individual condition hospitalization rates) represent a single quality construct. We tested the acute, chronic, and total composites at the state level.

2d1.2. What were the statistical results obtained from the analysis of the components? (e.g., *correlations, contribution of each component to the composite score, etc*.; *if no empirical analysis, identify the components that were considered and the pros and cons of each*)

Internal Consistency Results: Table 18 shows the results of the calculation of the Cronbach's alpha for each composite rate. The Cronbach alpha was calculated for each rate for the entire dual eligible population not within each strata. The highest Cronbach's alpha statistic was for the total composite at 0.82 at the state level. The Cronbach's alpha statistic ranged from 0.69 to 0.73 for the acute and chronic composites at the state level.

Table 18. Cronbach's alpha

Composite	State-level Cronbach's alpha
Chronic composite	0.73
Acute composite	0.69
Total composite	0.82

Source: Mathematica analysis of dual eligible beneficiaries in 50 states and the District of Columbia (51 states) with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

2d1.3. What is your interpretation of the results in terms of demonstrating that the components included in the composite are consistent with the described quality construct and add value to the overall composite? (i*.e., what do the results mean in terms of supporting inclusion of the components; if no empirical analysis, provide rationale for the components that were selected)*

Our results indicated moderate to good internal consistency within the chronic, acute, and total composite rates at the state level. These results suggest that each of the composites are meaningful.

2d2. Empirical analysis demonstrating that the aggregations and weighting rules are consistent with the quality construct and achieve the objective of simplicity to the extent possible

2d2.1 Describe the method used (*describe the steps—do not just name a method; what statistical analysis was used; if no empirical analysis, provide justification)*

To determine the method of aggregation, the team explored several alternative constructions of the measure composite rates and used feedback from ACSC Clinical Advisory Workgroup experts selected based on their subject matter expertise on hospitalization for ACSC among the elderly and disabled population to determine the appropriate construction. Although empiric analysis was used to examine the impact of different composite constructions, the workgroup determined that selecting the conditions to be included in the measure should be determined using clinical judgment not empiric analysis.

In their assessment of the composite construction, the workgroup focused on how this measure construction deviates from others that are currently used in public reporting in three programs: (1) HEDIS measure of hospitalization for ACSC in older adults in Medicare Advantage Plans (HEDIS-HPC); (2) AHRQ Prevent Quality Indicators used to describe hospitalization for ACSC at the state and regional level; and, (3) a measure of hospitalization for ACSC specifically in adults using home and community-based services (HCBS) specified for state-level reporting.

There is variation across the existing ACSC hospitalization measures with regard to which conditions are included in the acute composite rate (see Table 19 below). Specifically, cellulitis and pressure ulcers are acute conditions that are not part of the AHRQ PQIs but are common among older adults and adults using home and community-based services. Dehydration is included in the HCBS and AHRQ version of the measure but is not included in the HEDIS version. During their review of the HEDIS-HPC measure, the NCQA advisory panels (Geriatric Measurement Advisory Panel and Committee on Performance Measurement) raised concerns that dehydration was not accurately coded in older adults and also questioned the degree to which hospitalization for dehydration for older adults is preventable.

Table 19. Varying conditions between HEDIS, AHRQ and HCBS version of hospitalization for ACSC measure

Acute Condition	HEDIS-HPC	AHRQ PQIs	HCBS
Cellulitis	X		
Pressure Ulcers	X		
Dehydration		X	X

We reviewed these conditions with a ACSC Clinical Advisory Workgroup (alpha testing) convened for the purposes of advising on this measure and also constructed different versions of the measure, including and excluding these conditions, to determine the impact on measure performance (beta testing).

An analysis of missing component measures was not performed because it is not applicable to this measure. If a state has zero hospitalizations for a measure component, it simply contributes zero numerator cases to the composite rate. The state's dual eligible beneficiary population is the denominator for each measure component.

2d2.2. What were the statistical results obtained from the analysis of the aggregation and weighting rules? (e.g., *results of sensitivity analysis of effect of different aggregations and/or weighting rules; if no empirical analysis, identify the aggregation and weighting rules that were considered and the pros and cons of each*)

Alpha Testing/ACSC Clinical Advisory Workgroup Feedback: We asked the ACSC Clinical Advisory Workgroup to advise on which conditions to include in the acute composite. The ACSC Clinical Advisory Workgroup agreed with our recommendation to include cellulitis and pressure ulcers in the measure since these conditions are prevalent in the HCBS population. Additionally, they recommended dehydration NOT be included in the composite due to the lack of specificity in the diagnosis in the elderly. Several ACSC Clinical Advisory Workgroup members raised concerns that this diagnosis was frequently made in the emergency room and was not accurate.

In a subsequent meeting, the ACSC Clinical Advisory Workgroup also raised concerns about the inclusion of urinary tract infection (UTI) in the composite. However, other ACSC Clinical Advisory Workgroup members felt that despite the potential inaccuracy of the diagnosis, hospitalization for UTI was still an opportunity for quality improvement and should be included in the composite. At the 2016 November meeting of the Duals/HCBS TEP, members had divergent opinions regarding whether UTIs should be included. Some members noted that UTI is an important indicator to track for institutional residents or older adult populations, and can also signal dehydration or inactivity in HCBS users. Members noted that in certain populations, hospitalization for UTI is preventable. Other members commented that as a diagnostic category, UTIs are generally less reliable than other conditions included in the measure, as older adults and frail individuals who are asymptomatic often get misdiagnosed with UTIs.

Beta Testing: We also explored the impact of including and excluding specific conditions in the composite rate on the measure numerators (Table 20 and Figure 2). Our analyses revealed that four conditions accounted for 61 percent of all ACSC events: heart failure, COPD, bacterial pneumonia, and UTI. On the other side of the spectrum, acute bronchitis and uncontrolled diabetes were exceptionally rare and only accounted for 1 percent of all ACSC events. Overall, the majority of ACSC events are for chronic conditions because of the greater number of conditions and because of their prevalence. Dehydration, which was recommended for removal from the composite, accounted for 7 percent of the hospitalizations.

Table 20. Number of events by ACSC type

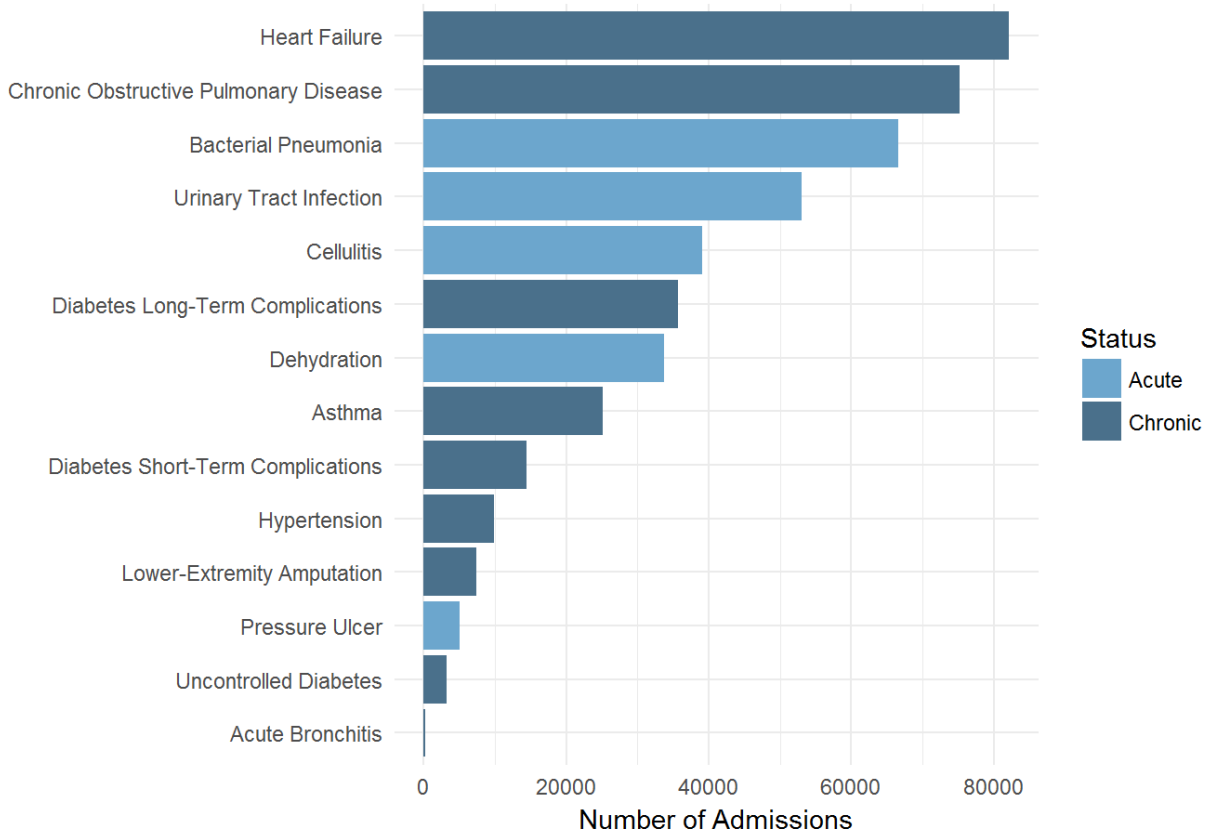
ACSC event	Number of events	Observed rate per 1,000	Percent of events
ACSC-01 Diabetes Short-Term Complications	14,434	2.95	3%
ACSC-02 Diabetes Long-Term Complications	35,696	7.30	8%
ACSC-03 Uncontrolled Diabetes Admission	3,190	0.65	1%
ACSC-04 Lower-Extremity Amputation	7,369	1.51	2%
ACSC-05 Chronic Obstructive Pulmonary Disease	75,135	15.36	17%
ACSC-06 Asthma Admission	25,168	5.15	6%
ACSC-07 Acute Bronchitis Admission	262	0.05	0%
ACSC-08 Heart Failure Admission	82,120	16.79	18%
ACSC-09 Hypertension Admission	9,852	2.01	2%

ACSC event	Number of events	Observed rate per 1,000	Percent of events
ACSC-10 Bacterial Pneumonia Admission	66,548	13.60	15%
ACSC-11 Urinary Tract Infection Admission	53,082	10.85	12%
ACSC-12 Dehydration Admission	33,707	6.89	7%
ACSC-13 Cellulitis Admission	39,116	8.00	9%
ACSC-14 Pressure Ulcer Admission	4,977	1.02	1%

Source: Mathematica analysis of dual eligible beneficiaries in 50 states and the District of Columbia (51 states) with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: Percentages may not add to 100 due to rounding. ACSC-04 Lower-Extremity Amputation does not reflect a toe amputation exclusion. Incorporating this exclusion would decrease numerator cases by 401 (5 percent).

Figure 2. Number of events by ACSC type



Source: Mathematica analysis of dual eligible beneficiaries in 50 states and the District of Columbia (51 states) with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

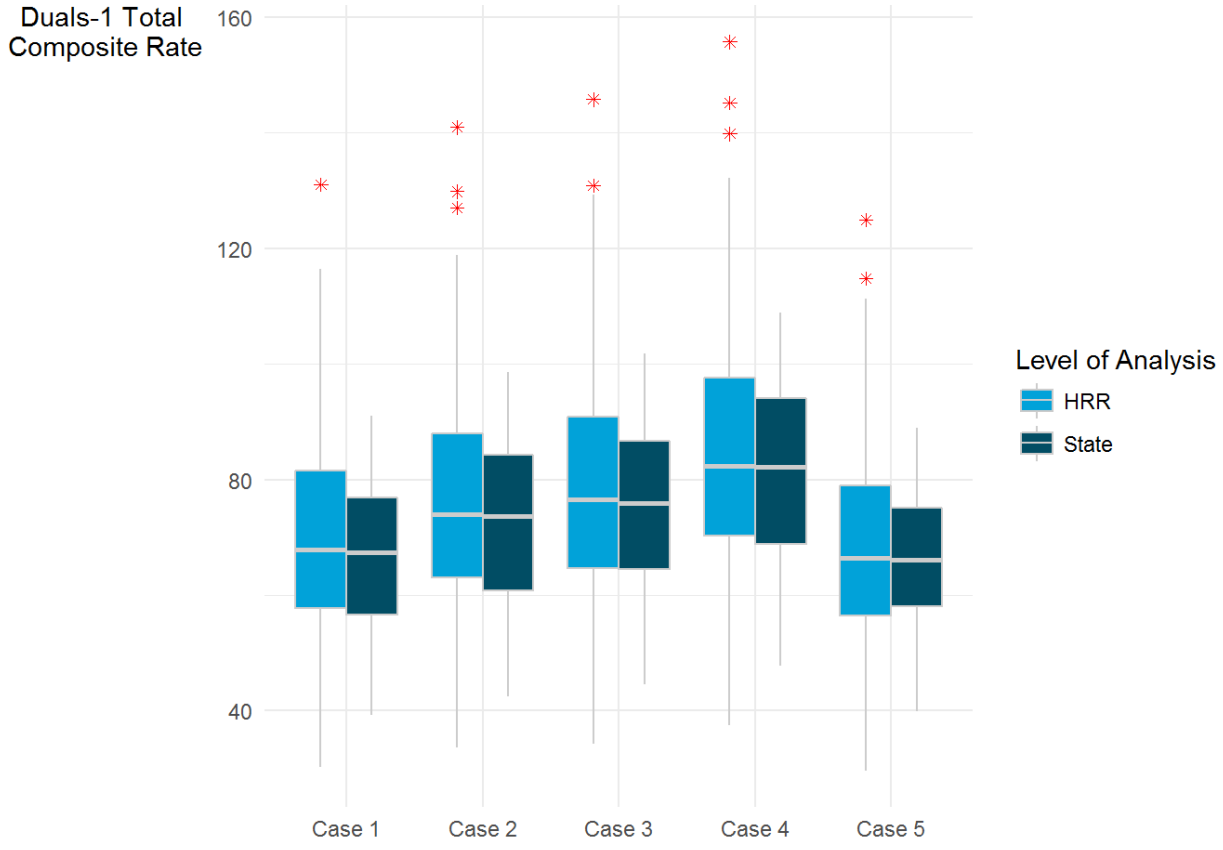
Note: Percents may not add to 100 due to rounding. ACSC-04 Lower-Extremity Amputation does not reflect a toe amputation exclusion. Incorporating this exclusion would decrease numerator cases by 401 (5 percent).

Although the conditions included in the chronic composite are identical to that of the PQIs, Medicaid HCBS, and HEDIS-HPC measures, the ACSC Clinical Advisory Workgroup suggested we examine how changes to the

acute composite specification impact the results for the overall composite. We examined variation in the overall composite based on the following five scenarios:

- Case 1 – All chronic ACSCs and two acute ACSCs: Bacterial Pneumonia and Urinary Tract Infection;
- Case 2 – All chronic ACSCs and three acute ACSCs: Bacterial Pneumonia, Urinary Tract Infection, and Dehydration;
- Case 3 – All chronic ACSCs and four acute ACSCs: Bacterial Pneumonia, Urinary Tract Infection, Cellulitis, and Pressure Ulcer;
- Case 4 – All chronic ACSCs and five acute ACSCs: Bacterial Pneumonia, Urinary Tract Infection, Dehydration, Cellulitis, and Pressure Ulcer; and,
- Case 5 – All chronic ACSCs and three acute ACSCs: Bacterial Pneumonia, Cellulitis, and Pressure Ulcer.

Figure 3. State- and HRR-level total composite rates under different acute composite definitions



Source: Mathematica analysis of dual eligible beneficiaries in 50 states and the District of Columbia (51 states) with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: Case 1 - chronic ACSCs and two acute ACSCs: Bacterial Pneumonia and Urinary Tract Infection; Case 2 - chronic ACSCs and three acute ACSCs: Bacterial Pneumonia, Urinary Tract Infection, and Dehydration; Case 3 - chronic ACSCs and four acute ACSCs: Bacterial Pneumonia, Urinary Tract Infection, Cellulitis, and Pressure Ulcer; Case 4 - chronic ACSCs and five acute ACSCs: Bacterial Pneumonia, Urinary Tract Infection, Dehydration, Cellulitis, and Pressure Ulcer; Case 5 – chronic ACSCs and three acute ACSCs: Bacterial Pneumonia, Cellulitis, and Pressure Ulcer. HRR-level rates are not being submitted for endorsement, but are included for your reference.

2d2.3. What is your interpretation of the results in terms of demonstrating the aggregation and weighting rules are consistent with the described quality construct? (i.*e., what do the results mean in terms of supporting the selected rules for aggregation and weighting; if no empirical analysis, provide rationale for the selected rules for aggregation and weighting*)

Adding conditions to the composite increased the overall rate because the denominator remained the same in all scenarios. Removing urinary tract infection from the acute composite resulted in much lower composite rates because it was one of the most frequent conditions. However, the different combinations had limited impact on the overall distribution of state rates, as shown in Figure 3.

The ACSC Clinical Advisory Workgroup determined the most clinically appropriate approach was Case 3 (bacterial pneumonia, urinary tract infection, cellulitis, and pressure ulcer).

APPENDIX A

Table A.1. SNR based on the risk-adjusted rates for the HCBS strata

State	Number of dual eligible beneficiaries	Acute Composite Group SNR based on risk-adjusted rates	Chronic Composite Group SNR based on risk-adjusted rates	Total Composite Group SNR based on risk-adjusted rates
State 1	5,819	0.89	0.92	0.93
State 2	1,715	0.73	0.79	0.81
State 3	5,265	0.90	0.92	0.93
State 4	3,612	0.89	0.92	0.93
State 5	28,763	0.97	0.97	0.98
State 6	12,818	0.95	0.96	0.97
State 7	13,137	0.95	0.97	0.97
State 8	2,343	0.79	0.85	0.87
State 9	1,865	0.76	0.82	0.84
State 10	45,127	0.99	0.99	0.99
State 11	11,198	0.95	0.96	0.97
State 12	890	0.53	0.54	0.61
State 13	5,210	0.88	0.90	0.92
State 14	37,103	0.98	0.99	0.99
State 15	13,082	0.95	0.96	0.97
State 16	12,731	0.94	0.96	0.97
State 17	10,362	0.93	0.95	0.96
State 18	8,252	0.92	0.94	0.95
State 19	7,245	0.91	0.92	0.94
State 20	3,356	0.77	0.76	0.82
State 21	12,795	0.94	0.94	0.96
State 22	13,794	0.96	0.97	0.97
State 23	9,723	0.95	0.96	0.97
State 24	20,855	0.96	0.96	0.97
State 25	12,346	0.95	0.97	0.97
State 26	14,269	0.96	0.97	0.98

State	Number of dual eligible beneficiaries	Acute Composite Group SNR based on risk-adjusted rates	Chronic Composite Group SNR based on risk-adjusted rates	Total Composite Group SNR based on risk-adjusted rates
State 27	2,680	0.78	0.79	0.84
State 28	5,387	0.87	0.88	0.91
State 29	1,852	0.74	0.77	0.82
State 30	4,130	0.85	0.89	0.91
State 31	12,599	0.95	0.96	0.97
State 32	7,664	0.91	0.93	0.94
State 33	92,988	0.99	0.99	1.00
State 34	10,365	0.94	0.96	0.97
State 35	1,476	0.54	0.48	0.60
State 36	29,067	0.98	0.98	0.99
State 37	13,182	0.96	0.98	0.98
State 38	9,813	0.94	0.95	0.96
State 39	27,385	0.98	0.98	0.99
State 40	3,301	0.82	0.85	0.88
State 41	10,211	0.94	0.95	0.96
State 42	2,568	0.73	0.73	0.80
State 43	8,600	0.94	0.96	0.96
State 44	28,717	0.98	0.99	0.99
State 45	1,818	0.68	0.69	0.76
State 46	3,654	0.82	0.84	0.88
State 47	14,021	0.96	0.97	0.97
State 48	20,285	0.97	0.98	0.98
State 49	4,859	0.89	0.93	0.94
State 50	26,411	0.97	0.98	0.98
State 51	1,938	0.71	0.78	0.81
Average	12,915	0.88	0.90	0.92

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

ACSC = ambulatory care sensitive conditions.

HCBS = home and community-based services

Table A.2. SNR based on the risk-adjusted rates for the community-dwelling, non-HCBS strata

State	Number of dual eligible beneficiaries	Acute Composite Rates SNR based on risk-adjusted rates	Chronic Composite Group SNR based on risk-adjusted rates	Total Composite Group SNR based on risk-adjusted rates
State 1	83,352	0.98	0.99	0.99
State 2	9,357	0.84	0.89	0.91
State 3	28,882	0.94	0.96	0.97
State 4	54,454	0.97	0.98	0.98
State 5	436,851	1.00	1.00	1.00
State 6	25,881	0.93	0.96	0.96
State 7	53,958	0.97	0.98	0.99
State 8	14,255	0.90	0.94	0.95
State 9	12,789	0.90	0.94	0.94
State 10	193,530	0.99	1.00	1.00
State 11	98,914	0.98	0.99	0.99
State 12	4,640	0.71	0.82	0.83
State 13	16,504	0.90	0.93	0.94
State 14	79,535	0.98	0.99	0.99
State 15	68,653	0.98	0.99	0.99
State 16	33,084	0.95	0.97	0.97
State 17	23,397	0.93	0.96	0.96
State 18	87,316	0.98	0.99	0.99
State 19	94,660	0.98	0.99	0.99
State 20	54,829	0.98	0.98	0.99
State 21	60,709	0.98	0.98	0.99
State 22	129,493	0.99	0.99	0.99
State 23	115,104	0.99	0.99	0.99
State 24	38,125	0.95	0.97	0.97
State 25	80,066	0.98	0.99	0.99
State 26	60,377	0.98	0.99	0.99
State 27	12,080	0.88	0.92	0.93
State 28	16,575	0.91	0.94	0.95
State 29	18,422	0.92	0.95	0.96
State 30	14,051	0.89	0.93	0.94
State 31	79,254	0.98	0.99	0.99
State 32	22,256	0.92	0.95	0.95
State 33	223,620	0.99	1.00	1.00
State 34	162,405	0.99	0.99	1.00
State 35	5,857	0.80	0.86	0.88
State 36	86,845	0.98	0.99	0.99
State 37	50,599	0.97	0.98	0.98
State 38	33,542	0.95	0.97	0.97

State	Number of dual eligible beneficiaries	Acute Composite Rates SNR based on risk-adjusted rates	Chronic Composite Group SNR based on risk-adjusted rates	Total Composite Group SNR based on risk-adjusted rates
State 39	121,158	0.99	0.99	0.99
State 40	15,412	0.90	0.94	0.95
State 41	50,844	0.97	0.98	0.98
State 42	8,887	0.85	0.91	0.92
State 43	91,982	0.98	0.99	0.99
State 44	169,081	0.99	0.99	1.00
State 45	8,544	0.82	0.88	0.90
State 46	16,597	0.91	0.94	0.95
State 47	62,903	0.98	0.99	0.99
State 48	64,587	0.97	0.98	0.98
State 49	41,212	0.96	0.98	0.98
State 50	50,856	0.97	0.98	0.98
State 51	4,269	0.71	0.80	0.83
Average	66,481	0.94	0.96	0.97

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

ACSC = ambulatory care sensitive conditions.

HCBS = home and community-based services

Table A.3. SNR based on the risk-adjusted rates for the institutionalized strata

State	Number of dual eligible beneficiaries	Acute Composite Group	Chronic Composite Group	Total Composite Group
		SNR based on risk-adjusted rates	SNR based on risk-adjusted rates	SNR based on risk-adjusted rates
State 1	8,267	0.98	0.94	0.98
State 2	276	0.59	0.34	0.63
State 3	1,516	0.89	0.76	0.90
State 4	7,794	0.97	0.93	0.98
State 5	33,272	0.99	0.99	1.00
State 6	4,285	0.96	0.90	0.96
State 7	8,465	0.98	0.95	0.98
State 8	1,334	0.87	0.73	0.89
State 9	723	0.77	0.55	0.80
State 10	15,400	0.99	0.97	0.99
State 11	12,263	0.98	0.96	0.99
State 12	707	0.74	0.47	0.75
State 13	1,607	0.89	0.77	0.91
State 14	23,325	0.99	0.98	0.99
State 15	14,540	0.99	0.97	0.99
State 16	7,565	0.97	0.93	0.98
State 17	5,382	0.97	0.91	0.97
State 18	8,350	0.98	0.95	0.98
State 19	14,273	0.99	0.97	0.99
State 20	2,288	0.92	0.82	0.93
State 21	6,344	0.97	0.94	0.98
State 22	11,875	0.98	0.96	0.99
State 23	10,193	0.98	0.96	0.99
State 24	3,372	0.94	0.87	0.95
State 25	9,780	0.98	0.95	0.98
State 26	13,167	0.99	0.97	0.99
State 27	1,629	0.89	0.75	0.90
State 28	3,776	0.95	0.87	0.96
State 29	1,344	0.87	0.72	0.89
State 30	2,567	0.93	0.84	0.94
State 31	14,236	0.99	0.96	0.99
State 32	1,654	0.89	0.74	0.90
State 33	31,611	0.99	0.98	0.99
State 34	14,785	0.99	0.97	0.99
State 35	1,928	0.90	0.75	0.91
State 36	21,494	0.99	0.98	0.99
State 37	7,658	0.98	0.94	0.98

State	Number of dual eligible beneficiaries	Acute Composite Group SNR based on risk-adjusted rates	Chronic Composite Group SNR based on risk-adjusted rates	Total Composite Group SNR based on risk-adjusted rates
State 38	1,380	0.89	0.79	0.91
State 39	23,596	0.99	0.98	0.99
State 40	1,622	0.89	0.75	0.90
State 41	7,540	0.97	0.94	0.98
State 42	1,999	0.91	0.78	0.92
State 43	10,392	0.98	0.96	0.99
State 44	30,286	0.99	0.98	0.99
State 45	1,604	0.88	0.71	0.89
State 46	942	0.83	0.65	0.85
State 47	7,080	0.97	0.94	0.98
State 48	4,819	0.96	0.91	0.97
State 49	3,860	0.95	0.90	0.96
State 50	7,515	0.97	0.93	0.98
State 51	903	0.81	0.63	0.84
Average	8,482	0.93	0.86	0.94

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

ACSC = ambulatory care sensitive conditions.

APPENDIX B

Raw Coefficients

Table B.1. Final logit model specification: Risk factor weights: HCBS users with acute ACSC admissions

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Intercept	-5.133	Chronic Kidney Disease, Severe (Stage 4)	0.231	Seizure Disorders and Convulsions	0.202
Female, ages 18-34	0.058	Chronic Obstructive Pulmonary Disease	0.459	Septicemia, Sepsis, Systemic Inflammatory Response Syndrome/Shock	0.445
Female, ages 35-44	0.365	Chronic Ulcer of Skin, Except Pressure	0.278	Severe Hematological Disorders	0.090
Female, ages 45-54	0.559	Coagulation Defects and Other Specified Hematological Disorders	0.089	Specified Heart Arrhythmias	0.092
Female, ages 55-59	0.836	Congestive Heart Failure	0.132	Spinal Cord Disorders/Injuries	0.432
Female, ages 60-64	0.981	Diabetes with Acute Complications	0.301	Traumatic Amputations and Complications	-0.047
Female, ages 65-69	1.171	Diabetes with Chronic Complications	0.093	Unstable Angina and Other Acute Ischemic Heart Disease	-0.012
Female, ages 70-74	1.242	Diabetes without Complication	0.072	Vascular Disease	-0.033
Female, ages 75-79	1.409	Drug/Alcohol Dependence	0.256	Vascular Disease with Complications	0.225
Female, ages 80-84	1.572	Drug/Alcohol Psychosis	0.199	Vertebral Fractures without Spinal Cord Injury	0.149
Female, ages 85-89	1.747	Exudative Macular Degeneration	-0.018	Chronic Condition Interaction: Diabetes and Congestive Heart Failure	-0.025
Female, ages 90-94	1.859	Fibrosis of Lung and Other Chronic Lung Disorders	0.224	Chronic Condition Interaction: Congestive Heart Failure and COPD	-0.049
Female, ages 95+	1.899	Ischemic or Unspecified Stroke	0.135	Chronic Condition Interaction: Cancer and Immune Disorders	0.141
Male, ages 35-44	0.335	Lung and Other Severe Cancers	0.061	Chronic Condition Interaction: Aspiration and Specified Bacterial Pneumonias and Pressure Ulcer	-0.452
Male, ages 45-54	0.528	Lymphoma and Other Cancers	0.091	Chronic Condition Interaction: Sepsis and Aspiration and Specified Bacterial Pneumonias	-0.237
Male, ages 55-59	0.767	Major Depressive, Bipolar, and Paranoid Disorders	0.088	Chronic Condition Interaction: Schizophrenia and COPD	0.094
Male, ages 60-64	0.883	Major Head Injury	0.028	Disability Interaction: HCC6 Opportunistic Infections	0.371
Male, ages 65-69	0.950	Metastatic Cancer and Acute Leukemia	-0.001	Disability Interaction: HCC34 Chronic Pancreatitis	0.152
Male, ages 70-74	1.188	Monoplegia, Other Paralytic Syndromes	0.003	Disability Interaction: HCC39 Bone/Joint/Muscle Infections/Necrosis	0.176
Male, ages 75-79	1.241	Morbid Obesity	0.446	Disability Interaction: HCC46 Severe Hematological Disorders	-0.230
Male, ages 80-84	1.406	Multiple Sclerosis	0.552	Disability Interaction: HCC54 Drug/Alcohol Psychosis	0.132

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Male, ages 85-89	1.550	Myasthenia Gravis/Myoneural Disorders, Inflammatory and Toxic Neuropathy	0.022	Disability Interaction: HCC55 Drug/Alcohol Dependence	0.151
Male, ages 90-94	1.720	Opportunistic Infections	-0.158	Disability Interaction: HCC77 Multiple Sclerosis	-0.080
Male, ages 95+	1.870	Other Significant Endocrine and Metabolic Disorders	-0.168	Disability Interaction: HCC85 Congestive Heart Failure	0.147
Acute Renal Failure	0.240	Paraplegia	0.919	Disability Interaction: HCC157 Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	0.541
Amputation Status, Lower Limb/Amputation Complications	0.271	Parkinson's and Huntington's Diseases	0.332	Disability Interaction: HCC158 Pressure Ulcer of Skin with Full Thickness Skin Loss	0.618
Artificial Openings for Feeding or Elimination	0.402	Pneumococcal Pneumonia, Empyema, Lung Abscess	0.371	Disability Interaction: HCC161 Chronic Ulcer of Skin, Except Pressure	0.280
Aspiration and Specified Bacterial Pneumonias	0.445	Pressure Ulcer of Skin with Full Thickness Skin Loss	0.245	Disability Interaction: HCC176 Complications of Specified Implanted Device or Graft	0.093
Atherosclerosis of the Extremities with Ulceration or Gangrene	0.193	Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	0.502	HCC Count: 1-2	0.328
Bone/Joint/Muscle Infections/Necrosis	0.015	Quadriplegia	1.018	HCC Count: 3-5	0.588
Cardio-Respiratory Failure and Shock	0.141	Rheumatoid Arthritis and Inflammatory Connective Tissue Disease	0.132	HCC Count: 6-10	0.528
Cerebral Palsy	0.239	Schizophrenia	0.154	HCC Count: 11+	0.020

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: The values in the beta columns represent the raw regression coefficients generated by the risk-adjustment model. These values are often referred to as “risk-adjustment weights.”

Sample: Full sample (N = 658,646)

ACSC = ambulatory care sensitive conditions.

HCBS = home and community-based services

* Denotes rounded value.

Table B.2. Final Poisson model specification: Risk factor weights: HCBS users with acute ACSC admissions

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Intercept	0.076	Chronic Kidney Disease, Severe (Stage 4)	-0.038	Seizure Disorders and Convulsions	-0.007
Female, ages 18-34	0.021	Chronic Obstructive Pulmonary Disease	0.035	Septicemia, Sepsis, Systemic Inflammatory Response Syndrome/Shock	0.064
Female, ages 35-44	0.032	Chronic Ulcer of Skin, Except Pressure	0.015	Severe Hematological Disorders	0.002
Female, ages 45-54	0.019	Coagulation Defects and Other Specified Hematological Disorders	0.018	Specified Heart Arrhythmias	0.005
Female, ages 55-59	0.001	Congestive Heart Failure	0.006	Spinal Cord Disorders/Injuries	0.002
Female, ages 60-64	0.027	Diabetes with Acute Complications	-0.006	Traumatic Amputations and Complications	0.118
Female, ages 65-69	-0.001	Diabetes with Chronic Complications	-0.003	Unstable Angina and Other Acute Ischemic Heart Disease	0.002
Female, ages 70-74	0.020	Diabetes without Complication	0.007	Vascular Disease	0.002
Female, ages 75-79	0.016	Drug/Alcohol Dependence	0.022	Vascular Disease with Complications	0.018
Female, ages 80-84	0.020	Drug/Alcohol Psychosis	-0.080	Vertebral Fractures without Spinal Cord Injury	0.008
Female, ages 85-89	0.031	Exudative Macular Degeneration	0.005	Chronic Condition Interaction: Diabetes and Congestive Heart Failure	-0.001
Female, ages 90-94	0.026	Fibrosis of Lung and Other Chronic Lung Disorders	0.033	Chronic Condition Interaction: Congestive Heart Failure and COPD	0.006
Female, ages 95+	0.014	Ischemic or Unspecified Stroke	0.009	Chronic Condition Interaction: Cancer and Immune Disorders	-0.040
Male, ages 35-44	0.001	Lung and Other Severe Cancers	-0.026	Chronic Condition Interaction: Aspiration and Specified Bacterial Pneumonias and Pressure Ulcer	-0.073
Male, ages 45-54	0.008	Lymphoma and Other Cancers	-0.022	Chronic Condition Interaction: Sepsis and Aspiration and Specified Bacterial Pneumonias	-0.019
Male, ages 55-59	-0.020	Major Depressive, Bipolar, and Paranoid Disorders	0.007	Chronic Condition Interaction: Schizophrenia and COPD	0.003
Male, ages 60-64	-0.011	Major Head Injury	0.005	Disability Interaction: HCC6 Opportunistic Infections	-0.030
Male, ages 65-69	0.002	Metastatic Cancer and Acute Leukemia	0.022	Disability Interaction: HCC34 Chronic Pancreatitis	-0.021
Male, ages 70-74	0.020	Monoplegia, Other Paralytic Syndromes	0.021	Disability Interaction: HCC39 Bone/Joint/Muscle Infections/Necrosis	-0.015
Male, ages 75-79	0.024	Morbid Obesity	0.051	Disability Interaction: HCC46 Severe Hematological Disorders	-0.009
Male, ages 80-84	-0.001	Multiple Sclerosis	-0.008	Disability Interaction: HCC54 Drug/Alcohol Psychosis	0.113
Male, ages 85-89	-0.016	Myasthenia Gravis/Myoneural Disorders, Inflammatory and Toxic Neuropathy	0.044	Disability Interaction: HCC55 Drug/Alcohol Dependence	0.031

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Male, ages 90-94	0.006	Opportunistic Infections	0.094	Disability Interaction: HCC77 Multiple Sclerosis	0.056
Male, ages 95+	0.011	Other Significant Endocrine and Metabolic Disorders	-0.002	Disability Interaction: HCC85 Congestive Heart Failure	-0.007
Acute Renal Failure	0.017	Paraplegia	0.080	Disability Interaction: HCC157 Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	0.043
Amputation Status, Lower Limb/Amputation Complications	0.007	Parkinson's and Huntington's Diseases	0.003	Disability Interaction: HCC158 Pressure Ulcer of Skin with Full Thickness Skin Loss	0.031
Artificial Openings for Feeding or Elimination	0.018	Pneumococcal Pneumonia, Empyema, Lung Abscess	0.064	Disability Interaction: HCC161 Chronic Ulcer of Skin, Except Pressure	0.033
Aspiration and Specified Bacterial Pneumonias	0.018	Pressure Ulcer of Skin with Full Thickness Skin Loss	0.043	Disability Interaction: HCC176 Complications of Specified Implanted Device or Graft	0.009
Atherosclerosis of the Extremities with Ulceration or Gangrene	0.033	Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	0.045	HCC Count: 1-2	-0.001
Bone/Joint/Muscle Infections/Necrosis	0.014	Quadriplegia	0.075	HCC Count: 3-5	0.022
Cardio-Respiratory Failure and Shock	-0.011	Rheumatoid Arthritis and Inflammatory Connective Tissue Disease	0.006	HCC Count: 6-10	0.031
Cerebral Palsy	0.017	Schizophrenia	-0.003	HCC Count: 11+	0.027

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: The values in the beta columns represent the raw regression coefficients generated by the risk-adjustment model. These values are often referred to as “risk-adjustment weights.”

Sample: Full sample (N = 658,646)

ACSC = ambulatory care sensitive conditions.

* Denotes rounded value.

Table B.3. Final logit model specification: Risk factor weights: HCBS users with chronic ACSC admissions

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Intercept	-6.454	Bone/Joint/Muscle Infections/Necrosis	0.064	Respirator Dependence/Tracheostomy Status	0.178
Female, ages 18--34	0.308	Cardio-Respiratory Failure and Shock	0.510	Respiratory Arrest	0.417
Female, ages 35-44	0.808	Chronic Hepatitis	0.218	Schizophrenia	-0.209
Female, ages 45-54	1.016	Chronic Kidney Disease, Severe (Stage 4)	0.553	Specified Heart Arrhythmias	0.318
Female, ages 55-59	1.281	Chronic Kidney Disease, Stage 5	0.663	Traumatic Amputations and Complications	0.174
Female, ages 60-64	1.363	Chronic Obstructive Pulmonary Disease	1.086	Unstable Angina and Other Acute Ischemic Heart Disease	0.185
Female, ages 65-69	1.507	Chronic Pancreatitis	-0.122	Vertebral Fractures without Spinal Cord Injury	0.131
Female, ages 70-74	1.538	Chronic Ulcer of Skin, Except Pressure	0.116	Chronic Condition Interaction: Diabetes and Congestive Heart Failure	-0.346
Female, ages 75-79	1.598	Cirrhosis of Liver	0.121	Chronic Condition Interaction: COPD and Cardiorespiratory Failure	0.147
Female, ages 80-84	1.637	Congestive Heart Failure	0.938	Chronic Condition Interaction: Congestive Heart Failure and Renal Disease	-0.215
Female, ages 85-89	1.694	Diabetes with Acute Complications	1.783	Chronic Condition Interaction: COPD and Aspiration and Specifical Bacterial Pneumonias	-0.088
Female, ages 90-94	1.784	Diabetes with Chronic Complications	0.875	Chronic Condition Interaction: Schizophrenia and Congestive Heart Failure	0.098
Female, ages 95+	1.538	Diabetes without Complication	0.561	Disability Interaction: HCC6 Opportunistic Infections	-0.015
Male, ages 35-44	0.505	Dialysis Status	0.742	Disability Interaction: HCC34 Chronic Pancreatitis	0.566
Male, ages 45-54	0.785	Disorders of Immunity	0.171	Disability Interaction: HCC39 Bone/Joint/Muscle Infections/Necrosis	0.375
Male, ages 55-59	1.030	Drug/Alcohol Dependence	0.173	Disability Interaction: HCC46 Severe Hematological Disorders	0.082
Male, ages 60-64	1.151	Drug/Alcohol Psychosis	0.161	Disability Interaction: HCC54 Drug/Alcohol Psychosis	0.227
Male, ages 65-69	1.340	End-Stage Liver Disease	-0.111	Disability Interaction: HCC55 Drug/Alcohol Dependence	0.206
Male, ages 70-74	1.438	Fibrosis of Lung and Other Chronic Lung Disorders	0.297	Disability Interaction: HCC77 Multiple Sclerosis	-0.257
Male, ages 75-79	1.515	HIV/AIDS	0.142	Disability Interaction: HCC85 Congestive Heart Failure	0.127

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Male, ages 80-84	1.512	Morbid Obesity	0.295	Disability Interaction: HCC157 Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	-0.151
Male, ages 85-89	1.632	Myasthenia Gravis/Myoneural Disorders, Inflammatory and Toxic Neuropathy	0.183	Disability Interaction: HCC158 Pressure Ulcer of Skin with Full Thickness Skin Loss	0.182
Male, ages 90-94	1.718	Opportunistic Infections	0.366	Disability Interaction: HCC161 Chronic Ulcer of Skin, Except Pressure	0.248
Male, ages 95+	1.913	Other Significant Endocrine and Metabolic Disorders	0.082	Disability Interaction: HCC176 Complications of Specified Implanted Device or Graft	-0.011
Acute Myocardial Infarction	0.312	Pneumococcal Pneumonia, Empyema, Lung Abscess	0.319	HCC Count: 1-2	0.683
Acute Renal Failure	0.488	Proliferative Diabetic Retinopathy and Vitreous Hemorrhage	0.373	HCC Count: 3-5	0.867
Amputation Status, Lower Limb/Amputation Complications	0.545	Protein-Calorie Malnutrition	-0.081	HCC Count: 6-10	0.687
Atherosclerosis of the Extremities with Ulceration or Gangrene	0.608	Quadriplegia	-0.223	HCC Count: 11+	0.180

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: The values in the beta columns represent the raw regression coefficients generated by the risk-adjustment model. These values are often referred to as “risk-adjustment weights.”

Sample: Full sample (N = 658,646)

ACSC = ambulatory care sensitive conditions.

* Denotes rounded value.

Table B.4. Final Poisson model specification: Risk factor weights: HCBS users with chronic ACSC admissions

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Intercept	0.340	Bone/Joint/Muscle Infections/Necrosis	0.078	Respirator Dependence/Tracheostomy Status	0.051
Female, ages 18-34	-0.064	Cardio-Respiratory Failure and Shock	0.061	Respiratory Arrest	0.114
Female, ages 35-44	-0.127	Chronic Hepatitis	0.017	Schizophrenia	-0.041
Female, ages 45-54	-0.138	Chronic Kidney Disease, Severe (Stage 4)	0.001	Specified Heart Arrhythmias	0.049
Female, ages 55-59	-0.245	Chronic Kidney Disease, Stage 5	0.049	Traumatic Amputations and Complications	0.037
Female, ages 60-64	-0.215	Chronic Obstructive Pulmonary Disease	0.105	Unstable Angina and Other Acute Ischemic Heart Disease	0.068
Female, ages 65-69	-0.230	Chronic Pancreatitis	-0.023	Vertebral Fractures without Spinal Cord Injury	0.020
Female, ages 70-74	-0.254	Chronic Ulcer of Skin, Except Pressure	0.055	Chronic Condition Interaction: Diabetes and Congestive Heart Failure	-0.006
Female, ages 75-79	-0.263	Cirrhosis of Liver	-0.012	Chronic Condition Interaction: COPD and Cardiorespiratory Failure	0.082
Female, ages 80-84	-0.275	Congestive Heart Failure	0.072	Chronic Condition Interaction: Congestive Heart Failure and Renal Disease	0.012
Female, ages 85-89	-0.270	Diabetes with Acute Complications	0.265	Chronic Condition Interaction: COPD and Aspiration and Specifical Bacterial Pneumonias	-0.030
Female, ages 90-94	-0.289	Diabetes with Chronic Complications	0.061	Chronic Condition Interaction: Schizophrenia and Congestive Heart Failure	0.061
Female, ages 95+	-0.259	Diabetes without Complication	0.042	Disability Interaction: HCC6 Opportunistic Infections	0.025
Male, ages 35-44	-0.105	Dialysis Status	0.000	Disability Interaction: HCC34 Chronic Pancreatitis	0.110
Male, ages 45-54	-0.169	Disorders of Immunity	0.043	Disability Interaction: HCC39 Bone/Joint/Muscle Infections/Necrosis	-0.027
Male, ages 55-59	-0.264	Drug/Alcohol Dependence	0.000	Disability Interaction: HCC46 Severe Hematological Disorders	-0.004
Male, ages 60-64	-0.176	Drug/Alcohol Psychosis	0.034	Disability Interaction: HCC54 Drug/Alcohol Psychosis	0.034
Male, ages 65-69	-0.213	End-Stage Liver Disease	-0.072	Disability Interaction: HCC55 Drug/Alcohol Dependence	0.115
Male, ages 70-74	-0.201	Fibrosis of Lung and Other Chronic Lung Disorders	-0.036	Disability Interaction: HCC77 Multiple Sclerosis	0.006
Male, ages 75-79	-0.241	HIV/AIDS	-0.039	Disability Interaction: HCC85 Congestive Heart Failure	0.003
Male, ages 80-84	-0.292	Morbid Obesity	-0.007	Disability Interaction: HCC157 Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	-0.113

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Male, ages 85-89	-0.283	Myasthenia Gravis/Myoneural Disorders, Inflammatory and Toxic Neuropathy	-0.014	Disability Interaction: HCC158 Pressure Ulcer of Skin with Full Thickness Skin Loss	0.016
Male, ages 90-94	-0.283	Opportunistic Infections	0.045	Disability Interaction: HCC161 Chronic Ulcer of Skin, Except Pressure	-0.077
Male, ages 95+	-0.202	Other Significant Endocrine and Metabolic Disorders	0.033	Disability Interaction: HCC176 Complications of Specified Implanted Device or Graft	0.017
Acute Myocardial Infarction	0.078	Pneumococcal Pneumonia, Empyema, Lung Abscess	0.018	HCC Count: 1-2	0.016
Acute Renal Failure	0.067	Proliferative Diabetic Retinopathy and Vitreous Hemorrhage	0.058	HCC Count: 3-5	0.020
Amputation Status, Lower Limb/Amputation Complications	0.101	Protein-Calorie Malnutrition	0.018	HCC Count: 6-10	0.018
Atherosclerosis of the Extremities with Ulceration or Gangrene	0.106	Quadriplegia	-0.124	HCC Count: 11+	-0.028

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: The values in the beta columns represent the raw regression coefficients generated by the risk-adjustment model. These values are often referred to as “risk-adjustment weights.”

Sample: Full sample (N = 658,646)

ACSC = ambulatory care sensitive conditions.

* Denotes rounded value.

Table B.5. Final logit model specification: Risk factor weights: HCBS users with acute or chronic ACSC admissions

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Intercept	-4.841	Chronic Pancreatitis	-0.11	Septicemia, Sepsis, Systemic Inflammatory Response Syndrome/Shock	0.197
Female, ages 18-34	0.122	Chronic Ulcer of Skin, Except Pressure	0.151	Severe Hematological Disorders	0.075
Female, ages 35-44	0.469	Cirrhosis of Liver	0.027	Specified Heart Arrhythmias	0.178
Female, ages 45-54	0.652	Coagulation Defects and Other Specified Hematological Disorders	0.033	Spinal Cord Disorders/Injuries	0.223
Female, ages 55-59	0.915	Congestive Heart Failure	0.487	Traumatic Amputations and Complications	0.033
Female, ages 60-64	1.041	Diabetes with Acute Complications	1.076	Unstable Angina and Other Acute Ischemic Heart Disease	0.077
Female, ages 65-69	1.214	Diabetes with Chronic Complications	0.4	Vascular Disease	-0.014
Female, ages 70-74	1.259	Diabetes without Complication	0.186	Vascular Disease with Complications	0.121
Female, ages 75-79	1.368	Dialysis Status	-0.003	Vertebral Fractures without Spinal Cord Injury	0.075
Female, ages 80-84	1.475	Disorders of Immunity	0.064	Chronic Condition Interaction: Diabetes and Congestive Heart Failure	-0.039
Female, ages 85-89	1.596	Drug/Alcohol Dependence	0.205	Chronic Condition Interaction: COPD and Cardiorespiratory Failure	0.312
Female, ages 90-94	1.704	Drug/Alcohol Psychosis	0.106	Chronic Condition Interaction: Congestive Heart Failure and COPD	-0.203
Female, ages 95+	1.652	End-Stage Liver Disease	-0.06	Chronic Condition Interaction: Congestive Heart Failure and Renal Disease	-0.125
Male, ages 35-44	0.351	Fibrosis of Lung and Other Chronic Lung Disorders	0.242	Chronic Condition Interaction: Sepsis and Pressure Ulcer	-0.237
Male, ages 45-54	0.555	HIV/AIDS	-0.212	Chronic Condition Interaction: COPD and Aspiration and Specified Bacterial Pneumonias	-0.242
Male, ages 55-59	0.782	Lung and Other Severe Cancers	0.038	Chronic Condition Interaction: Aspiration and Specified Bacterial Pneumonias and Pressure Ulcer	-0.254
Male, ages 60-64	0.884	Lymphoma and Other Cancers	-0.008	Chronic Condition Interaction: Sepsis and Aspiration and Specified Bacterial Pneumonias	-0.178
Male, ages 65-69	1.009	Major Depressive, Bipolar, and Paranoid Disorders	-0.046	Chronic Condition Interaction: Schizophrenia and COPD	0.022
Male, ages 70-74	1.181	Metastatic Cancer and Acute Leukemia	-0.123	Chronic Condition Interaction: Schizophrenia and Congestive Heart Failure	0.12
Male, ages 75-79	1.246	Morbid Obesity	0.338	Disability Interaction: HCC6 Opportunistic Infections	0.209

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Male, ages 80-84	1.322	Multiple Sclerosis	0.254	Disability Interaction: HCC34 Chronic Pancreatitis	0.41
Male, ages 85-89	1.453	Myasthenia Gravis/Myoneural Disorders, Inflammatory and Toxic Neuropathy	0.044	Disability Interaction: HCC39 Bone/Joint/Muscle Infections/Necrosis	0.283
Male, ages 90-94	1.598	Opportunistic Infections	0.086	Disability Interaction: HCC46 Severe Hematological Disorders	-0.117
Male, ages 95+	1.789	Other Significant Endocrine and Metabolic Disorders	0.035	Disability Interaction: HCC54 Drug/Alcohol Psychosis	0.223
Acute Myocardial Infarction	0.155	Paraplegia	0.644	Disability Interaction: HCC55 Drug/Alcohol Dependence	0.147
Acute Renal Failure	0.304	Parkinson's and Huntington's Diseases	0.111	Disability Interaction: HCC77 Multiple Sclerosis	-0.034
Amputation Status, Lower Limb/Amputation Complications	0.435	Pneumococcal Pneumonia, Empyema, Lung Abscess	0.345	Disability Interaction: HCC85 Congestive Heart Failure	0.172
Aspiration and Specified Bacterial Pneumonias	0.36	Pressure Ulcer of Skin with Full Thickness Skin Loss	0.194	Disability Interaction: HCC157 Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	0.607
Atherosclerosis of the Extremities with Ulceration or Gangrene	0.465	Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	0.26	Disability Interaction: HCC158 Pressure Ulcer of Skin with Full Thickness Skin Loss	0.511
Bone/Joint/Muscle Infections/Necrosis	0.023	Proliferative Diabetic Retinopathy and Vitreous Hemorrhage	0.22	Disability Interaction: HCC161 Chronic Ulcer of Skin, Except Pressure	0.304
Cardio-Respiratory Failure and Shock	0.219	Protein-Calorie Malnutrition	-0.014	Disability Interaction: HCC176 Complications of Specified Implanted Device or Graft	0.159
Cerebral Palsy	0.039	Quadriplegia	0.779	HCC Count: 1-2	0.486
Chronic Hepatitis	0.086	Respiratory Arrest	0.312	HCC Count: 3-5	0.799
Chronic Kidney Disease, Severe (Stage 4)	0.309	Rheumatoid Arthritis and Inflammatory Connective Tissue Disease	0.018	HCC Count: 6-10	0.849
Chronic Kidney Disease, Stage 5	0.115	Schizophrenia	-0.085	HCC Count: 11+	0.497
Chronic Obstructive Pulmonary Disease	0.787	Seizure Disorders and Convulsions	0.024		

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: The values in the beta columns represent the raw regression coefficients generated by the risk-adjustment model. These values are often referred to as “risk-adjustment weights.”

Sample: Full sample (N = 658,646)

ACSC = ambulatory care sensitive conditions.

* Denotes rounded value.

Table B.6. Final Poisson model specification: Risk factor weights: HCBS users with acute or chronic ACSC admissions

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Intercept	0.174	Chronic Pancreatitis	0.019	Septicemia, Sepsis, Systemic Inflammatory Response Syndrome/Shock	0.003
Female, ages 18-34	0.004	Chronic Ulcer of Skin, Except Pressure	0.043	Severe Hematological Disorders	-0.026
Female, ages 35-44	-0.004	Cirrhosis of Liver	-0.016	Specified Heart Arrhythmias	0.042
Female, ages 45-54	-0.007	Coagulation Defects and Other Specified Hematological Disorders	-0.020	Spinal Cord Disorders/Injuries	-0.042
Female, ages 55-59	-0.062	Congestive Heart Failure	0.053	Traumatic Amputations and Complications	0.082
Female, ages 60-64	-0.036	Diabetes with Acute Complications	0.275	Unstable Angina and Other Acute Ischemic Heart Disease	0.050
Female, ages 65-69	-0.059	Diabetes with Chronic Complications	0.052	Vascular Disease	0.004
Female, ages 70-74	-0.065	Diabetes without Complication	0.036	Vascular Disease with Complications	0.031
Female, ages 75-79	-0.074	Dialysis Status	-0.015	Vertebral Fractures without Spinal Cord Injury	0.026
Female, ages 80-84	-0.084	Disorders of Immunity	0.026	Chronic Condition Interaction: Diabetes and Congestive Heart Failure	0.002
Female, ages 85-89	-0.072	Drug/Alcohol Dependence	-0.007	Chronic Condition Interaction: COPD and Cardiorespiratory Failure	0.091
Female, ages 90-94	-0.082	Drug/Alcohol Psychosis	0.015	Chronic Condition Interaction: Congestive Heart Failure and COPD	0.032
Female, ages 95+	-0.094	End-Stage Liver Disease	-0.045	Chronic Condition Interaction: Congestive Heart Failure and Renal Disease	0.015
Male, ages 35-44	-0.016	Fibrosis of Lung and Other Chronic Lung Disorders	-0.020	Chronic Condition Interaction: Sepsis and Pressure Ulcer	-0.043
Male, ages 45-54	-0.037	HIV/AIDS	-0.052	Chronic Condition Interaction: COPD and Aspiration and Specified Bacterial Pneumonias	-0.024
Male, ages 55-59	-0.095	Lung and Other Severe Cancers	-0.007	Chronic Condition Interaction: Aspiration and Specified Bacterial Pneumonias and Pressure Ulcer	-0.058
Male, ages 60-64	-0.036	Lymphoma and Other Cancers	-0.050	Chronic Condition Interaction: Sepsis and Aspiration and Specified Bacterial Pneumonias	-0.034
Male, ages 65-69	-0.048	Major Depressive, Bipolar, and Paranoid Disorders	0.006	Chronic Condition Interaction: Schizophrenia and COPD	-0.002
Male, ages 70-74	-0.036	Metastatic Cancer and Acute Leukemia	0.010	Chronic Condition Interaction: Schizophrenia and Congestive Heart Failure	0.023
Male, ages 75-79	-0.068	Morbid Obesity	0.022	Disability Interaction: HCC6 Opportunistic Infections	0.002
Male, ages 80-84	-0.102	Multiple Sclerosis	-0.037	Disability Interaction: HCC34 Chronic Pancreatitis	0.058

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Male, ages 85-89	-0.102	Myasthenia Gravis/Myoneural Disorders, Inflammatory and Toxic Neuropathy	0.020	Disability Interaction: HCC39 Bone/Joint/Muscle Infections/Necrosis	-0.017
Male, ages 90-94	-0.102	Opportunistic Infections	0.082	Disability Interaction: HCC46 Severe Hematological Disorders	0.021
Male, ages 95+	-0.063	Other Significant Endocrine and Metabolic Disorders	0.015	Disability Interaction: HCC54 Drug/Alcohol Psychosis	0.049
Acute Myocardial Infarction	0.054	Paraplegia	0.013	Disability Interaction: HCC55 Drug/Alcohol Dependence	0.100
Acute Renal Failure	0.051	Parkinson's and Huntington's Diseases	-0.027	Disability Interaction: HCC77 Multiple Sclerosis	0.067
Amputation Status, Lower Limb/Amputation Complications	0.077	Pneumococcal Pneumonia, Empyema, Lung Abscess	0.040	Disability Interaction: HCC85 Congestive Heart Failure	0.004
Aspiration and Specified Bacterial Pneumonias	0.027	Pressure Ulcer of Skin with Full Thickness Skin Loss	0.028	Disability Interaction: HCC157 Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	-0.013
Atherosclerosis of the Extremities with Ulceration or Gangrene	0.107	Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	0.058	Disability Interaction: HCC158 Pressure Ulcer of Skin with Full Thickness Skin Loss	0.043
Bone/Joint/Muscle Infections/Necrosis	0.056	Proliferative Diabetic Retinopathy and Vitreous Hemorrhage	0.055	Disability Interaction: HCC161 Chronic Ulcer of Skin, Except Pressure	-0.031
Cardio-Respiratory Failure and Shock	0.036	Protein-Calorie Malnutrition	0.025	Disability Interaction: HCC176 Complications of Specified Implanted Device or Graft	0.001
Cerebral Palsy	-0.027	Quadriplegia	0.006	HCC Count: 1-2	0.018
Chronic Hepatitis	-0.001	Respiratory Arrest	0.041	HCC Count: 3-5	0.048
Chronic Kidney Disease, Severe (Stage 4)	0.002	Rheumatoid Arthritis and Inflammatory Connective Tissue Disease	-0.017	HCC Count: 6-10	0.061
Chronic Kidney Disease, Stage 5	0.041	Schizophrenia	-0.022	HCC Count: 11+	0.040
Chronic Obstructive Pulmonary Disease	0.101	Seizure Disorders and Convulsions	-0.030		

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: The values in the beta columns represent the raw regression coefficients generated by the risk-adjustment model. These values are often referred to as “risk-adjustment weights.”

Sample: Full sample (N = 658,646)

ACSC = ambulatory care sensitive conditions.

* Denotes rounded value.

Table B.7. Final logit model specification: Risk factor weights: Non-HCBS users with acute ACSC admissions

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Intercept	-5.655	Chronic Kidney Disease, Severe (Stage 4)	0.200	Seizure Disorders and Convulsions	0.248
Female, ages 18-34	0.292	Chronic Obstructive Pulmonary Disease	0.652	Septicemia, Sepsis, Systemic Inflammatory Response Syndrome/Shock	0.484
Female, ages 35-44	0.446	Chronic Ulcer of Skin, Except Pressure	0.500	Severe Hematological Disorders	0.087
Female, ages 45-54	0.490	Coagulation Defects and Other Specified Hematological Disorders	0.134	Specified Heart Arrhythmias	0.157
Female, ages 55-59	0.540	Congestive Heart Failure	0.285	Spinal Cord Disorders/Injuries	0.373
Female, ages 60-64	0.598	Diabetes with Acute Complications	0.513	Traumatic Amputations and Complications	0.281
Female, ages 65-69	0.664	Diabetes with Chronic Complications	0.253	Unstable Angina and Other Acute Ischemic Heart Disease	0.077
Female, ages 70-74	0.835	Diabetes without Complication	0.124	Vascular Disease	0.092
Female, ages 75-79	1.030	Drug/Alcohol Dependence	0.342	Vascular Disease with Complications	0.320
Female, ages 80-84	1.315	Drug/Alcohol Psychosis	0.347	Vertebral Fractures without Spinal Cord Injury	0.298
Female, ages 85-89	1.563	Exudative Macular Degeneration	-0.057	Chronic Condition Interaction: Diabetes and Congestive Heart Failure	-0.052
Female, ages 90-94	1.860	Fibrosis of Lung and Other Chronic Lung Disorders	0.417	Chronic Condition Interaction: Congestive Heart Failure and COPD	-0.006
Female, ages 95+	2.097	Ischemic or Unspecified Stroke	0.191	Chronic Condition Interaction: Cancer and Immune Disorders	0.106
Male, ages 35-44	0.256	Lung and Other Severe Cancers	0.284	Chronic Condition Interaction: Aspiration and Specified Bacterial Pneumonias and Pressure Ulcer	-0.775
Male, ages 45-54	0.361	Lymphoma and Other Cancers	0.206	Chronic Condition Interaction: Sepsis and Aspiration and Specified Bacterial Pneumonias	-0.424
Male, ages 55-59	0.433	Major Depressive, Bipolar, and Paranoid Disorders	0.164	Chronic Condition Interaction: Schizophrenia and COPD	0.192
Male, ages 60-64	0.474	Major Head Injury	0.117	Disability Interaction: HCC6 Opportunistic Infections	-0.032
Male, ages 65-69	0.564	Metastatic Cancer and Acute Leukemia	0.487	Disability Interaction: HCC34 Chronic Pancreatitis	0.289
Male, ages 70-74	0.713	Monoplegia, Other Paralytic Syndromes	0.229	Disability Interaction: HCC39 Bone/Joint/Muscle Infections/Necrosis	0.124
Male, ages 75-79	0.901	Morbid Obesity	0.489	Disability Interaction: HCC46 Severe Hematological Disorders	-0.241
Male, ages 80-84	1.085	Multiple Sclerosis	0.408	Disability Interaction: HCC54 Drug/Alcohol Psychosis	0.203

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Male, ages 85-89	1.365	Myasthenia Gravis/Myoneural Disorders, Inflammatory and Toxic Neuropathy	0.100	Disability Interaction: HCC55 Drug/Alcohol Dependence	0.061
Male, ages 90-94	1.700	Opportunistic Infections	0.197	Disability Interaction: HCC77 Multiple Sclerosis	0.010
Male, ages 95+	2.071	Other Significant Endocrine and Metabolic Disorders	-0.153	Disability Interaction: HCC85 Congestive Heart Failure	0.111
Acute Renal Failure	0.339	Paraplegia	1.325	Disability Interaction: HCC157 Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	0.508
Amputation Status, Lower Limb/Amputation Complications	0.251	Parkinson's and Huntington's Diseases	0.444	Disability Interaction: HCC158 Pressure Ulcer of Skin with Full Thickness Skin Loss	0.386
Artificial Openings for Feeding or Elimination	0.474	Pneumococcal Pneumonia, Empyema, Lung Abscess	0.428	Disability Interaction: HCC161 Chronic Ulcer of Skin, Except Pressure	0.354
Aspiration and Specified Bacterial Pneumonias	0.576	Pressure Ulcer of Skin with Full Thickness Skin Loss	0.587	Disability Interaction: HCC176 Complications of Specified Implanted Device or Graft	-0.015
Atherosclerosis of the Extremities with Ulceration or Gangrene	0.300	Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	0.865	HCC Count: 1-2	0.396
Bone/Joint/Muscle Infections/Necrosis	0.121	Quadriplegia	1.139	HCC Count: 3-5	0.656
Cardio-Respiratory Failure and Shock	0.294	Rheumatoid Arthritis and Inflammatory Connective Tissue Disease	0.215	HCC Count: 6-10	0.440
Cerebral Palsy	0.473	Schizophrenia	0.081	HCC Count: 11+	-0.297

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: The values in the beta columns represent the raw regression coefficients generated by the risk-adjustment model. These values are often referred to as “risk-adjustment weights.”

Sample: Full sample (N = 3,390,553)

ACSC = ambulatory care sensitive conditions.

* Denotes rounded value.

Table B.8. Final Poisson model specification: Risk factor weights: Non-HCBS users with acute ACSC admissions

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Intercept	0.115	Chronic Kidney Disease, Severe (Stage 4)	-0.010	Seizure Disorders and Convulsions	0.026
Female, ages 18-34	-0.024	Chronic Obstructive Pulmonary Disease	0.021	Septicemia, Sepsis, Systemic Inflammatory Response Syndrome/Shock	0.062
Female, ages 35-44	-0.035	Chronic Ulcer of Skin, Except Pressure	0.050	Severe Hematological Disorders	-0.004
Female, ages 45-54	-0.068	Coagulation Defects and Other Specified Hematological Disorders	0.004	Specified Heart Arrhythmias	-0.015
Female, ages 55-59	-0.073	Congestive Heart Failure	0.010	Spinal Cord Disorders/Injuries	0.000
Female, ages 60-64	-0.064	Diabetes with Acute Complications	-0.015	Traumatic Amputations and Complications	0.042
Female, ages 65-69	-0.065	Diabetes with Chronic Complications	0.002	Unstable Angina and Other Acute Ischemic Heart Disease	0.001
Female, ages 70-74	-0.060	Diabetes without Complication	0.000	Vascular Disease	0.008
Female, ages 75-79	-0.046	Drug/Alcohol Dependence	0.031	Vascular Disease with Complications	0.037
Female, ages 80-84	-0.045	Drug/Alcohol Psychosis	0.063	Vertebral Fractures without Spinal Cord Injury	0.008
Female, ages 85-89	-0.043	Exudative Macular Degeneration	-0.002	Chronic Condition Interaction: Diabetes and Congestive Heart Failure	-0.012
Female, ages 90-94	-0.039	Fibrosis of Lung and Other Chronic Lung Disorders	-0.001	Chronic Condition Interaction: Congestive Heart Failure and COPD	0.013
Female, ages 95+	-0.027	Ischemic or Unspecified Stroke	0.001	Chronic Condition Interaction: Cancer and Immune Disorders	-0.007
Male, ages 35-44	-0.041	Lung and Other Severe Cancers	-0.012	Chronic Condition Interaction: Aspiration and Specified Bacterial Pneumonias and Pressure Ulcer	0.005
Male, ages 45-54	-0.052	Lymphoma and Other Cancers	-0.011	Chronic Condition Interaction: Sepsis and Aspiration and Specified Bacterial Pneumonias	-0.048
Male, ages 55-59	-0.069	Major Depressive, Bipolar, and Paranoid Disorders	0.009	Chronic Condition Interaction: Schizophrenia and COPD	0.013
Male, ages 60-64	-0.082	Major Head Injury	0.011	Disability Interaction: HCC6 Opportunistic Infections	-0.012
Male, ages 65-69	-0.062	Metastatic Cancer and Acute Leukemia	0.014	Disability Interaction: HCC34 Chronic Pancreatitis	0.005
Male, ages 70-74	-0.055	Monoplegia, Other Paralytic Syndromes	0.082	Disability Interaction: HCC39 Bone/Joint/Muscle Infections/Necrosis	0.041
Male, ages 75-79	-0.053	Morbid Obesity	0.055	Disability Interaction: HCC46 Severe Hematological Disorders	-0.005
Male, ages 80-84	-0.055	Multiple Sclerosis	-0.030	Disability Interaction: HCC54 Drug/Alcohol Psychosis	-0.036

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Male, ages 85-89	-0.040	Myasthenia Gravis/Myoneural Disorders, Inflammatory and Toxic Neuropathy	-0.011	Disability Interaction: HCC55 Drug/Alcohol Dependence	0.002
Male, ages 90-94	-0.043	Opportunistic Infections	0.010	Disability Interaction: HCC77 Multiple Sclerosis	0.083
Male, ages 95+	-0.089	Other Significant Endocrine and Metabolic Disorders	-0.003	Disability Interaction: HCC85 Congestive Heart Failure	0.000
Acute Renal Failure	0.007	Paraplegia	0.122	Disability Interaction: HCC157 Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	0.014
Amputation Status, Lower Limb/Amputation Complications	-0.004	Parkinson's and Huntington's Diseases	0.029	Disability Interaction: HCC158 Pressure Ulcer of Skin with Full Thickness Skin Loss	0.021
Artificial Openings for Feeding or Elimination	0.062	Pneumococcal Pneumonia, Empyema, Lung Abscess	0.014	Disability Interaction: HCC161 Chronic Ulcer of Skin, Except Pressure	0.037
Aspiration and Specified Bacterial Pneumonias	0.031	Pressure Ulcer of Skin with Full Thickness Skin Loss	0.083	Disability Interaction: HCC176 Complications of Specified Implanted Device or Graft	0.050
Atherosclerosis of the Extremities with Ulceration or Gangrene	0.060	Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	0.037	HCC Count: 1-2	0.007
Bone/Joint/Muscle Infections/Necrosis	-0.013	Quadriplegia	0.058	HCC Count: 3-5	0.025
Cardio-Respiratory Failure and Shock	-0.001	Rheumatoid Arthritis and Inflammatory Connective Tissue Disease	0.009	HCC Count: 6-10	0.039
Cerebral Palsy	0.017	Schizophrenia	0.000	HCC Count: 11+	0.016

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: The values in the beta columns represent the raw regression coefficients generated by the risk-adjustment model. These values are often referred to as “risk-adjustment weights.”

Sample: Full sample (N = 3,390,553)

ACSC = ambulatory care sensitive conditions.

* Denotes rounded value.

Table B.9. Final logit model specification: Risk factor weights: Non-HCBS users with chronic ACSC admissions

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Intercept	-5.613	Bone/Joint/Muscle Infections/Necrosis	0.290	Respirator Dependence/Tracheostomy Status	0.164
Female, ages 18-34	0.276	Cardio-Respiratory Failure and Shock	0.610	Respiratory Arrest	0.466
Female, ages 35-44	0.396	Chronic Hepatitis	0.025	Schizophrenia	-0.276
Female, ages 45-54	0.518	Chronic Kidney Disease, Severe (Stage 4)	0.590	Specified Heart Arrhythmias	0.331
Female, ages 55-59	0.606	Chronic Kidney Disease, Stage 5	0.642	Traumatic Amputations and Complications	0.004
Female, ages 60-64	0.607	Chronic Obstructive Pulmonary Disease	1.136	Unstable Angina and Other Acute Ischemic Heart Disease	0.281
Female, ages 65-69	0.581	Chronic Pancreatitis	0.033	Vertebral Fractures without Spinal Cord Injury	0.118
Female, ages 70-74	0.637	Chronic Ulcer of Skin, Except Pressure	0.251	Chronic Condition Interaction: Diabetes and Congestive Heart Failure	-0.242
Female, ages 75-79	0.621	Cirrhosis of Liver	0.060	Chronic Condition Interaction: COPD and Cardiorespiratory Failure	0.187
Female, ages 80-84	0.774	Congestive Heart Failure	0.918	Chronic Condition Interaction: Congestive Heart Failure and Renal Disease	-0.245
Female, ages 85-89	0.924	Diabetes with Acute Complications	2.088	Chronic Condition Interaction: COPD and Aspiration and Specifical Bacterial Pneumonias	0.037
Female, ages 90-94	1.072	Diabetes with Chronic Complications	0.818	Chronic Condition Interaction: Schizophrenia and Congestive Heart Failure	0.230
Female, ages 95+	1.130	Diabetes without Complication	0.423	Disability Interaction: HCC6 Opportunistic Infections	0.161
Male, ages 35-44	0.313	Dialysis Status	0.786	Disability Interaction: HCC34 Chronic Pancreatitis	0.348
Male, ages 45-54	0.405	Disorders of Immunity	0.048	Disability Interaction: HCC39 Bone/Joint/Muscle Infections/Necrosis	0.206
Male, ages 55-59	0.453	Drug/Alcohol Dependence	0.221	Disability Interaction: HCC46 Severe Hematological Disorders	0.003
Male, ages 60-64	0.575	Drug/Alcohol Psychosis	0.179	Disability Interaction: HCC54 Drug/Alcohol Psychosis	0.041
Male, ages 65-69	0.574	End-Stage Liver Disease	-0.054	Disability Interaction: HCC55 Drug/Alcohol Dependence	-0.034
Male, ages 70-74	0.605	Fibrosis of Lung and Other Chronic Lung Disorders	0.317	Disability Interaction: HCC77 Multiple Sclerosis	-0.331
Male, ages 75-79	0.602	HIV/AIDS	0.013	Disability Interaction: HCC85 Congestive Heart Failure	0.092
Male, ages 80-84	0.684	Morbid Obesity	0.184	Disability Interaction: HCC157 Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	-0.013

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Male, ages 85-89	0.811	Myasthenia Gravis/Myoneural Disorders, Inflammatory and Toxic Neuropathy	-0.050	Disability Interaction: HCC158 Pressure Ulcer of Skin with Full Thickness Skin Loss	0.174
Male, ages 90-94	0.852	Opportunistic Infections	0.200	Disability Interaction: HCC161 Chronic Ulcer of Skin, Except Pressure	0.360
Male, ages 95+	0.991	Other Significant Endocrine and Metabolic Disorders	0.088	Disability Interaction: HCC176 Complications of Specified Implanted Device or Graft	0.031
Acute Myocardial Infarction	0.209	Pneumococcal Pneumonia, Empyema, Lung Abscess	0.244	HCC Count: 1-2	0.545
Acute Renal Failure	0.559	Proliferative Diabetic Retinopathy and Vitreous Hemorrhage	0.366	HCC Count: 3-5	0.797
Amputation Status, Lower Limb/Amputation Complications	0.632	Protein-Calorie Malnutrition	0.081	HCC Count: 6-10	0.621
Atherosclerosis of the Extremities with Ulceration or Gangrene	0.763	Quadriplegia	-0.434	HCC Count: 11+	-0.005

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: The values in the beta columns represent the raw regression coefficients generated by the risk-adjustment model. These values are often referred to as “risk-adjustment weights.”

Sample: Full sample (N = 3,390,553)

ACSC = ambulatory care sensitive conditions.

* Denotes rounded value.

Table B.10. Final Poisson model specification: Risk factor weights: Non-HCBS users with chronic ACSC admissions

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Intercept	0.368	Bone/Joint/Muscle Infections/Necrosis	-0.007	Respirator Dependence/Tracheostomy Status	-0.062
Female, ages 18-34	0.052	Cardio-Respiratory Failure and Shock	0.051	Respiratory Arrest	0.001
Female, ages 35-44	-0.099	Chronic Hepatitis	0.005	Schizophrenia	-0.039
Female, ages 45-54	-0.184	Chronic Kidney Disease, Severe (Stage 4)	0.005	Specified Heart Arrhythmias	0.035
Female, ages 55-59	-0.203	Chronic Kidney Disease, Stage 5	-0.003	Traumatic Amputations and Complications	-0.020
Female, ages 60-64	-0.239	Chronic Obstructive Pulmonary Disease	0.080	Unstable Angina and Other Acute Ischemic Heart Disease	0.060
Female, ages 65-69	-0.251	Chronic Pancreatitis	-0.061	Vertebral Fractures without Spinal Cord Injury	0.023
Female, ages 70-74	-0.263	Chronic Ulcer of Skin, Except Pressure	0.020	Chronic Condition Interaction: Diabetes and Congestive Heart Failure	-0.014
Female, ages 75-79	-0.270	Cirrhosis of Liver	-0.046	Chronic Condition Interaction: COPD and Cardiorespiratory Failure	0.106
Female, ages 80-84	-0.289	Congestive Heart Failure	0.100	Chronic Condition Interaction: Congestive Heart Failure and Renal Disease	-0.032
Female, ages 85-89	-0.299	Diabetes with Acute Complications	0.417	Chronic Condition Interaction: COPD and Aspiration and Specifical Bacterial Pneumonias	0.041
Female, ages 90-94	-0.290	Diabetes with Chronic Complications	0.069	Chronic Condition Interaction: Schizophrenia and Congestive Heart Failure	0.090
Female, ages 95+	-0.303	Diabetes without Complication	0.030	Disability Interaction: HCC6 Opportunistic Infections	0.009
Male, ages 35-44	-0.083	Dialysis Status	0.003	Disability Interaction: HCC34 Chronic Pancreatitis	0.109
Male, ages 45-54	-0.156	Disorders of Immunity	-0.019	Disability Interaction: HCC39 Bone/Joint/Muscle Infections/Necrosis	0.057
Male, ages 55-59	-0.199	Drug/Alcohol Dependence	0.027	Disability Interaction: HCC46 Severe Hematological Disorders	0.052
Male, ages 60-64	-0.207	Drug/Alcohol Psychosis	0.047	Disability Interaction: HCC54 Drug/Alcohol Psychosis	0.109
Male, ages 65-69	-0.208	End-Stage Liver Disease	-0.067	Disability Interaction: HCC55 Drug/Alcohol Dependence	0.089
Male, ages 70-74	-0.237	Fibrosis of Lung and Other Chronic Lung Disorders	0.026	Disability Interaction: HCC77 Multiple Sclerosis	-0.065
Male, ages 75-79	-0.237	HIV/AIDS	-0.038	Disability Interaction: HCC85 Congestive Heart Failure	0.006

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Male, ages 80-84	-0.258	Morbid Obesity	-0.004	Disability Interaction: HCC157 Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	-0.043
Male, ages 85-89	-0.282	Myasthenia Gravis/Myoneural Disorders, Inflammatory and Toxic Neuropathy	-0.052	Disability Interaction: HCC158 Pressure Ulcer of Skin with Full Thickness Skin Loss	-0.017
Male, ages 90-94	-0.286	Opportunistic Infections	0.082	Disability Interaction: HCC161 Chronic Ulcer of Skin, Except Pressure	0.011
Male, ages 95+	-0.277	Other Significant Endocrine and Metabolic Disorders	0.001	Disability Interaction: HCC176 Complications of Specified Implanted Device or Graft	0.021
Acute Myocardial Infarction	0.074	Pneumococcal Pneumonia, Empyema, Lung Abscess	0.029	HCC Count: 1-2	0.001
Acute Renal Failure	0.082	Proliferative Diabetic Retinopathy and Vitreous Hemorrhage	0.001	HCC Count: 3-5	0.015
Amputation Status, Lower Limb/Amputation Complications	0.057	Protein-Calorie Malnutrition	0.056	HCC Count: 6-10	0.034
Atherosclerosis of the Extremities with Ulceration or Gangrene	0.078	Quadriplegia	-0.038	HCC Count: 11+	-0.011

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: The values in the beta columns represent the raw regression coefficients generated by the risk-adjustment model. These values are often referred to as “risk-adjustment weights.”

Sample: Full sample (N = 3,390,553)

ACSC = ambulatory care sensitive conditions.

* Denotes rounded value.

Table B.11. Final logit model specification: Risk factor weights: Non-HCBS users with acute or chronic ACSC admissions

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Intercept	-4.892	Chronic Pancreatitis	0.124	Septicemia, Sepsis, Systemic Inflammatory Response Syndrome/Shock	0.195
Female, ages 18-34	0.282	Chronic Ulcer of Skin, Except Pressure	0.349	Severe Hematological Disorders	0.041
Female, ages 35-44	0.407	Cirrhosis of Liver	0.083	Specified Heart Arrhythmias	0.255
Female, ages 45-54	0.482	Coagulation Defects and Other Specified Hematological Disorders	0.044	Spinal Cord Disorders/Injuries	0.116
Female, ages 55-59	0.549	Congestive Heart Failure	0.794	Traumatic Amputations and Complications	0.101
Female, ages 60-64	0.561	Diabetes with Acute Complications	1.659	Unstable Angina and Other Acute Ischemic Heart Disease	0.209
Female, ages 65-69	0.563	Diabetes with Chronic Complications	0.594	Vascular Disease	0.083
Female, ages 70-74	0.660	Diabetes without Complication	0.268	Vascular Disease with Complications	0.140
Female, ages 75-79	0.735	Dialysis Status	0.277	Vertebral Fractures without Spinal Cord Injury	0.167
Female, ages 80-84	0.954	Disorders of Immunity	0.027	Chronic Condition Interaction: Diabetes and Congestive Heart Failure	-0.120
Female, ages 85-89	1.159	Drug/Alcohol Dependence	0.252	Chronic Condition Interaction: COPD and Cardiorespiratory Failure	0.375
Female, ages 90-94	1.406	Drug/Alcohol Psychosis	0.231	Chronic Condition Interaction: Congestive Heart Failure and COPD	-0.336
Female, ages 95+	1.573	End-Stage Liver Disease	0.022	Chronic Condition Interaction: Congestive Heart Failure and Renal Disease	-0.185
Male, ages 35-44	0.286	Fibrosis of Lung and Other Chronic Lung Disorders	0.335	Chronic Condition Interaction: Sepsis and Pressure Ulcer	-0.183
Male, ages 45-54	0.359	HIV/AIDS	-0.090	Chronic Condition Interaction: COPD and Aspiration and Specified Bacterial Pneumonias	-0.017
Male, ages 55-59	0.405	Lung and Other Severe Cancers	0.181	Chronic Condition Interaction: Aspiration and Specified Bacterial Pneumonias and Pressure Ulcer	-0.509
Male, ages 60-64	0.498	Lymphoma and Other Cancers	0.045	Chronic Condition Interaction: Sepsis and Aspiration and Specified Bacterial Pneumonias	-0.366
Male, ages 65-69	0.516	Major Depressive, Bipolar, and Paranoid Disorders	-0.029	Chronic Condition Interaction: Schizophrenia and COPD	0.072
Male, ages 70-74	0.586	Metastatic Cancer and Acute Leukemia	0.084	Chronic Condition Interaction: Schizophrenia and Congestive Heart Failure	0.172
Male, ages 75-79	0.659	Morbid Obesity	0.289	Disability Interaction: HCC6 Opportunistic Infections	0.089

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Male, ages 80-84	0.794	Multiple Sclerosis	0.204	Disability Interaction: HCC34 Chronic Pancreatitis	0.222
Male, ages 85-89	1.008	Myasthenia Gravis/Myoneural Disorders, Inflammatory and Toxic Neuropathy	-0.010	Disability Interaction: HCC39 Bone/Joint/Muscle Infections/Necrosis	0.191
Male, ages 90-94	1.207	Opportunistic Infections	0.195	Disability Interaction: HCC46 Severe Hematological Disorders	-0.125
Male, ages 95+	1.489	Other Significant Endocrine and Metabolic Disorders	0.060	Disability Interaction: HCC54 Drug/Alcohol Psychosis	0.106
Acute Myocardial Infarction	0.158	Paraplegia	0.796	Disability Interaction: HCC55 Drug/Alcohol Dependence	-0.005
Acute Renal Failure	0.447	Parkinson's and Huntington's Diseases	0.187	Disability Interaction: HCC77 Multiple Sclerosis	-0.151
Amputation Status, Lower Limb/Amputation Complications	0.514	Pneumococcal Pneumonia, Empyema, Lung Abscess	0.280	Disability Interaction: HCC85 Congestive Heart Failure	0.162
Aspiration and Specified Bacterial Pneumonias	0.313	Pressure Ulcer of Skin with Full Thickness Skin Loss	0.329	Disability Interaction: HCC157 Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	0.505
Atherosclerosis of the Extremities with Ulceration or Gangrene	0.701	Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	0.544	Disability Interaction: HCC158 Pressure Ulcer of Skin with Full Thickness Skin Loss	0.314
Bone/Joint/Muscle Infections/Necrosis	0.206	Proliferative Diabetic Retinopathy and Vitreous Hemorrhage	0.277	Disability Interaction: HCC161 Chronic Ulcer of Skin, Except Pressure	0.370
Cardio-Respiratory Failure and Shock	0.362	Protein-Calorie Malnutrition	0.101	Disability Interaction: HCC176 Complications of Specified Implanted Device or Graft	0.095
Cerebral Palsy	0.067	Quadriplegia	0.647	HCC Count: 1-2	0.461
Chronic Hepatitis	0.036	Respiratory Arrest	0.195	HCC Count: 3-5	0.743
Chronic Kidney Disease, Severe (Stage 4)	0.409	Rheumatoid Arthritis and Inflammatory Connective Tissue Disease	0.014	HCC Count: 6-10	0.654
Chronic Kidney Disease, Stage 5	0.278	Schizophrenia	-0.180	HCC Count: 11+	0.082
Chronic Obstructive Pulmonary Disease	1.012	Seizure Disorders and Convulsions	0.079		

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: The values in the beta columns represent the raw regression coefficients generated by the risk-adjustment model. These values are often referred to as “risk-adjustment weights.”

Sample: Full sample (N = 3,390,553)

ACSC = ambulatory care sensitive conditions.

* Denotes rounded value.

Table B.12. Final Poisson model specification: Risk factor weights: Non-HCBS users with acute or chronic ACSC admissions

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Intercept	0.283	Chronic Pancreatitis	-0.089	Septicemia, Sepsis, Systemic Inflammatory Response Syndrome/Shock	0.024
Female, ages 18-34	0.027	Chronic Ulcer of Skin, Except Pressure	0.042	Severe Hematological Disorders	0.024
Female, ages 35-44	-0.075	Cirrhosis of Liver	-0.036	Specified Heart Arrhythmias	0.035
Female, ages 45-54	-0.139	Coagulation Defects and Other Specified Hematological Disorders	-0.004	Spinal Cord Disorders/Injuries	-0.013
Female, ages 55-59	-0.152	Congestive Heart Failure	0.092	Traumatic Amputations and Complications	-0.009
Female, ages 60-64	-0.172	Diabetes with Acute Complications	0.442	Unstable Angina and Other Acute Ischemic Heart Disease	0.057
Female, ages 65-69	-0.180	Diabetes with Chronic Complications	0.081	Vascular Disease	0.018
Female, ages 70-74	-0.184	Diabetes without Complication	0.042	Vascular Disease with Complications	0.024
Female, ages 75-79	-0.189	Dialysis Status	0.001	Vertebral Fractures without Spinal Cord Injury	0.027
Female, ages 80-84	-0.198	Disorders of Immunity	-0.001	Chronic Condition Interaction: Diabetes and Congestive Heart Failure	-0.015
Female, ages 85-89	-0.198	Drug/Alcohol Dependence	0.040	Chronic Condition Interaction: COPD and Cardiorespiratory Failure	0.105
Female, ages 90-94	-0.196	Drug/Alcohol Psychosis	0.067	Chronic Condition Interaction: Congestive Heart Failure and COPD	0.013
Female, ages 95+	-0.188	End-Stage Liver Disease	-0.042	Chronic Condition Interaction: Congestive Heart Failure and Renal Disease	-0.031
Male, ages 35-44	-0.068	Fibrosis of Lung and Other Chronic Lung Disorders	0.026	Chronic Condition Interaction: Sepsis and Pressure Ulcer	-0.068
Male, ages 45-54	-0.114	HIV/AIDS	-0.037	Chronic Condition Interaction: COPD and Aspiration and Specified Bacterial Pneumonias	0.048
Male, ages 55-59	-0.146	Lung and Other Severe Cancers	-0.004	Chronic Condition Interaction: Aspiration and Specified Bacterial Pneumonias and Pressure Ulcer	-0.110
Male, ages 60-64	-0.152	Lymphoma and Other Cancers	-0.008	Chronic Condition Interaction: Sepsis and Aspiration and Specified Bacterial Pneumonias	-0.041
Male, ages 65-69	-0.144	Major Depressive, Bipolar, and Paranoid Disorders	0.014	Chronic Condition Interaction: Schizophrenia and COPD	0.004
Male, ages 70-74	-0.160	Metastatic Cancer and Acute Leukemia	-0.012	Chronic Condition Interaction: Schizophrenia and Congestive Heart Failure	0.064
Male, ages 75-79	-0.165	Morbid Obesity	0.017	Disability Interaction: HCC6 Opportunistic Infections	0.013

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Male, ages 80-84	-0.184	Multiple Sclerosis	-0.046	Disability Interaction: HCC34 Chronic Pancreatitis	0.138
Male, ages 85-89	-0.200	Myasthenia Gravis/Myoneural Disorders, Inflammatory and Toxic Neuropathy	-0.042	Disability Interaction: HCC39 Bone/Joint/Muscle Infections/Necrosis	0.061
Male, ages 90-94	-0.202	Opportunistic Infections	0.068	Disability Interaction: HCC46 Severe Hematological Disorders	0.012
Male, ages 95+	-0.213	Other Significant Endocrine and Metabolic Disorders	0.007	Disability Interaction: HCC54 Drug/Alcohol Psychosis	0.037
Acute Myocardial Infarction	0.059	Paraplegia	0.014	Disability Interaction: HCC55 Drug/Alcohol Dependence	0.053
Acute Renal Failure	0.080	Parkinson's and Huntington's Diseases	-0.003	Disability Interaction: HCC77 Multiple Sclerosis	0.026
Amputation Status, Lower Limb/Amputation Complications	0.062	Pneumococcal Pneumonia, Empyema, Lung Abscess	0.035	Disability Interaction: HCC85 Congestive Heart Failure	0.018
Aspiration and Specified Bacterial Pneumonias	0.003	Pressure Ulcer of Skin with Full Thickness Skin Loss	0.050	Disability Interaction: HCC157 Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	-0.004
Atherosclerosis of the Extremities with Ulceration or Gangrene	0.096	Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	0.068	Disability Interaction: HCC158 Pressure Ulcer of Skin with Full Thickness Skin Loss	0.029
Bone/Joint/Muscle Infections/Necrosis	0.000	Proliferative Diabetic Retinopathy and Vitreous Hemorrhage	0.010	Disability Interaction: HCC161 Chronic Ulcer of Skin, Except Pressure	0.024
Cardio-Respiratory Failure and Shock	0.060	Protein-Calorie Malnutrition	0.045	Disability Interaction: HCC176 Complications of Specified Implanted Device or Graft	0.031
Cerebral Palsy	-0.015	Quadriplegia	-0.017	HCC Count: 1-2	-0.002
Chronic Hepatitis	0.013	Respiratory Arrest	0.021	HCC Count: 3-5	0.008
Chronic Kidney Disease, Severe (Stage 4)	0.014	Rheumatoid Arthritis and Inflammatory Connective Tissue Disease	-0.012	HCC Count: 6-10	0.015
Chronic Kidney Disease, Stage 5	0.005	Schizophrenia	-0.031	HCC Count: 11+	-0.043
Chronic Obstructive Pulmonary Disease	0.100	Seizure Disorders and Convulsions	0.004		

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: The values in the beta columns represent the raw regression coefficients generated by the risk-adjustment model. These values are often referred to as “risk-adjustment weights.”

Sample: Full sample (N = 3,390,553)

ACSC = ambulatory care sensitive conditions.

* Denotes rounded value.

Table B.13. Final logit model specification: Risk factor weights: Institutional residents with acute ACSC admissions

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Intercept	-4.179	Chronic Kidney Disease, Severe (Stage 4)	0.132	Seizure Disorders and Convulsions	0.129
Female, ages 18-34	-0.252	Chronic Obstructive Pulmonary Disease	0.421	Septicemia, Sepsis, Systemic Inflammatory Response Syndrome/Shock	0.264
Female, ages 35-44	0.232	Chronic Ulcer of Skin, Except Pressure	0.208	Severe Hematological Disorders	0.159
Female, ages 45-54	0.392	Coagulation Defects and Other Specified Hematological Disorders	0.039	Specified Heart Arrhythmias	0.111
Female, ages 55-59	0.459	Congestive Heart Failure	0.214	Spinal Cord Disorders/Injuries	0.144
Female, ages 60-64	0.558	Diabetes with Acute Complications	0.179	Traumatic Amputations and Complications	0.024
Female, ages 65-69	0.622	Diabetes with Chronic Complications	0.145	Unstable Angina and Other Acute Ischemic Heart Disease	-0.054
Female, ages 70-74	0.687	Diabetes without Complication	0.142	Vascular Disease	-0.026
Female, ages 75-79	0.738	Drug/Alcohol Dependence	-0.049	Vascular Disease with Complications	0.172
Female, ages 80-84	0.734	Drug/Alcohol Psychosis	-0.171	Vertebral Fractures without Spinal Cord Injury	0.186
Female, ages 85-89	0.713	Exudative Macular Degeneration	0.107	Chronic Condition Interaction: Diabetes and Congestive Heart Failure	-0.047
Female, ages 90-94	0.614	Fibrosis of Lung and Other Chronic Lung Disorders	0.388	Chronic Condition Interaction: Congestive Heart Failure and COPD	0.011
Female, ages 95+	0.461	Ischemic or Unspecified Stroke	0.021	Chronic Condition Interaction: Cancer and Immune Disorders	-0.174
Male, ages 35-44	0.073	Lung and Other Severe Cancers	0.136	Chronic Condition Interaction: Aspiration and Specified Bacterial Pneumonias and Pressure Ulcer	-0.150
Male, ages 45-54	0.234	Lymphoma and Other Cancers	0.107	Chronic Condition Interaction: Sepsis and Aspiration and Specified Bacterial Pneumonias	-0.241
Male, ages 55-59	0.279	Major Depressive, Bipolar, and Paranoid Disorders	0.080	Chronic Condition Interaction: Schizophrenia and COPD	0.064
Male, ages 60-64	0.396	Major Head Injury	0.029	Disability Interaction: HCC6 Opportunistic Infections	-0.133
Male, ages 65-69	0.516	Metastatic Cancer and Acute Leukemia	0.063	Disability Interaction: HCC34 Chronic Pancreatitis	0.056
Male, ages 70-74	0.501	Monoplegia, Other Paralytic Syndromes	0.100	Disability Interaction: HCC39 Bone/Joint/Muscle Infections/Necrosis	0.041
Male, ages 75-79	0.614	Morbid Obesity	0.335	Disability Interaction: HCC46 Severe Hematological Disorders	0.099
Male, ages 80-84	0.638	Multiple Sclerosis	0.214	Disability Interaction: HCC54 Drug/Alcohol Psychosis	0.117

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Male, ages 85-89	0.706	Myasthenia Gravis/Myoneural Disorders, Inflammatory and Toxic Neuropathy	0.117	Disability Interaction: HCC55 Drug/Alcohol Dependence	0.317
Male, ages 90-94	0.680	Opportunistic Infections	0.325	Disability Interaction: HCC77 Multiple Sclerosis	0.047
Male, ages 95+	0.606	Other Significant Endocrine and Metabolic Disorders	-0.089	Disability Interaction: HCC85 Congestive Heart Failure	-0.010
Acute Renal Failure	0.211	Paraplegia	0.529	Disability Interaction: HCC157 Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	0.236
Amputation Status, Lower Limb/Amputation Complications	0.080	Parkinson's and Huntington's Diseases	0.079	Disability Interaction: HCC158 Pressure Ulcer of Skin with Full Thickness Skin Loss	0.223
Artificial Openings for Feeding or Elimination	0.295	Pneumococcal Pneumonia, Empyema, Lung Abscess	0.266	Disability Interaction: HCC161 Chronic Ulcer of Skin, Except Pressure	0.172
Aspiration and Specified Bacterial Pneumonias	0.325	Pressure Ulcer of Skin with Full Thickness Skin Loss	0.226	Disability Interaction: HCC176 Complications of Specified Implanted Device or Graft	-0.050
Atherosclerosis of the Extremities with Ulceration or Gangrene	0.075	Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	0.483	HCC Count: 1-2	0.163
Bone/Joint/Muscle Infections/Necrosis	0.114	Quadriplegia	0.373	HCC Count: 3-5	0.393
Cardio-Respiratory Failure and Shock	0.054	Rheumatoid Arthritis and Inflammatory Connective Tissue Disease	0.212	HCC Count: 6-10	0.373
Cerebral Palsy	0.229	Schizophrenia	0.043	HCC Count: 11+	0.015

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: The values in the beta columns represent the raw regression coefficients generated by the risk-adjustment model. These values are often referred to as “risk-adjustment weights.”

Sample: Full sample (N = 432,583)

ACSC = ambulatory care sensitive conditions.

* Denotes rounded value.

Table B.14. Final Poisson model specification: Risk factor weights: Institutional residents with acute ACSC admissions

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Intercept	0.169	Chronic Kidney Disease, Severe (Stage 4)	-0.005	Seizure Disorders and Convulsions	0.003
Female, ages 18-34	-0.116	Chronic Obstructive Pulmonary Disease	0.010	Septicemia, Sepsis, Systemic Inflammatory Response Syndrome/Shock	0.017
Female, ages 35-44	-0.020	Chronic Ulcer of Skin, Except Pressure	0.042	Severe Hematological Disorders	0.025
Female, ages 45-54	-0.076	Coagulation Defects and Other Specified Hematological Disorders	0.001	Specified Heart Arrhythmias	0.013
Female, ages 55-59	-0.068	Congestive Heart Failure	0.016	Spinal Cord Disorders/Injuries	0.042
Female, ages 60-64	-0.079	Diabetes with Acute Complications	-0.014	Traumatic Amputations and Complications	0.001
Female, ages 65-69	-0.092	Diabetes with Chronic Complications	0.007	Unstable Angina and Other Acute Ischemic Heart Disease	-0.005
Female, ages 70-74	-0.079	Diabetes without Complication	-0.007	Vascular Disease	0.007
Female, ages 75-79	-0.085	Drug/Alcohol Dependence	0.059	Vascular Disease with Complications	-0.018
Female, ages 80-84	-0.092	Drug/Alcohol Psychosis	-0.002	Vertebral Fractures without Spinal Cord Injury	-0.007
Female, ages 85-89	-0.093	Exudative Macular Degeneration	-0.027	Chronic Condition Interaction: Diabetes and Congestive Heart Failure	0.010
Female, ages 90-94	-0.100	Fibrosis of Lung and Other Chronic Lung Disorders	0.020	Chronic Condition Interaction: Congestive Heart Failure and COPD	0.027
Female, ages 95+	-0.110	Ischemic or Unspecified Stroke	0.001	Chronic Condition Interaction: Cancer and Immune Disorders	-0.060
Male, ages 35-44	-0.084	Lung and Other Severe Cancers	-0.003	Chronic Condition Interaction: Aspiration and Specified Bacterial Pneumonias and Pressure Ulcer	-0.007
Male, ages 45-54	-0.091	Lymphoma and Other Cancers	0.019	Chronic Condition Interaction: Sepsis and Aspiration and Specified Bacterial Pneumonias	-0.005
Male, ages 55-59	-0.093	Major Depressive, Bipolar, and Paranoid Disorders	0.018	Chronic Condition Interaction: Schizophrenia and COPD	-0.002
Male, ages 60-64	-0.083	Major Head Injury	-0.004	Disability Interaction: HCC6 Opportunistic Infections	-0.074
Male, ages 65-69	-0.118	Metastatic Cancer and Acute Leukemia	-0.005	Disability Interaction: HCC34 Chronic Pancreatitis	0.028
Male, ages 70-74	-0.087	Monoplegia, Other Paralytic Syndromes	-0.005	Disability Interaction: HCC39 Bone/Joint/Muscle Infections/Necrosis	-0.029
Male, ages 75-79	-0.105	Morbid Obesity	0.044	Disability Interaction: HCC46 Severe Hematological Disorders	-0.078
Male, ages 80-84	-0.086	Multiple Sclerosis	-0.027	Disability Interaction: HCC54 Drug/Alcohol Psychosis	-0.031

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Male, ages 85-89	-0.110	Myasthenia Gravis/Myoneural Disorders, Inflammatory and Toxic Neuropathy	0.036	Disability Interaction: HCC55 Drug/Alcohol Dependence	0.000
Male, ages 90-94	-0.066	Opportunistic Infections	0.016	Disability Interaction: HCC77 Multiple Sclerosis	0.030
Male, ages 95+	-0.106	Other Significant Endocrine and Metabolic Disorders	-0.004	Disability Interaction: HCC85 Congestive Heart Failure	-0.012
Acute Renal Failure	0.015	Paraplegia	0.049	Disability Interaction: HCC157 Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	0.063
Amputation Status, Lower Limb/Amputation Complications	-0.007	Parkinson's and Huntington's Diseases	0.015	Disability Interaction: HCC158 Pressure Ulcer of Skin with Full Thickness Skin Loss	0.052
Artificial Openings for Feeding or Elimination	0.009	Pneumococcal Pneumonia, Empyema, Lung Abscess	-0.022	Disability Interaction: HCC161 Chronic Ulcer of Skin, Except Pressure	-0.001
Aspiration and Specified Bacterial Pneumonias	0.033	Pressure Ulcer of Skin with Full Thickness Skin Loss	0.005	Disability Interaction: HCC176 Complications of Specified Implanted Device or Graft	0.030
Atherosclerosis of the Extremities with Ulceration or Gangrene	-0.010	Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	0.062	HCC Count: 1-2	0.009
Bone/Joint/Muscle Infections/Necrosis	0.013	Quadriplegia	0.014	HCC Count: 3-5	0.023
Cardio-Respiratory Failure and Shock	0.002	Rheumatoid Arthritis and Inflammatory Connective Tissue Disease	0.013	HCC Count: 6-10	0.014
Cerebral Palsy	0.013	Schizophrenia	0.012	HCC Count: 11+	0.015

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: The values in the beta columns represent the raw regression coefficients generated by the risk-adjustment model. These values are often referred to as “risk-adjustment weights.”

Sample: Full sample (*N* = 432,583)

ACSC = ambulatory care sensitive conditions.

* Denotes rounded value.

Table B.15. Final logit model specification: Risk factor weights: Institutional residents with chronic ACSC admissions

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Intercept	-5.273	Bone/Joint/Muscle Infections/Necrosis	0.238	Respirator Dependence/Tracheostomy Status	-0.041
Female, ages 18-34	0.357	Cardio-Respiratory Failure and Shock	0.441	Respiratory Arrest	0.403
Female, ages 35-44	0.062	Chronic Hepatitis	0.277	Schizophrenia	-0.047
Female, ages 45-54	0.313	Chronic Kidney Disease, Severe (Stage 4)	0.527	Specified Heart Arrhythmias	0.325
Female, ages 55-59	0.339	Chronic Kidney Disease, Stage 5	0.648	Traumatic Amputations and Complications	0.116
Female, ages 60-64	0.326	Chronic Obstructive Pulmonary Disease	0.908	Unstable Angina and Other Acute Ischemic Heart Disease	0.331
Female, ages 65-69	0.365	Chronic Pancreatitis	-0.116	Vertebral Fractures without Spinal Cord Injury	0.282
Female, ages 70-74	0.427	Chronic Ulcer of Skin, Except Pressure	0.332	Chronic Condition Interaction: Diabetes and Congestive Heart Failure	-0.385
Female, ages 75-79	0.365	Cirrhosis of Liver	0.118	Chronic Condition Interaction: COPD and Cardiorespiratory Failure	0.085
Female, ages 80-84	0.337	Congestive Heart Failure	0.892	Chronic Condition Interaction: Congestive Heart Failure and Renal Disease	-0.117
Female, ages 85-89	0.259	Diabetes with Acute Complications	1.539	Chronic Condition Interaction: COPD and Aspiration and Specifical Bacterial Pneumonias	0.006
Female, ages 90-94	0.179	Diabetes with Chronic Complications	0.982	Chronic Condition Interaction: Schizophrenia and Congestive Heart Failure	0.037
Female, ages 95+	-0.016	Diabetes without Complication	0.617	Disability Interaction: HCC6 Opportunistic Infections	0.122
Male, ages 35-44	0.072	Dialysis Status	0.668	Disability Interaction: HCC34 Chronic Pancreatitis	0.358
Male, ages 45-54	0.250	Disorders of Immunity	0.065	Disability Interaction: HCC39 Bone/Joint/Muscle Infections/Necrosis	0.244
Male, ages 55-59	0.252	Drug/Alcohol Dependence	0.239	Disability Interaction: HCC46 Severe Hematological Disorders	-0.050
Male, ages 60-64	0.291	Drug/Alcohol Psychosis	0.091	Disability Interaction: HCC54 Drug/Alcohol Psychosis	0.199
Male, ages 65-69	0.393	End-Stage Liver Disease	-0.008	Disability Interaction: HCC55 Drug/Alcohol Dependence	0.110
Male, ages 70-74	0.387	Fibrosis of Lung and Other Chronic Lung Disorders	0.080	Disability Interaction: HCC77 Multiple Sclerosis	-0.481
Male, ages 75-79	0.397	HIV/AIDS	0.093	Disability Interaction: HCC85 Congestive Heart Failure	0.011

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Male, ages 80-84	0.322	Morbid Obesity	0.309	Disability Interaction: HCC157 Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	-0.050
Male, ages 85-89	0.278	Myasthenia Gravis/Myoneural Disorders, Inflammatory and Toxic Neuropathy	0.135	Disability Interaction: HCC158 Pressure Ulcer of Skin with Full Thickness Skin Loss	0.048
Male, ages 90-94	0.114	Opportunistic Infections	0.327	Disability Interaction: HCC161 Chronic Ulcer of Skin, Except Pressure	0.048
Male, ages 95+	0.241	Other Significant Endocrine and Metabolic Disorders	0.071	Disability Interaction: HCC176 Complications of Specified Implanted Device or Graft	-0.026
Acute Myocardial Infarction	0.264	Pneumococcal Pneumonia, Empyema, Lung Abscess	0.245	HCC Count: 1-2	0.233
Acute Renal Failure	0.363	Proliferative Diabetic Retinopathy and Vitreous Hemorrhage	0.348	HCC Count: 3-5	0.418
Amputation Status, Lower Limb/Amputation Complications	0.383	Protein-Calorie Malnutrition	-0.109	HCC Count: 6-10	0.302
Atherosclerosis of the Extremities with Ulceration or Gangrene	0.788	Quadriplegia	-0.519	HCC Count: 11+	-0.124

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: The values in the beta columns represent the raw regression coefficients generated by the risk-adjustment model. These values are often referred to as “risk-adjustment weights.”

Sample: Full sample (N = 432,583)

ACSC = ambulatory care sensitive conditions.

* Denotes rounded value.

Table B.16. Final Poisson model specification: Risk factor weights: Institutional residents with chronic ACSC admissions

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Intercept	0.564	Bone/Joint/Muscle Infections/Necrosis	0.084	Respirator Dependence/Tracheostomy Status	-0.071
Female, ages 18-34	-0.022	Cardio-Respiratory Failure and Shock	0.030	Respiratory Arrest	0.042
Female, ages 35-44	-0.010	Chronic Hepatitis	0.020	Schizophrenia	-0.066
Female, ages 45-54	-0.341	Chronic Kidney Disease, Severe (Stage 4)	-0.030	Specified Heart Arrhythmias	0.010
Female, ages 55-59	-0.389	Chronic Kidney Disease, Stage 5	0.025	Traumatic Amputations and Complications	-0.057
Female, ages 60-64	-0.399	Chronic Obstructive Pulmonary Disease	0.059	Unstable Angina and Other Acute Ischemic Heart Disease	0.055
Female, ages 65-69	-0.428	Chronic Pancreatitis	0.013	Vertebral Fractures without Spinal Cord Injury	0.025
Female, ages 70-74	-0.423	Chronic Ulcer of Skin, Except Pressure	0.048	Chronic Condition Interaction: Diabetes and Congestive Heart Failure	-0.048
Female, ages 75-79	-0.452	Cirrhosis of Liver	0.051	Chronic Condition Interaction: COPD and Cardiorespiratory Failure	0.043
Female, ages 80-84	-0.457	Congestive Heart Failure	0.083	Chronic Condition Interaction: Congestive Heart Failure and Renal Disease	0.016
Female, ages 85-89	-0.489	Diabetes with Acute Complications	0.315	Chronic Condition Interaction: COPD and Aspiration and Specifical Bacterial Pneumonias	-0.056
Female, ages 90-94	-0.495	Diabetes with Chronic Complications	0.102	Chronic Condition Interaction: Schizophrenia and Congestive Heart Failure	0.067
Female, ages 95+	-0.492	Diabetes without Complication	0.072	Disability Interaction: HCC6 Opportunistic Infections	0.028
Male, ages 35-44	-0.196	Dialysis Status	0.023	Disability Interaction: HCC34 Chronic Pancreatitis	0.095
Male, ages 45-54	-0.314	Disorders of Immunity	-0.019	Disability Interaction: HCC39 Bone/Joint/Muscle Infections/Necrosis	-0.024
Male, ages 55-59	-0.331	Drug/Alcohol Dependence	-0.012	Disability Interaction: HCC46 Severe Hematological Disorders	-0.020
Male, ages 60-64	-0.370	Drug/Alcohol Psychosis	-0.080	Disability Interaction: HCC54 Drug/Alcohol Psychosis	0.164
Male, ages 65-69	-0.361	End-Stage Liver Disease	-0.065	Disability Interaction: HCC55 Drug/Alcohol Dependence	0.103
Male, ages 70-74	-0.403	Fibrosis of Lung and Other Chronic Lung Disorders	0.005	Disability Interaction: HCC77 Multiple Sclerosis	-0.083
Male, ages 75-79	-0.412	HIV/AIDS	0.034	Disability Interaction: HCC85 Congestive Heart Failure	-0.002

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Male, ages 80-84	-0.444	Morbid Obesity	0.013	Disability Interaction: HCC157 Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	-0.142
Male, ages 85-89	-0.457	Myasthenia Gravis/Myoneural Disorders, Inflammatory and Toxic Neuropathy	-0.041	Disability Interaction: HCC158 Pressure Ulcer of Skin with Full Thickness Skin Loss	-0.047
Male, ages 90-94	-0.428	Opportunistic Infections	0.179	Disability Interaction: HCC161 Chronic Ulcer of Skin, Except Pressure	-0.027
Male, ages 95+	-0.521	Other Significant Endocrine and Metabolic Disorders	0.008	Disability Interaction: HCC176 Complications of Specified Implanted Device or Graft	-0.007
Acute Myocardial Infarction	0.050	Pneumococcal Pneumonia, Empyema, Lung Abscess	0.023	HCC Count: 1-2	-0.032
Acute Renal Failure	0.031	Proliferative Diabetic Retinopathy and Vitreous Hemorrhage	0.015	HCC Count: 3-5	-0.041
Amputation Status, Lower Limb/Amputation Complications	0.039	Protein-Calorie Malnutrition	0.005	HCC Count: 6-10	-0.042
Atherosclerosis of the Extremities with Ulceration or Gangrene	0.130	Quadriplegia	-0.069	HCC Count: 11+	-0.084

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: The values in the beta columns represent the raw regression coefficients generated by the risk-adjustment model. These values are often referred to as “risk-adjustment weights.”

Sample: Full sample (N = 432,583)

ACSC = ambulatory care sensitive conditions.

* Denotes rounded value.

Table B.17. Final logit model specification: Risk factor weights: Institutional residents with acute or chronic ACSC admissions

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Intercept	-3.831	Chronic Pancreatitis	0.068	Septicemia, Sepsis, Systemic Inflammatory Response Syndrome/Shock	0.127
Female, ages 18-34	-0.117	Chronic Ulcer of Skin, Except Pressure	0.229	Severe Hematological Disorders	0.183
Female, ages 35-44	0.210	Cirrhosis of Liver	0.087	Specified Heart Arrhythmias	0.169
Female, ages 45-54	0.360	Coagulation Defects and Other Specified Hematological Disorders	0.026	Spinal Cord Disorders/Injuries	0.057
Female, ages 55-59	0.396	Congestive Heart Failure	0.380	Traumatic Amputations and Complications	0.063
Female, ages 60-64	0.467	Diabetes with Acute Complications	0.727	Unstable Angina and Other Acute Ischemic Heart Disease	0.141
Female, ages 65-69	0.494	Diabetes with Chronic Complications	0.405	Vascular Disease	-0.017
Female, ages 70-74	0.565	Diabetes without Complication	0.224	Vascular Disease with Complications	0.147
Female, ages 75-79	0.564	Dialysis Status	-0.205	Vertebral Fractures without Spinal Cord Injury	0.175
Female, ages 80-84	0.543	Disorders of Immunity	-0.071	Chronic Condition Interaction: Diabetes and Congestive Heart Failure	-0.054
Female, ages 85-89	0.502	Drug/Alcohol Dependence	0.032	Chronic Condition Interaction: COPD and Cardiorespiratory Failure	0.078
Female, ages 90-94	0.416	Drug/Alcohol Psychosis	-0.135	Chronic Condition Interaction: Congestive Heart Failure and COPD	-0.031
Female, ages 95+	0.239	End-Stage Liver Disease	-0.009	Chronic Condition Interaction: Congestive Heart Failure and Renal Disease	-0.036
Male, ages 35-44	0.089	Fibrosis of Lung and Other Chronic Lung Disorders	0.282	Chronic Condition Interaction: Sepsis and Pressure Ulcer	-0.196
Male, ages 45-54	0.249	HIV/AIDS	-0.215	Chronic Condition Interaction: COPD and Aspiration and Specified Bacterial Pneumonias	-0.093
Male, ages 55-59	0.267	Lung and Other Severe Cancers	0.138	Chronic Condition Interaction: Aspiration and Specified Bacterial Pneumonias and Pressure Ulcer	0.023
Male, ages 60-64	0.338	Lymphoma and Other Cancers	0.060	Chronic Condition Interaction: Sepsis and Aspiration and Specified Bacterial Pneumonias	-0.214
Male, ages 65-69	0.450	Major Depressive, Bipolar, and Paranoid Disorders	0.024	Chronic Condition Interaction: Schizophrenia and COPD	0.081
Male, ages 70-74	0.434	Metastatic Cancer and Acute Leukemia	-0.048	Chronic Condition Interaction: Schizophrenia and Congestive Heart Failure	0.033
Male, ages 75-79	0.510	Morbid Obesity	0.303	Disability Interaction: HCC6 Opportunistic Infections	0.041

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Male, ages 80-84	0.482	Multiple Sclerosis	0.077	Disability Interaction: HCC34 Chronic Pancreatitis	0.074
Male, ages 85-89	0.512	Myasthenia Gravis/Myoneural Disorders, Inflammatory and Toxic Neuropathy	0.094	Disability Interaction: HCC39 Bone/Joint/Muscle Infections/Necrosis	0.169
Male, ages 90-94	0.441	Opportunistic Infections	0.268	Disability Interaction: HCC46 Severe Hematological Disorders	-0.055
Male, ages 95+	0.449	Other Significant Endocrine and Metabolic Disorders	0.083	Disability Interaction: HCC54 Drug/Alcohol Psychosis	0.147
Acute Myocardial Infarction	0.114	Paraplegia	0.342	Disability Interaction: HCC55 Drug/Alcohol Dependence	0.219
Acute Renal Failure	0.186	Parkinson's and Huntington's Diseases	-0.057	Disability Interaction: HCC77 Multiple Sclerosis	0.009
Amputation Status, Lower Limb/Amputation Complications	0.259	Pneumococcal Pneumonia, Empyema, Lung Abscess	0.252	Disability Interaction: HCC85 Congestive Heart Failure	0.012
Aspiration and Specified Bacterial Pneumonias	0.242	Pressure Ulcer of Skin with Full Thickness Skin Loss	0.161	Disability Interaction: HCC157 Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	0.210
Atherosclerosis of the Extremities with Ulceration or Gangrene	0.502	Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	0.321	Disability Interaction: HCC158 Pressure Ulcer of Skin with Full Thickness Skin Loss	0.196
Bone/Joint/Muscle Infections/Necrosis	0.144	Proliferative Diabetic Retinopathy and Vitreous Hemorrhage	0.131	Disability Interaction: HCC161 Chronic Ulcer of Skin, Except Pressure	0.138
Cardio-Respiratory Failure and Shock	0.210	Protein-Calorie Malnutrition	0.019	Disability Interaction: HCC176 Complications of Specified Implanted Device or Graft	0.083
Cerebral Palsy	0.069	Quadriplegia	0.186	HCC Count: 1-2	0.218
Chronic Hepatitis	0.130	Respiratory Arrest	0.213	HCC Count: 3-5	0.489
Chronic Kidney Disease, Severe (Stage 4)	0.226	Rheumatoid Arthritis and Inflammatory Connective Tissue Disease	0.120	HCC Count: 6-10	0.562
Chronic Kidney Disease, Stage 5	0.114	Schizophrenia	-0.058	HCC Count: 11+	0.332
Chronic Obstructive Pulmonary Disease	0.581	Seizure Disorders and Convulsions	0.000		

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: The values in the beta columns represent the raw regression coefficients generated by the risk-adjustment model. These values are often referred to as “risk-adjustment weights.”

Sample: Full sample (N = 432,583)

ACSC = ambulatory care sensitive conditions.

* Denotes rounded value.

Table B.18. Final Poisson model specification: Risk factor weights: Institutional residents with acute or chronic ACSC admissions

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Intercept	0.363	Chronic Pancreatitis	-0.082	Septicemia, Sepsis, Systemic Inflammatory Response Syndrome/Shock	0.009
Female, ages 18-34	0.031	Chronic Ulcer of Skin, Except Pressure	0.048	Severe Hematological Disorders	0.035
Female, ages 35-44	-0.047	Cirrhosis of Liver	0.022	Specified Heart Arrhythmias	0.020
Female, ages 45-54	-0.181	Coagulation Defects and Other Specified Hematological Disorders	-0.002	Spinal Cord Disorders/Injuries	-0.001
Female, ages 55-59	-0.204	Congestive Heart Failure	0.062	Traumatic Amputations and Complications	-0.023
Female, ages 60-64	-0.220	Diabetes with Acute Complications	0.271	Unstable Angina and Other Acute Ischemic Heart Disease	0.031
Female, ages 65-69	-0.229	Diabetes with Chronic Complications	0.077	Vascular Disease	0.017
Female, ages 70-74	-0.229	Diabetes without Complication	0.032	Vascular Disease with Complications	0.001
Female, ages 75-79	-0.244	Dialysis Status	0.008	Vertebral Fractures without Spinal Cord Injury	0.017
Female, ages 80-84	-0.251	Disorders of Immunity	-0.019	Chronic Condition Interaction: Diabetes and Congestive Heart Failure	-0.010
Female, ages 85-89	-0.270	Drug/Alcohol Dependence	0.032	Chronic Condition Interaction: COPD and Cardiorespiratory Failure	0.029
Female, ages 90-94	-0.286	Drug/Alcohol Psychosis	-0.028	Chronic Condition Interaction: Congestive Heart Failure and COPD	0.019
Female, ages 95+	-0.287	End-Stage Liver Disease	-0.043	Chronic Condition Interaction: Congestive Heart Failure and Renal Disease	0.002
Male, ages 35-44	-0.129	Fibrosis of Lung and Other Chronic Lung Disorders	0.010	Chronic Condition Interaction: Sepsis and Pressure Ulcer	-0.023
Male, ages 45-54	-0.189	HIV/AIDS	-0.043	Chronic Condition Interaction: COPD and Aspiration and Specified Bacterial Pneumonias	-0.001
Male, ages 55-59	-0.198	Lung and Other Severe Cancers	-0.024	Chronic Condition Interaction: Aspiration and Specified Bacterial Pneumonias and Pressure Ulcer	-0.055
Male, ages 60-64	-0.200	Lymphoma and Other Cancers	-0.009	Chronic Condition Interaction: Sepsis and Aspiration and Specified Bacterial Pneumonias	-0.014
Male, ages 65-69	-0.213	Major Depressive, Bipolar, and Paranoid Disorders	0.004	Chronic Condition Interaction: Schizophrenia and COPD	-0.010
Male, ages 70-74	-0.223	Metastatic Cancer and Acute Leukemia	-0.035	Chronic Condition Interaction: Schizophrenia and Congestive Heart Failure	0.016
Male, ages 75-79	-0.246	Morbid Obesity	0.037	Disability Interaction: HCC6 Opportunistic Infections	-0.023

Risk factor	Beta	Risk factor	Beta	Risk factor	Beta
Male, ages 80-84	-0.247	Multiple Sclerosis	-0.071	Disability Interaction: HCC34 Chronic Pancreatitis	0.209
Male, ages 85-89	-0.274	Myasthenia Gravis/Myoneural Disorders, Inflammatory and Toxic Neuropathy	0.006	Disability Interaction: HCC39 Bone/Joint/Muscle Infections/Necrosis	-0.026
Male, ages 90-94	-0.239	Opportunistic Infections	0.141	Disability Interaction: HCC46 Severe Hematological Disorders	-0.085
Male, ages 95+	-0.319	Other Significant Endocrine and Metabolic Disorders	-0.003	Disability Interaction: HCC54 Drug/Alcohol Psychosis	0.095
Acute Myocardial Infarction	0.026	Paraplegia	-0.001	Disability Interaction: HCC55 Drug/Alcohol Dependence	0.064
Acute Renal Failure	0.034	Parkinson's and Huntington's Diseases	-0.012	Disability Interaction: HCC77 Multiple Sclerosis	0.026
Amputation Status, Lower Limb/Amputation Complications	0.028	Pneumococcal Pneumonia, Empyema, Lung Abscess	-0.003	Disability Interaction: HCC85 Congestive Heart Failure	0.003
Aspiration and Specified Bacterial Pneumonias	0.006	Pressure Ulcer of Skin with Full Thickness Skin Loss	0.002	Disability Interaction: HCC157 Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	0.034
Atherosclerosis of the Extremities with Ulceration or Gangrene	0.106	Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	-0.006	Disability Interaction: HCC158 Pressure Ulcer of Skin with Full Thickness Skin Loss	0.017
Bone/Joint/Muscle Infections/Necrosis	0.074	Proliferative Diabetic Retinopathy and Vitreous Hemorrhage	0.032	Disability Interaction: HCC161 Chronic Ulcer of Skin, Except Pressure	-0.019
Cardio-Respiratory Failure and Shock	0.042	Protein-Calorie Malnutrition	0.003	Disability Interaction: HCC176 Complications of Specified Implanted Device or Graft	0.000
Cerebral Palsy	-0.027	Quadriplegia	-0.036	HCC Count: 1-2	-0.010
Chronic Hepatitis	-0.004	Respiratory Arrest	0.006	HCC Count: 3-5	0.002
Chronic Kidney Disease, Severe (Stage 4)	-0.006	Rheumatoid Arthritis and Inflammatory Connective Tissue Disease	0.007	HCC Count: 6-10	-0.001
Chronic Kidney Disease, Stage 5	0.023	Schizophrenia	-0.014	HCC Count: 11+	-0.017
Chronic Obstructive Pulmonary Disease	0.064	Seizure Disorders and Convulsions	-0.012		

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: The values in the beta columns represent the raw regression coefficients generated by the risk-adjustment model. These values are often referred to as “risk-adjustment weights.”

Sample: Full sample (N = 432,583)

ACSC = ambulatory care sensitive conditions.

* Denotes rounded value.

APPENDIX C

Hierarchical Condition Categories (HCC) List

Table C.1. HCCs, Chronic Condition and Disability Interactions

HCC	Description	HCBS Prevalence N = 658,646	Non-HCBS Prevalence N = 3,390,553	Institutional Prevalence N = 432,583
1	HIV/AIDS*	1.11%	1.30%	0.33%
2	Septicemia, Sepsis, Systemic Inflammatory Response Syndrome/Shock*	4.31%	2.12%	8.57%
6	Opportunistic Infections*	0.31%	0.30%	0.31%
8	Metastatic Cancer and Acute Leukemia*	0.52%	0.59%	0.35%
9	Lung and Other Severe Cancers*	0.87%	0.89%	0.63%
10	Lymphoma and Other Cancers*	0.94%	0.93%	0.77%
11	Colorectal, Bladder, and Other Cancers	1.29%	1.39%	1.09%
12	Breast, Prostate, and Other Cancers and Tumors	3.22%	3.27%	2.65%
17	Diabetes with Acute Complications*	0.51%	0.47%	0.70%
18	Diabetes with Chronic Complications*	14.64%	11.31%	14.99%
19	Diabetes without Complication*	17.03%	18.67%	20.65%
21	Protein-Calorie Malnutrition*	2.37%	1.24%	5.36%
22	Morbid Obesity*	5.77%	5.02%	4.19%
23	Other Significant Endocrine and Metabolic Disorders*	3.69%	2.81%	3.09%
27	End-Stage Liver Disease*	0.44%	0.49%	0.53%
28	Cirrhosis of Liver*	0.57%	0.73%	0.59%
29	Chronic Hepatitis*	0.74%	1.33%	0.48%
33	Intestinal Obstruction/Perforation	2.15%	1.35%	3.09%
34	Chronic Pancreatitis*	0.28%	0.37%	0.24%
35	Inflammatory Bowel Disease	0.70%	0.78%	0.54%
39	Bone/Joint/Muscle Infections/Necrosis*	1.52%	1.08%	2.10%
40	Rheumatoid Arthritis and Inflammatory Connective Tissue Disease*	4.42%	5.25%	3.05%
46	Severe Hematological Disorders*	0.43%	0.43%	0.45%
47	Disorders of Immunity*	1.30%	1.10%	1.08%
48	Coagulation Defects and Other Specified Hematological Disorders*	4.22%	3.07%	5.02%
54	Drug/Alcohol Psychosis*	0.69%	1.13%	1.00%
55	Drug/Alcohol Dependence*	1.58%	3.30%	1.16%
57	Schizophrenia*	6.68%	6.43%	10.09%
58	Major Depressive, Bipolar, and Paranoid Disorders*	13.05%	11.61%	16.03%
70	Quadriplegia*	1.68%	0.15%	1.73%
71	Paraplegia*	1.04%	0.25%	1.01%
72	Spinal Cord Disorders/Injuries*	1.37%	0.57%	1.06%

HCC	Description	HCBS Prevalence N = 658,646	Non-HCBS Prevalence N = 3,390,553	Institutional Prevalence N = 432,583
73	Amyotrophic Lateral Sclerosis and Other Motor Neuron Disease	0.11%	0.03%	0.10%
74	Cerebral Palsy*	4.70%	0.41%	2.98%
75	Myasthenia Gravis/Myoneural Disorders, Inflammatory and Toxic Neuropathy*	0.63%	0.48%	0.54%
76	Muscular Dystrophy	0.30%	0.10%	0.15%
77	Multiple Sclerosis*	1.48%	0.67%	1.91%
78	Parkinson's and Huntington's Diseases*	2.22%	0.69%	5.25%
79	Seizure Disorders and Convulsions*	15.25%	4.94%	15.84%
80	Coma, Brain Compression/Anoxic Damage	0.45%	0.18%	0.89%
82	Respirator Dependence/Tracheostomy Status*	0.53%	0.17%	0.95%
83	Respiratory Arrest*	0.04%	0.03%	0.08%
84	Cardio-Respiratory Failure and Shock*	4.15%	2.65%	6.07%
85	Congestive Heart Failure*	14.52%	9.50%	21.70%
86	Acute Myocardial Infarction*	1.03%	0.90%	1.41%
87	Unstable Angina and Other Acute Ischemic Heart Disease*	1.51%	1.54%	1.38%
88	Angina Pectoris	1.84%	2.09%	1.14%
96	Specified Heart Arrhythmias*	10.47%	7.57%	16.80%
99	Cerebral Hemorrhage	0.56%	0.29%	1.20%
100	Ischemic or Unspecified Stroke*	4.14%	2.15%	9.19%
103	Hemiplegia/Hemiparesis	3.23%	0.93%	6.10%
104	Monoplegia, Other Paralytic Syndromes*	0.29%	0.11%	0.36%
106	Atherosclerosis of the Extremities with Ulceration or Gangrene*	0.85%	0.48%	1.57%
107	Vascular Disease with Complications*	2.23%	1.64%	2.39%
108	Vascular Disease*	14.91%	9.42%	27.07%
110	Cystic Fibrosis	0.03%	0.04%	0.01%
111	Chronic Obstructive Pulmonary Disease*	15.31%	15.65%	18.87%
112	Fibrosis of Lung and Other Chronic Lung Disorders*	0.68%	0.67%	0.53%
114	Aspiration and Specified Bacterial Pneumonias*	1.94%	0.66%	4.47%
115	Pneumococcal Pneumonia, Empyema, Lung Abscess*	0.30%	0.25%	0.42%
122	Proliferative Diabetic Retinopathy and Vitreous Hemorrhage*	0.90%	0.87%	0.80%
124	Exudative Macular Degeneration*	1.07%	0.79%	1.23%
134	Dialysis Status*	1.96%	1.94%	1.78%
135	Acute Renal Failure*	5.45%	3.42%	9.00%
136	Chronic Kidney Disease, Stage 5*	0.61%	0.72%	0.64%
137	Chronic Kidney Disease, Severe (Stage 4)*	0.80%	0.58%	0.71%

HCC	Description	HCBS Prevalence N = 658,646	Non-HCBS Prevalence N = 3,390,553	Institutional Prevalence N = 432,583
157	Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone*	0.53%	0.09%	0.91%
158	Pressure Ulcer of Skin with Full Thickness Skin Loss*	0.66%	0.14%	1.22%
161	Chronic Ulcer of Skin, Except Pressure*	4.34%	2.08%	5.42%
162	Severe Skin Burn or Condition	0.03%	0.02%	0.03%
166	Severe Head Injury	0.03%	0.01%	0.05%
167	Major Head Injury*	1.43%	0.56%	1.78%
169	Vertebral Fractures without Spinal Cord Injury*	1.13%	0.82%	1.46%
170	Hip Fracture/Dislocation	1.50%	0.70%	3.76%
173	Traumatic Amputations and Complications*	0.45%	0.32%	0.63%
176	Complications of Specified Implanted Device or Graft	2.99%	1.95%	3.40%
186	Major Organ Transplant or Replacement Status	0.22%	0.33%	0.06%
188	Artificial Openings for Feeding or Elimination*	2.57%	0.69%	5.43%
189	Amputation Status, Lower Limb/Amputation Complications*	0.95%	0.51%	1.21%
	Chronic Condition Interaction: Diabetes and Congestive Heart Failure*	8.30%	5.00%	11.11%
	Chronic Condition Interaction: COPD and Cardiorespiratory Failure	2.72%	1.78%	3.80%
	Chronic Condition Interaction: Congestive Heart Failure and COPD*	5.94%	3.66%	7.95%
	Chronic Condition Interaction: Cancer and Immune Disorders*	0.30%	0.30%	0.18%
	Chronic Condition Interaction: Congestive Heart Failure and Renal Disease*	4.22%	2.55%	5.85%
	Chronic Condition Interaction: Sepsis and Cardiorespiratory Failure	1.52%	0.70%	3.12%
	Chronic Condition Interaction: Sepsis and Pressure Ulcer*	0.41%	0.08%	0.97%
	Chronic Condition Interaction: Sepsis and Artificial Openings for Feeding or Elimination	0.72%	0.16%	1.85%
	Chronic Condition Interaction: Artificial Openings for Feeding or Elimination and Pressure Ulcer	0.34%	0.05%	0.61%
	Chronic Condition Interaction: COPD and Aspiration and Specified Bacterial Pneumonias*	0.79%	0.37%	1.89%
	Chronic Condition Interaction: Aspiration and Specified Bacterial Pneumonias and Pressure Ulcer*	0.13%	0.02%	0.37%
	Chronic Condition Interaction: Sepsis and Aspiration and Specified Bacterial Pneumonias*	0.87%	0.26%	2.17%

HCC	Description	HCBS Prevalence N = 658,646	Non-HCBS Prevalence N = 3,390,553	Institutional Prevalence N = 432,583
	Chronic Condition Interaction: Schizophrenia and COPD*	1.21%	1.04%	2.77%
	Chronic Condition Interaction: Schizophrenia and Congestive Heart Failure*	0.63%	0.33%	1.91%
	Chronic Condition Interaction: Schizophrenia and Seizure Disorders and Convulsions	1.39%	0.54%	2.25%
	Disability Interaction: HCC6 Opportunistic Infections*	0.23%	0.22%	0.18%
	Disability Interaction: HCC34 Chronic Pancreatitis*	0.20%	0.31%	0.16%
	Disability Interaction: HCC39 Bone/Joint/Muscle Infections/Necrosis*	1.14%	0.85%	1.24%
	Disability Interaction: HCC46 Severe Hematological Disorders*	0.27%	0.30%	0.21%
	Disability Interaction: HCC54 Drug/Alcohol Psychosis*	0.51%	1.00%	0.57%
	Disability Interaction: HCC55 Drug/Alcohol Dependence*	1.30%	2.98%	0.77%
	Disability Interaction: HCC77 Multiple Sclerosis*	1.36%	0.64%	1.64%
	Disability Interaction: HCC85 Congestive Heart Failure*	7.07%	5.27%	8.03%
	Disability Interaction: HCC110 Cystic Fibrosis	0.03%	0.03%	0.01%
	Disability Interaction: HCC157 Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone*	0.45%	0.08%	0.58%
	Disability Interaction: HCC158 Pressure Ulcer of Skin with Full Thickness Skin Loss*	0.48%	0.10%	0.66%
	Disability Interaction: HCC161 Chronic Ulcer of Skin, Except Pressure*	2.66%	1.37%	2.50%
	Disability Interaction: HCC176 Complications of Specified Implanted Device or Graft*	2.27%	1.53%	2.13%

Source: NCQA. (2015). Proposed New Measure for HEDIS® 2016: Hospitalization for Potentially Preventable Complications (HPC). Available at: https://www.ncqa.org/Portals/0/PublicComment/HEDIS2016/7.%20Hospitalization%20for%20Potentially%20Preventable%20Complications.pdf

Note: HCC version 22 effective in 2014 payment year.

HCC = Hierarchical Condition Categories

HCBS = home and community-based services

* = Included in risk-adjustment algorithm.

APPENDIX D

Predictive Performance

Table D.1. Decile table generated from the two-step risk-adjustment model: HCBS users with acute ACSC admissions

Decile	Number of dual eligible beneficiaries	Observed mean admissions rate for ACSCs	Predicted mean admissions rate for ACSCs
1 (lowest)	32,933	5	7
2	32,932	10	12
3	32,932	14	17
4	32,933	22	22
5	32,932	30	29
6	32,932	41	38
7	32,933	52	48
8	32,932	64	62
9	32,932	91	86
10 (highest)	32,932	170	179

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: The measure result is reported as a rate per 1,000 beneficiaries.

Deciles are classified on the basis of the predicted number of admissions for acute ACSCs from the risk-adjustment model.

Sample: Model validation half sample, HCBS (n = 329,323).

ACSC = ambulatory care sensitive conditions.

HCBS = home and community-based services

Table D.2. Decile table generated from the two-step risk-adjustment model: HCBS users with chronic ACSC admissions

Decile	Number of dual eligible beneficiaries	Observed mean admissions rate for ACSCs	Predicted mean admissions rate for ACSCs
1 (lowest)	32,933	1	3
2	32,932	1	5
3	32,932	4	8
4	32,933	8	10
5	32,932	10	15
6	32,932	19	21
7	32,933	33	33
8	32,932	60	51
9	32,932	112	93
10 (highest)	32,932	310	319

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Notes: The measure result is reported as a rate per 1,000 beneficiaries.

Deciles are classified on the basis of the predicted number of admissions for chronic ACSCs from the risk-adjustment model.

Sample: Model validation half sample, HCBS (n = 329,323).

ACSC = ambulatory care sensitive conditions.

HCBS = home and community-based services

Table D.3. Decile table generated from the two-step risk-adjustment model: HCBS users with acute or chronic ACSC admissions

Decile	Number of dual eligible beneficiaries	Observed mean admissions rate for ACSCs	Predicted mean admissions rate for ACSCs
1 (lowest)	32,933	6	11
2	32,932	13	18
3	32,932	17	26
4	32,933	30	34
5	32,932	50	45
6	32,932	64	62
7	32,933	89	83
8	32,932	131	120
9	32,932	209	193
10 (highest)	32,932	446	466

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Notes: The measure result is reported as a rate per 1,000 beneficiaries.

Deciles are classified on the basis of the predicted number of admissions for total ACSCs from the risk-adjustment model.

Sample: Model validation half sample, HCBS (n = 329,323).

ACSC = ambulatory care sensitive conditions.

HCBS = home and community-based services

Table D.4. Decile table generated from the two-step risk-adjustment model: Non-HCBS users with acute ACSC admissions

Decile	Number of dual eligible beneficiaries	Observed mean admissions rate for ACSCs	Predicted mean admissions rate for ACSCs
1 (lowest)	169,528	5	5
2	169,528	6	7
3	169,528	7	9
4	169,527	9	10
5	169,528	11	12
6	169,528	15	15
7	169,527	19	19
8	169,528	27	25
9	169,528	38	37
10 (highest)	169,527	88	89

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Notes: The measure result is reported as a rate per 1,000 beneficiaries.

Deciles are classified on the basis of the predicted number of admissions for acute ACSCs from the risk-adjustment model.

Sample: Model validation half sample, Non-HCBS (n = 1,695,277).

ACSC = ambulatory care sensitive conditions.

HCBS = home and community-based services

Table D.5. Decile table generated from the two-step risk-adjustment model: Non-HCBS users with chronic ACSC admissions

Decile	Number of dual eligible beneficiaries	Observed mean admissions rate for ACSCs	Predicted mean admissions rate for ACSCs
1 (lowest)	169,528	4	7
2	169,528	7	7
3	169,528	7	8
4	169,527	7	11
5	169,528	9	13
6	169,528	16	19
7	169,527	23	25
8	169,528	46	38
9	169,528	76	65
10 (highest)	169,527	254	255

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Notes: The measure result is reported as a rate per 1,000 beneficiaries.

Deciles are classified on the basis of the predicted number of admissions for chronic ACSCs from the risk-adjustment model.

Sample: Model validation half sample, Non-HCBS (n = 1,695,277).

ACSC = ambulatory care sensitive conditions.

HCBS = home and community-based services

Table D.6. Decile table generated from the two-step risk-adjustment model: Non-HCBS users with acute or chronic ACSC admissions

Decile	Number of dual eligible beneficiaries	Observed mean admissions rate for ACSCs	Predicted mean admissions rate for ACSCs
1 (lowest)	169,528	9	12
2	169,528	13	14
3	169,528	15	17
4	169,527	16	21
5	169,528	25	26
6	169,528	31	32
7	169,527	45	44

Decile	Number of dual eligible beneficiaries	Observed mean admissions rate for ACSCs	Predicted mean admissions rate for ACSCs
8	169,528	74	65
9	169,528	116	108
10 (highest)	169,527	331	335

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Notes: The measure result is reported as a rate per 1,000 beneficiaries.

Deciles are classified on the basis of the predicted number of admissions for total ACSCs from the risk-adjustment model.

Sample: Model validation half sample, Non-HCBS (n = 1,695,277).

ACSC = ambulatory care sensitive conditions.

HCBS = home and community-based services

Table D.7. Decile table generated from the two-step risk-adjustment model: Institutional residents with acute ACSC admissions

Decile	Number of dual eligible beneficiaries	Observed mean admissions rate for ACSCs	Predicted mean admissions rate for ACSCs
1 (lowest)	21,630	24	25
2	21,629	32	32
3	21,629	34	37
4	21,629	39	42
5	21,629	45	46
6	21,629	56	54
7	21,629	64	63
8	21,629	81	77
9	21,629	103	98
10 (highest)	21,629	162	163

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Notes: The measure result is reported as a rate per 1,000 beneficiaries.

Deciles are classified on the basis of the predicted number of admissions for acute ACSCs from the risk-adjustment model.

Sample: Model validation half sample, Institutional (n = 216,291).

ACSC = ambulatory care sensitive conditions.

Table D.8. Decile table generated from the two-step risk-adjustment model: Institutional residents with chronic ACSC admissions

Decile	Number of dual eligible beneficiaries	Observed mean admissions rate for ACSCs	Predicted mean admissions rate for ACSCs
1 (lowest)	21,630	8	7
2	21,629	8	9
3	21,629	7	10
4	21,629	9	12
5	21,629	15	17
6	21,629	21	23
7	21,629	33	30
8	21,629	44	42
9	21,629	72	72
10 (highest)	21,629	198	210

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Notes: The measure result is reported as a rate per 1,000 beneficiaries.

Deciles are classified on the basis of the predicted number of admissions for chronic ACSCs from the risk-adjustment model.

Sample: Model validation half sample, Institutional (n = 216,291).

ACSC = ambulatory care sensitive conditions.

Table D.9. Decile table generated from the two-step risk-adjustment model: Institutional residents with acute or chronic ACSC admissions

Decile	Number of dual eligible beneficiaries	Observed mean admissions rate for ACSCs	Predicted mean admissions rate for ACSCs
1 (lowest)	21,630	34	33
2	21,629	40	40
3	21,629	40	47
4	21,629	55	55
5	21,629	66	64
6	21,629	77	78
7	21,629	99	96
8	21,629	128	125
9	21,629	174	176
10 (highest)	21,629	342	352

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Notes: The measure result is reported as a rate per 1,000 beneficiaries.

Deciles are classified on the basis of the predicted number of admissions for total ACSCs from the risk-adjustment model.

Sample: Model validation half sample, Institutional (n = 216,291).

ACSC = ambulatory care sensitive conditions.

Table D.10. Predictive performance by key dual eligible beneficiary characteristics: HCBS users with acute ACSC admissions

Patient characteristic	Observed-to-expected ratio
Sex	
Male	0.99
Female	1.00
Age group	
18–39	1.11
40–64	1.01
65–74	1.00
75 or older	0.98
Number of chronic conditions	
None	1.08
1–2	0.96
3–5	1.01
6–10	1.00
11+	0.99

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: Expected values are generated from the risk-adjustment model. Observed values are the unadjusted, actual measurements.

Sample: Model validation half sample, HCBS (n = 329,323).

ACSC = ambulatory care sensitive conditions.

HCBS = home and community-based services

Table D.11. Predictive performance by key dual eligible beneficiary characteristics: HCBS users with chronic ACSC admissions

Patient characteristic	Observed-to-expected ratio
Sex	
Male	1.00
Female	1.00
Age group	
18–39	1.27
40–64	0.99
65–74	1.01
75 or older	0.98
Number of chronic conditions	
None	0.79
1–2	0.96
3–5	1.04
6–10	0.99
11+	0.99

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: Expected values are generated from the risk-adjustment model. Observed values are the unadjusted, actual measurements.

Sample: Model validation half sample, HCBS (n = 329,323).

ACSC = ambulatory care sensitive conditions.

HCBS = home and community-based services

Table D.12. Predictive performance by key dual eligible beneficiary characteristics: HCBS users with acute and chronic ACSC admissions

Patient characteristic	Observed-to-expected ratio
Sex	
Male	0.99
Female	1.00
Age group	
18–39	1.16
40–64	1.00
65–74	1.01
75 or older	0.98
Number of chronic conditions	
None	1.00
1–2	0.96
3–5	1.03
6–10	1.00
11+	0.99

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: Expected values are generated from the risk-adjustment model. Observed values are the unadjusted, actual measurements.

Sample: Model validation half sample, HCBS (n = 329,323).

ACSC = ambulatory care sensitive conditions.

HCBS = home and community-based services

Table D.13. Predictive performance by key dual eligible beneficiary characteristics: Non-HCBS users with acute ACSC admissions

Patient characteristic	Observed-to-expected ratio
Sex	
Male	1.01
Female	0.98
Age group	
18–39	1.00
40–64	0.98
65–74	1.01
75 or older	0.99
Number of chronic conditions	
None	0.98
1–2	1.01
3–5	1.01
6–10	0.94
11+	0.94

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: Expected values are generated from the risk-adjustment model. Observed values are the unadjusted, actual measurements.

Sample: Model validation half sample, Non-HCBS (n = 1,695,277).

ACSC = ambulatory care sensitive conditions.

HCBS = home and community-based services

Table D.14. Predictive performance by key dual eligible beneficiary characteristics: Non-HCBS users with chronic ACSC admissions

Patient characteristic	Observed-to-expected ratio
Sex	
Male	1.00
Female	1.00
Age group	
18–39	1.13
40–64	1.01
65–74	0.99

Patient characteristic	Observed-to-expected ratio
75 or older	0.98
Number of chronic conditions	
None	0.97
1–2	1.02
3–5	1.02
6–10	0.97
11+	0.99

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: Expected values are generated from the risk-adjustment model. Observed values are the unadjusted, actual measurements.

Sample: Model validation half sample, Non-HCBS (n = 1,695,277).

ACSC = ambulatory care sensitive conditions.

HCBS = home and community-based services

Table D.15. Predictive performance by key dual eligible beneficiary characteristics: Non-HCBS users with acute or chronic ACSC admissions

Patient characteristic	Observed-to-expected ratio
Sex	
Male	1.00
Female	1.00
Age group	
18–39	1.08
40–64	1.00
65–74	1.00
75 or older	0.99
Number of chronic conditions	
None	0.97
1–2	1.02
3–5	1.02
6–10	0.96
11+	0.98

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: Expected values are generated from the risk-adjustment model. Observed values are the unadjusted, actual measurements.

Sample: Model validation half sample, Non-HCBS (n = 1,695,277).

ACSC = ambulatory care sensitive conditions.

HCBS = home and community-based services

Table D.16. Predictive performance by key dual eligible beneficiary characteristics: Institutional residents with acute ACSC admissions

Patient characteristic	Observed-to-expected ratio
Sex	
Male	1.03
Female	1.00
Age group	
18–39	1.01
40–64	1.00
65–74	1.01
75 or older	1.01
Number of chronic conditions	
None	1.08
1–2	0.98
3–5	1.00
6–10	1.03
11+	0.99

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: Expected values are generated from the risk-adjustment model. Observed values are the unadjusted, actual measurements.

Sample: Model validation half sample, Institutional (n = 216,291).

ACSC = ambulatory care sensitive conditions.

Table D.17. Predictive performance by key dual eligible beneficiary characteristics: Institutional users with chronic ACSC admissions

Patient characteristic	Observed-to-expected ratio
Sex	
Male	1.00
Female	0.94
Age group	
18–39	1.03
40–64	0.99
65–74	0.95
75 or older	0.95
Number of chronic conditions	
None	1.02
1–2	0.99
3–5	0.99
6–10	0.92
11+	1.00

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: Expected values are generated from the risk-adjustment model. Observed values are the unadjusted, actual measurements.

Sample: Model validation half sample, Institutional (n = 216,291).

ACSC = ambulatory care sensitive conditions.

Table D.18. Predictive performance by key dual eligible beneficiary characteristics: Institutional users with acute or chronic ACSC admissions

Patient characteristic	**Observed-to-expected ratio**
Sex	
Male	1.01
Female	0.98
Age group	
18–39	1.01
40–64	1.00
65–74	0.99
75 or older	0.98
Number of chronic conditions	
None	1.07
1–2	0.98
3–5	1.00
6–10	0.97
11+	1.00

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: Expected values are generated from the risk-adjustment model. Observed values are the unadjusted, actual measurements.

Sample: Model validation half sample, Institutional (n = 216,291).

ACSC = ambulatory care sensitive conditions.

APPENDIX E

Table E.1. Final logit model specification for the HCBS subpopulation: Risk factor prevalence and odds ratios for the acute ACSC outcome

	2014–2015 development sample n = 329,323			2014–2015 validation sample n = 329,323			2014–2015 full sample N = 658,646		
Risk factor	**Percentage of dual eligible beneficiaries with this risk factor**	**OR**	**OR (95% CI)**	**Percentage of dual eligible beneficiaries with this risk factor**	**OR**	**OR (95% CI)**	**Percentage of dual eligible beneficiaries with this risk factor**	**OR**	**OR (95% CI)**
Intercept		0.01	(0.00,0.01)		0.01	(0.01,0.01)*		0.01	(0.01,0.01)*
Female, Age 0-34	4.28	1.13	(0.93,1.39)	4.24	1.00	(0.82,1.21)	4.26	1.06	(0.92,1.22)
Female, Age 35-44	4.76	1.52	(1.27,1.82)	4.79	1.38	(1.17,1.63)	4.78	1.44	(1.28,1.62)
Female, Age 45-54	7.32	2.02	(1.73,2.35)	7.35	1.53	(1.32,1.77)	7.34	1.75	(1.57,1.94)
Female, Age 55-59	4.35	2.46	(2.09,2.89)	4.34	2.19	(1.88,2.54)	4.34	2.31	(2.07,2.58)
Female, Age 60-64	4.18	2.88	(2.46,3.38)	4.28	2.50	(2.15,2.89)	4.23	2.67	(2.40,2.97)
Female, Age 65-69	5.65	3.58	(3.08,4.16)	5.55	2.94	(2.55,3.38)	5.60	3.22	(2.91,3.57)
Female, Age 70-74	5.59	3.78	(3.25,4.39)	5.72	3.21	(2.79,3.69)	5.65	3.46	(3.12,3.84)
Female, Age 75-79	6.16	4.51	(3.88,5.23)	6.08	3.75	(3.26,4.32)	6.12	4.09	(3.69,4.53)
Female, Age 80-84	6.03	5.27	(4.54,6.12)	6.08	4.45	(3.87,5.12)	6.06	4.82	(4.35,5.33)
Female, Age 85-89	5.49	6.39	(5.50,7.42)	5.51	5.22	(4.54,6.00)	5.50	5.74	(5.18,6.35)
Female, Age 90-94	3.43	7.18	(6.15,8.39)	3.35	5.79	(5.00,6.71)	3.39	6.42	(5.77,7.14)
Female, Age 95+	1.28	7.87	(6.58,9.42)	1.30	5.72	(4.80,6.82)	1.29	6.68	(5.89,7.57)
Male, Age 35-44	6.17	1.56	(1.32,1.84)	6.20	1.27	(1.08,1.49)	6.19	1.40	(1.25,1.57)
Male, Age 45-54	8.56	1.89	(1.62,2.20)	8.52	1.54	(1.33,1.78)	8.54	1.70	(1.53,1.88)
Male, Age 55-59	4.34	2.48	(2.11,2.91)	4.31	1.89	(1.62,2.21)	4.33	2.15	(1.93,2.41)
Male, Age 60-64	3.51	2.62	(2.22,3.08)	3.50	2.27	(1.94,2.65)	3.51	2.42	(2.16,2.71)
Male, Age 65-69	3.26	2.67	(2.26,3.16)	3.24	2.52	(2.16,2.94)	3.25	2.59	(2.31,2.90)
Male, Age 70-74	2.71	3.64	(3.09,4.30)	2.76	2.99	(2.56,3.50)	2.73	3.28	(2.93,3.68)
Male, Age 75-79	2.40	3.87	(3.27,4.59)	2.36	3.13	(2.66,3.68)	2.38	3.46	(3.08,3.89)
Male, Age 80-84	1.85	4.61	(3.87,5.49)	1.90	3.64	(3.08,4.31)	1.88	4.08	(3.62,4.60)
Male, Age 85-89	1.42	5.32	(4.43,6.38)	1.38	4.22	(3.54,5.03)	1.40	4.71	(4.15,5.35)
Male, Age 90-94	0.63	6.26	(5.03,7.79)	0.63	5.06	(4.09,6.25)	0.63	5.59	(4.80,6.50)
Male, Age 95+	0.16	7.03	(4.93,10.03)	0.15	6.06	(4.25,8.64)	0.16	6.49	(5.05,8.34)
Acute Renal Failure	5.45	1.27	(1.19,1.34)	5.45	1.28	(1.21,1.36)	5.45	1.27	(1.22,1.33)
Amputation Status, Lower Limb/Amputation Complications	0.97	1.22	(1.07,1.38)	0.94	1.41	(1.24,1.60)	0.95	1.31	(1.20,1.43)
Artificial Openings for Feeding or Elimination	2.55	1.52	(1.40,1.65)	2.60	1.48	(1.36,1.60)	2.57	1.49	(1.41,1.59)
Aspiration and Specified Bacterial Pneumonias	1.93	1.60	(1.43,1.80)	1.94	1.52	(1.35,1.71)	1.94	1.56	(1.44,1.70)

	2014–2015 development sample n = 329,323			2014–2015 validation sample n = 329,323			2014–2015 full sample N = 658,646		
Risk factor	Percentage of dual eligible beneficiaries with this risk factor	OR	OR (95% CI)	Percentage of dual eligible beneficiaries with this risk factor	OR	OR (95% CI)	Percentage of dual eligible beneficiaries with this risk factor	OR	OR (95% CI)
Atherosclerosis of the Extremities with Ulceration or Gangrene	0.87	1.21	(1.05,1.39)	0.83	1.22	(1.06,1.40)	0.85	1.21	(1.10,1.34)
Bone/Joint/Muscle Infections/Necrosis	1.51	0.92	(0.74,1.13)	1.52	1.12	(0.92,1.36)	1.52	1.02	(0.88,1.17)
Cardio-Respiratory Failure and Shock	4.16	1.18	(1.10,1.26)	4.13	1.13	(1.05,1.21)	4.15	1.15	(1.10,1.21)
Cerebral Palsy	4.75	1.24	(1.13,1.36)	4.65	1.31	(1.19,1.43)	4.70	1.27	(1.19,1.36)
Chronic Kidney Disease, Severe (Stage 4)	0.80	1.22	(1.05,1.42)	0.81	1.30	(1.12,1.51)	0.80	1.26	(1.13,1.40)
Chronic Obstructive Pulmonary Disease	15.33	1.58	(1.49,1.67)	15.29	1.59	(1.50,1.68)	15.31	1.58	(1.52,1.65)
Chronic Ulcer of Skin, Except Pressure	4.33	1.37	(1.24,1.50)	4.34	1.28	(1.16,1.41)	4.34	1.32	(1.23,1.41)
Coagulation Defects and Other Specified Hematological Disorders	4.20	1.14	(1.06,1.22)	4.24	1.05	(0.97,1.12)	4.22	1.09	(1.04,1.15)
Congestive Heart Failure	14.53	1.10	(1.01,1.19)	14.51	1.19	(1.10,1.29)	14.52	1.14	(1.08,1.21)
Diabetes with Acute Complications	0.51	1.38	(1.15,1.65)	0.51	1.33	(1.11,1.60)	0.51	1.35	(1.19,1.54)
Diabetes with Chronic Complications	14.63	1.10	(1.04,1.17)	14.64	1.09	(1.03,1.16)	14.64	1.10	(1.05,1.14)
Diabetes without Complication	17.00	1.07	(1.01,1.13)	17.05	1.08	(1.02,1.14)	17.03	1.07	(1.03,1.12)
Drug/Alcohol Dependence	1.60	1.16	(0.91,1.48)	1.56	1.41	(1.14,1.76)	1.58	1.29	(1.10,1.52)
Drug/Alcohol Psychosis	0.68	1.22	(0.91,1.63)	0.69	1.22	(0.92,1.61)	0.69	1.22	(1.00,1.49)
Exudative Macular Degeneration	1.09	0.91	(0.79,1.04)	1.05	1.06	(0.93,1.22)	1.07	0.98	(0.89,1.08)

	2014–2015 development sample n = 329,323			2014–2015 validation sample n = 329,323			2014–2015 full sample N = 658,646		
Risk factor	Percentage of dual eligible beneficiaries with this risk factor	OR	OR (95% CI)	Percentage of dual eligible beneficiaries with this risk factor	OR	OR (95% CI)	Percentage of dual eligible beneficiaries with this risk factor	OR	OR (95% CI)
Fibrosis of Lung and Other Chronic Lung Disorders	0.68	1.20	(1.01,1.43)	0.68	1.30	(1.10,1.54)	0.68	1.25	(1.11,1.41)
Ischemic or Unspecified Stroke	4.18	1.11	(1.04,1.20)	4.11	1.18	(1.10,1.26)	4.14	1.14	(1.09,1.20)
Lung and Other Severe Cancers	0.88	1.07	(0.92,1.24)	0.87	1.06	(0.92,1.24)	0.87	1.06	(0.96,1.18)
Lymphoma and Other Cancers	0.92	1.11	(0.95,1.29)	0.96	1.08	(0.93,1.26)	0.94	1.10	(0.98,1.22)
Major Depressive, Bipolar, and Paranoid Disorders	13.00	1.08	(1.03,1.14)	13.11	1.10	(1.05,1.16)	13.05	1.09	(1.05,1.13)
Major Head Injury	1.45	1.06	(0.92,1.21)	1.42	1.00	(0.87,1.16)	1.43	1.03	(0.93,1.14)
Metastatic Cancer and Acute Leukemia	0.53	1.15	(0.95,1.39)	0.50	0.84	(0.68,1.05)	0.52	1.00	(0.86,1.15)
Monoplegia, Other Paralytic Syndromes	0.30	0.95	(0.71,1.27)	0.29	1.06	(0.80,1.41)	0.29	1.00	(0.82,1.23)
Morbid Obesity	5.76	1.49	(1.40,1.58)	5.77	1.64	(1.54,1.74)	5.77	1.56	(1.50,1.63)
Multiple Sclerosis	1.49	1.89	(1.37,2.60)	1.47	1.59	(1.15,2.21)	1.48	1.74	(1.38,2.19)
Myasthenia Gravis/Myoneural Disorders, Inflammatory and Toxic Neuropathy	0.62	0.96	(0.80,1.15)	0.63	1.09	(0.91,1.29)	0.63	1.02	(0.90,1.16)
Opportunistic Infections	0.31	0.73	(0.46,1.18)	0.32	0.99	(0.65,1.51)	0.31	0.85	(0.62,1.17)
Other Significant Endocrine and Metabolic Disorders	3.71	0.85	(0.78,0.93)	3.68	0.84	(0.77,0.91)	3.69	0.85	(0.80,0.90)
Paraplegia	1.05	2.59	(2.30,2.92)	1.03	2.43	(2.15,2.74)	1.04	2.51	(2.30,2.73)
Parkinson's and Huntington's Diseases	2.21	1.38	(1.27,1.52)	2.23	1.40	(1.28,1.53)	2.22	1.39	(1.31,1.48)
Pneumococcal Pneumonia, Empyema, Lung Abscess	0.29	1.74	(1.43,2.11)	0.30	1.20	(0.97,1.49)	0.30	1.45	(1.25,1.68)

	2014–2015 development sample n = 329,323			2014–2015 validation sample n = 329,323			2014–2015 full sample N = 658,646		
Risk factor	Percentage of dual eligible beneficiaries with this risk factor	OR	OR (95% CI)	Percentage of dual eligible beneficiaries with this risk factor	OR	OR (95% CI)	Percentage of dual eligible beneficiaries with this risk factor	OR	OR (95% CI)
Pressure Ulcer of Skin with Full Thickness Skin Loss	0.65	1.36	(1.05,1.76)	0.66	1.20	(0.93,1.56)	0.66	1.28	(1.06,1.53)
Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	0.52	1.70	(1.22,2.36)	0.55	1.59	(1.15,2.19)	0.53	1.65	(1.31,2.08)
Quadriplegia	1.70	2.58	(2.33,2.85)	1.66	2.98	(2.70,3.29)	1.68	2.77	(2.58,2.97)
Rheumatoid Arthritis and Inflammatory Connective Tissue Disease	4.47	1.16	(1.08,1.24)	4.37	1.12	(1.05,1.21)	4.42	1.14	(1.09,1.20)
Schizophrenia	6.72	1.20	(1.09,1.31)	6.64	1.14	(1.04,1.25)	6.68	1.17	(1.09,1.25)
Seizure Disorders and Convulsions	15.25	1.22	(1.16,1.29)	15.26	1.23	(1.16,1.29)	15.25	1.22	(1.18,1.27)
Septicemia, Sepsis, Systemic Inflammatory Response Syndrome/Shock	4.27	1.65	(1.54,1.77)	4.35	1.47	(1.37,1.58)	4.31	1.56	(1.48,1.64)
Severe Hematological Disorders	0.42	1.12	(0.82,1.52)	0.45	1.07	(0.80,1.43)	0.43	1.09	(0.89,1.35)
Specified Heart Arrhythmias	10.53	1.09	(1.04,1.15)	10.42	1.10	(1.05,1.16)	10.47	1.10	(1.06,1.14)
Spinal Cord Disorders/Injuries	1.35	1.50	(1.31,1.71)	1.39	1.58	(1.39,1.80)	1.37	1.54	(1.40,1.69)
Traumatic Amputations and Complications	0.46	0.92	(0.76,1.12)	0.44	0.99	(0.82,1.20)	0.45	0.95	(0.83,1.09)
Unstable Angina and Other Acute Ischemic Heart Disease	1.53	0.98	(0.88,1.09)	1.50	1.00	(0.89,1.11)	1.51	0.99	(0.91,1.07)
Vascular Disease	14.87	0.98	(0.93,1.03)	14.94	0.96	(0.91,1.00)	14.91	0.97	(0.94,1.00)
Vascular Disease with Complications	2.26	1.24	(1.14,1.35)	2.20	1.26	(1.16,1.38)	2.23	1.25	(1.18,1.33)
Vertebral Fractures without Spinal Cord Injury	1.14	1.14	(1.01,1.29)	1.13	1.18	(1.04,1.34)	1.13	1.16	(1.06,1.27)

	2014–2015 development sample n = 329,323			2014–2015 validation sample n = 329,323			2014–2015 full sample N = 658,646		
Risk factor	Percentage of dual eligible beneficiaries with this risk factor	OR	OR (95% CI)	Percentage of dual eligible beneficiaries with this risk factor	OR	OR (95% CI)	Percentage of dual eligible beneficiaries with this risk factor	OR	OR (95% CI)
Chronic Condition Interaction: Diabetes and Congestive Heart Failure	8.31	1.02	(0.94,1.10)	8.29	0.93	(0.86,1.01)	8.30	0.97	(0.92,1.03)
Chronic Condition Interaction: Congestive Heart Failure and COPD	5.95	1.00	(0.92,1.09)	5.93	0.90	(0.83,0.98)	5.94	0.95	(0.90,1.01)
Chronic Condition Interaction: Cancer and Immune Disorders	0.30	1.28	(1.01,1.62)	0.29	1.03	(0.79,1.34)	0.30	1.15	(0.97,1.37)
Chronic Condition Interaction: Aspiration and Specified Bacterial Pneumonias and Pressure Ulcer	0.13	0.58	(0.43,0.77)	0.13	0.71	(0.54,0.93)	0.13	0.64	(0.52,0.77)
Chronic Condition Interaction: Sepsis and Aspiration and Specified Bacterial Pneumonias	0.86	0.73	(0.62,0.87)	0.88	0.85	(0.72,1.01)	0.87	0.79	(0.70,0.89)
Chronic Condition Interaction: Schizophrenia and COPD	1.24	1.03	(0.89,1.20)	1.18	1.17	(1.01,1.36)	1.21	1.10	(0.99,1.22)
Disability Interaction: HCC6 Opportunistic Infections	0.22	1.46	(0.84,2.52)	0.24	1.43	(0.88,2.32)	0.23	1.45	(1.01,2.08)
Disability Interaction: HCC34 Chronic Pancreatitis	0.20	1.17	(0.86,1.60)	0.20	1.15	(0.85,1.56)	0.20	1.16	(0.94,1.45)
Disability Interaction: HCC39 Bone/Joint/Muscle Infections/Necrosis	1.13	1.22	(0.96,1.55)	1.14	1.17	(0.94,1.47)	1.14	1.19	(1.01,1.40)

	2014–2015 development sample n = 329,323			2014–2015 validation sample n = 329,323			2014–2015 full sample N = 658,646		
Risk factor	**Percentage of dual eligible beneficiaries with this risk factor**	**OR**	**OR (95% CI)**	**Percentage of dual eligible beneficiaries with this risk factor**	**OR**	**OR (95% CI)**	**Percentage of dual eligible beneficiaries with this risk factor**	**OR**	**OR (95% CI)**
Disability Interaction: HCC46 Severe Hematological Disorders	0.26	0.65	(0.42,1.03)	0.27	0.95	(0.63,1.43)	0.27	0.79	(0.59,1.08)
Disability Interaction: HCC54 Drug/Alcohol Psychosis	0.52	1.03	(0.73,1.45)	0.51	1.27	(0.91,1.76)	0.51	1.14	(0.90,1.45)
Disability Interaction: HCC55 Drug/Alcohol Dependence	1.32	1.27	(0.98,1.67)	1.29	1.07	(0.84,1.37)	1.30	1.16	(0.97,1.39)
Disability Interaction: HCC77 Multiple Sclerosis	1.37	0.86	(0.61,1.22)	1.35	0.99	(0.70,1.40)	1.36	0.92	(0.72,1.18)
Disability Interaction: HCC85 Congestive Heart Failure	7.07	1.20	(1.11,1.28)	7.08	1.12	(1.05,1.21)	7.07	1.16	(1.10,1.22)
Disability Interaction: HCC157 Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	0.43	1.85	(1.29,2.64)	0.46	1.63	(1.15,2.32)	0.45	1.72	(1.34,2.21)
Disability Interaction: HCC158 Pressure Ulcer of Skin with Full Thickness Skin Loss	0.48	1.64	(1.22,2.20)	0.48	2.08	(1.55,2.78)	0.48	1.85	(1.51,2.28)
Disability Interaction: HCC161 Chronic Ulcer of Skin, Except Pressure	2.66	1.41	(1.24,1.59)	2.65	1.24	(1.10,1.41)	2.66	1.32	(1.21,1.44)

	2014–2015 development sample n = 329,323			2014–2015 validation sample n = 329,323			2014–2015 full sample N = 658,646		
Risk factor	**Percentage of dual eligible beneficiaries with this risk factor**	**OR**	**OR (95% CI)**	**Percentage of dual eligible beneficiaries with this risk factor**	**OR**	**OR (95% CI)**	**Percentage of dual eligible beneficiaries with this risk factor**	**OR**	**OR (95% CI)**
Disability Interaction: HCC176 Complications of Specified Implanted Device or Graft	2.25	1.19	(1.08,1.30)	2.30	1.01	(0.92,1.11)	2.27	1.10	(1.03,1.17)
Number of Chronic Conditions: 1-2	44.34	1.49	(1.38,1.61)	44.46	1.29	(1.20,1.40)	44.40	1.39	(1.31,1.47)
Number of Chronic Conditions: 3-5	24.59	1.87	(1.69,2.07)	24.56	1.73	(1.57,1.91)	24.57	1.80	(1.68,1.93)
Number of Chronic Conditions: 6-10	8.82	1.69	(1.47,1.95)	8.79	1.69	(1.47,1.95)	8.81	1.70	(1.53,1.88)
Number of Chronic Conditions: 11+	1.01	1.01	(0.81,1.27)	1.02	1.02	(0.81,1.28)	1.02	1.02	(0.87,1.20)

Source: Mathematica analysis of dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: Expected values are generated from the risk-adjustment model. Observed values are the unadjusted, actual measurements.

Sample: Full sample for the HCBS users *(*n = 658,646).

* The identical lower and upper bounds of the CI are due to rounding.

ACSC = ambulatory care sensitive conditions

CI = confidence interval

HCBS = home and community-based services

OR = odds ratio.

Table E.2. Final Poisson model specification for the HCBS subpopulation: Risk factor prevalence and incidence rate ratios for the acute ACSC outcome

	2014–2015 development sample n = 13,960			2014–2015 validation sample n = 13,900			2014–2015 full sample N = 27,860		
Risk factor	**Percentage of dual eligible beneficiaries with this risk factor**	**IRR**	**IRR (95% CI)**	**Percentage of dual eligible beneficiaries with this risk factor**	**IRR**	**IRR (95% CI)**	**Percentage of dual eligible beneficiaries with this risk factor**	**IRR**	**IRR (95% CI)**
Intercept		1.05	(0.92,1.21)		1.10	(0.97,1.25)		1.08	(0.98,1.18)
Female, Age 0-34	4.28	1.06	(0.88,1.27)	4.24	0.98	(0.83,1.17)	4.26	1.02	(0.90,1.16)
Female, Age 35-44	4.76	1.08	(0.92,1.26)	4.79	1.00	(0.86,1.15)	4.78	1.03	(0.93,1.15)
Female, Age 45-54	7.32	1.03	(0.90,1.19)	7.35	1.01	(0.89,1.15)	7.34	1.02	(0.93,1.12)
Female, Age 55-59	4.35	1.01	(0.87,1.17)	4.34	1.00	(0.87,1.14)	4.34	1.00	(0.91,1.10)
Female, Age 60-64	4.18	1.05	(0.91,1.21)	4.28	1.01	(0.89,1.15)	4.23	1.03	(0.93,1.13)
Female, Age 65-69	5.65	1.03	(0.90,1.18)	5.55	0.97	(0.86,1.10)	5.60	1.00	(0.91,1.10)
Female, Age 70-74	5.59	1.04	(0.91,1.20)	5.72	1.00	(0.88,1.13)	5.65	1.02	(0.93,1.12)
Female, Age 75-79	6.16	1.05	(0.92,1.21)	6.08	0.99	(0.87,1.12)	6.12	1.02	(0.93,1.11)
Female, Age 80-84	6.03	1.05	(0.92,1.21)	6.08	0.99	(0.87,1.12)	6.06	1.02	(0.93,1.12)
Female, Age 85-89	5.49	1.08	(0.94,1.24)	5.51	0.99	(0.87,1.12)	5.50	1.03	(0.94,1.13)
Female, Age 90-94	3.43	1.05	(0.91,1.21)	3.35	1.01	(0.88,1.15)	3.39	1.03	(0.93,1.13)
Female, Age 95+	1.28	1.05	(0.89,1.23)	1.30	0.99	(0.84,1.15)	1.29	1.01	(0.91,1.14)
Male, Age 35-44	6.17	1.02	(0.87,1.18)	6.20	0.98	(0.85,1.13)	6.19	1.00	(0.90,1.11)
Male, Age 45-54	8.56	1.05	(0.91,1.20)	8.52	0.97	(0.86,1.11)	8.54	1.01	(0.92,1.11)
Male, Age 55-59	4.34	1.02	(0.88,1.18)	4.31	0.95	(0.83,1.09)	4.33	0.98	(0.89,1.08)
Male, Age 60-64	3.51	1.03	(0.89,1.20)	3.50	0.95	(0.83,1.09)	3.51	0.99	(0.89,1.09)
Male, Age 65-69	3.26	1.06	(0.91,1.23)	3.24	0.95	(0.83,1.09)	3.25	1.00	(0.90,1.11)
Male, Age 70-74	2.71	1.05	(0.91,1.22)	2.76	0.99	(0.86,1.14)	2.73	1.02	(0.92,1.13)
Male, Age 75-79	2.40	1.08	(0.92,1.26)	2.36	0.97	(0.84,1.13)	2.38	1.02	(0.92,1.14)
Male, Age 80-84	1.85	1.03	(0.88,1.21)	1.90	0.97	(0.84,1.13)	1.88	1.00	(0.90,1.11)
Male, Age 85-89	1.42	1.03	(0.87,1.21)	1.38	0.95	(0.81,1.11)	1.40	0.98	(0.88,1.10)
Male, Age 90-94	0.63	1.04	(0.86,1.27)	0.63	0.97	(0.80,1.17)	0.63	1.01	(0.88,1.15)
Male, Age 95+	0.16	1.03	(0.75,1.42)	0.15	1.00	(0.73,1.36)	0.16	1.01	(0.81,1.26)
Acute Renal Failure	5.45	1.02	(0.97,1.07)	5.45	1.02	(0.97,1.07)	5.45	1.02	(0.98,1.05)
Amputation Status, Lower Limb/Amputation Complications	0.97	1.02	(0.92,1.14)	0.94	0.99	(0.90,1.10)	0.95	1.01	(0.94,1.08)
Artificial Openings for Feeding or Elimination	2.55	0.99	(0.93,1.06)	2.60	1.04	(0.97,1.11)	2.57	1.02	(0.97,1.07)
Aspiration and Specified Bacterial Pneumonias	1.93	1.04	(0.94,1.14)	1.94	1.00	(0.91,1.10)	1.94	1.02	(0.95,1.09)

	2014–2015 development sample n = 13,960			2014–2015 validation sample n = 13,900			2014–2015 full sample N = 27,860		
Risk factor	Percentage of dual eligible beneficiaries with this risk factor	IRR	IRR (95% CI)	Percentage of dual eligible beneficiaries with this risk factor	IRR	IRR (95% CI)	Percentage of dual eligible beneficiaries with this risk factor	IRR	IRR (95% CI)
Atherosclerosis of the Extremities with Ulceration or Gangrene	0.87	1.06	(0.95,1.19)	0.83	1.01	(0.90,1.13)	0.85	1.03	(0.95,1.12)
Bone/Joint/Muscle Infections/Necrosis	1.51	1.02	(0.85,1.22)	1.52	1.00	(0.85,1.19)	1.52	1.01	(0.90,1.15)
Cardio-Respiratory Failure and Shock	4.16	1.00	(0.94,1.05)	4.13	0.98	(0.93,1.04)	4.15	0.99	(0.95,1.03)
Cerebral Palsy	4.75	1.04	(0.96,1.13)	4.65	0.99	(0.91,1.07)	4.70	1.02	(0.96,1.08)
Chronic Kidney Disease, Severe (Stage 4)	0.80	0.95	(0.83,1.10)	0.81	0.97	(0.85,1.11)	0.80	0.96	(0.88,1.06)
Chronic Obstructive Pulmonary Disease	15.33	1.03	(0.98,1.08)	15.29	1.04	(0.99,1.09)	15.31	1.04	(1.00,1.07)
Chronic Ulcer of Skin, Except Pressure	4.33	1.03	(0.95,1.12)	4.34	1.00	(0.92,1.09)	4.34	1.02	(0.96,1.08)
Coagulation Defects and Other Specified Hematological Disorders	4.20	1.00	(0.94,1.06)	4.24	1.04	(0.98,1.11)	4.22	1.02	(0.98,1.06)
Congestive Heart Failure	14.53	0.98	(0.91,1.05)	14.51	1.03	(0.96,1.10)	14.52	1.01	(0.96,1.06)
Diabetes with Acute Complications	0.51	0.99	(0.85,1.16)	0.51	0.99	(0.85,1.16)	0.51	0.99	(0.89,1.11)
Diabetes with Chronic Complications	14.63	0.99	(0.94,1.04)	14.64	1.00	(0.95,1.06)	14.64	1.00	(0.96,1.03)
Diabetes without Complication	17.00	1.00	(0.95,1.05)	17.05	1.01	(0.96,1.06)	17.03	1.01	(0.97,1.04)
Drug/Alcohol Dependence	1.60	0.99	(0.80,1.22)	1.56	1.05	(0.88,1.27)	1.58	1.02	(0.89,1.17)
Drug/Alcohol Psychosis	0.68	0.91	(0.70,1.19)	0.69	0.93	(0.73,1.20)	0.69	0.92	(0.77,1.11)
Exudative Macular Degeneration	1.09	1.02	(0.90,1.15)	1.05	1.00	(0.88,1.12)	1.07	1.01	(0.92,1.09)
Fibrosis of Lung and Other Chronic Lung Disorders	0.68	1.06	(0.91,1.23)	0.68	1.01	(0.87,1.17)	0.68	1.03	(0.93,1.15)

	2014–2015 development sample n = 13,960			2014–2015 validation sample n = 13,900			2014–2015 full sample N = 27,860		
Risk factor	Percentage of dual eligible beneficiaries with this risk factor	IRR	IRR (95% CI)	Percentage of dual eligible beneficiaries with this risk factor	IRR	IRR (95% CI)	Percentage of dual eligible beneficiaries with this risk factor	IRR	IRR (95% CI)
Ischemic or Unspecified Stroke	4.18	1.01	(0.95,1.08)	4.11	1.01	(0.95,1.07)	4.14	1.01	(0.97,1.05)
Lung and Other Severe Cancers	0.88	0.93	(0.82,1.07)	0.87	1.01	(0.89,1.15)	0.87	0.97	(0.89,1.07)
Lymphoma and Other Cancers	0.92	0.96	(0.83,1.10)	0.96	1.00	(0.88,1.15)	0.94	0.98	(0.89,1.08)
Major Depressive, Bipolar, and Paranoid Disorders	13.00	1.01	(0.96,1.06)	13.11	1.01	(0.96,1.05)	13.05	1.01	(0.97,1.04)
Major Head Injury	1.45	1.01	(0.90,1.14)	1.42	1.00	(0.88,1.13)	1.43	1.01	(0.92,1.09)
Metastatic Cancer and Acute Leukemia	0.53	1.02	(0.87,1.21)	0.50	1.02	(0.84,1.24)	0.52	1.02	(0.90,1.16)
Monoplegia, Other Paralytic Syndromes	0.30	1.02	(0.79,1.32)	0.29	1.02	(0.79,1.30)	0.29	1.02	(0.85,1.22)
Morbid Obesity	5.76	1.05	(0.99,1.10)	5.77	1.06	(1.00,1.11)	5.77	1.05	(1.01,1.09)
Multiple Sclerosis	1.49	0.95	(0.72,1.26)	1.47	1.04	(0.79,1.36)	1.48	0.99	(0.82,1.21)
Myasthenia Gravis/Myoneural Disorders, Inflammatory and Toxic Neuropathy	0.62	1.05	(0.90,1.22)	0.63	1.04	(0.90,1.20)	0.63	1.04	(0.94,1.16)
Opportunistic Infections	0.31	0.95	(0.62,1.44)	0.32	1.23	(0.89,1.70)	0.31	1.10	(0.85,1.42)
Other Significant Endocrine and Metabolic Disorders	3.71	1.01	(0.94,1.09)	3.68	0.98	(0.91,1.06)	3.69	1.00	(0.95,1.05)
Paraplegia	1.05	1.12	(1.02,1.24)	1.03	1.04	(0.95,1.15)	1.04	1.08	(1.01,1.16)
Parkinson's and Huntington's Diseases	2.21	0.99	(0.92,1.08)	2.23	1.01	(0.93,1.09)	2.22	1.00	(0.95,1.06)
Pneumococcal Pneumonia, Empyema, Lung Abscess	0.29	1.04	(0.89,1.21)	0.30	1.11	(0.94,1.32)	0.30	1.07	(0.95,1.20)
Pressure Ulcer of Skin with Full Thickness Skin Loss	0.65	1.00	(0.81,1.24)	0.66	1.08	(0.87,1.32)	0.66	1.04	(0.90,1.21)

	2014–2015 development sample n = 13,960			2014–2015 validation sample n = 13,900			2014–2015 full sample N = 27,860		
Risk factor	**Percentage of dual eligible beneficiaries with this risk factor**	**IRR**	**IRR (95% CI)**	**Percentage of dual eligible beneficiaries with this risk factor**	**IRR**	**IRR (95% CI)**	**Percentage of dual eligible beneficiaries with this risk factor**	**IRR**	**IRR (95% CI)**
Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	0.52	1.12	(0.87,1.44)	0.55	0.98	(0.75,1.28)	0.53	1.05	(0.87,1.26)
Quadriplegia	1.70	1.09	(1.01,1.19)	1.66	1.06	(0.98,1.15)	1.68	1.08	(1.02,1.14)
Rheumatoid Arthritis and Inflammatory Connective Tissue Disease	4.47	0.99	(0.93,1.06)	4.37	1.02	(0.96,1.08)	4.42	1.01	(0.96,1.05)
Schizophrenia	6.72	0.99	(0.91,1.08)	6.64	1.00	(0.92,1.09)	6.68	1.00	(0.94,1.06)
Seizure Disorders and Convulsions	15.25	0.98	(0.94,1.03)	15.26	1.00	(0.96,1.05)	15.25	0.99	(0.96,1.03)
Septicemia, Sepsis, Systemic Inflammatory Response Syndrome/Shock	4.27	1.06	(1.00,1.12)	4.35	1.08	(1.02,1.14)	4.31	1.07	(1.03,1.11)
Severe Hematological Disorders	0.42	0.95	(0.72,1.24)	0.45	1.05	(0.82,1.35)	0.43	1.00	(0.84,1.20)
Specified Heart Arrhythmias	10.53	1.01	(0.97,1.06)	10.42	1.00	(0.96,1.04)	10.47	1.00	(0.97,1.04)
Spinal Cord Disorders/Injuries	1.35	1.01	(0.90,1.14)	1.39	1.00	(0.89,1.12)	1.37	1.00	(0.92,1.09)
Traumatic Amputations and Complications	0.46	1.12	(0.96,1.29)	0.44	1.14	(0.98,1.31)	0.45	1.13	(1.02,1.25)
Unstable Angina and Other Acute Ischemic Heart Disease	1.53	0.97	(0.89,1.07)	1.50	1.03	(0.94,1.13)	1.51	1.00	(0.94,1.07)
Vascular Disease	14.87	1.00	(0.96,1.05)	14.94	1.00	(0.96,1.04)	14.91	1.00	(0.97,1.03)
Vascular Disease with Complications	2.26	1.01	(0.94,1.09)	2.20	1.02	(0.95,1.10)	2.23	1.02	(0.97,1.07)
Vertebral Fractures without Spinal Cord Injury	1.14	1.02	(0.91,1.13)	1.13	1.00	(0.90,1.11)	1.13	1.01	(0.93,1.09)

	2014–2015 development sample n = 13,960			2014–2015 validation sample n = 13,900			2014–2015 full sample N = 27,860		
Risk factor	Percentage of dual eligible beneficiaries with this risk factor	IRR	IRR (95% CI)	Percentage of dual eligible beneficiaries with this risk factor	IRR	IRR (95% CI)	Percentage of dual eligible beneficiaries with this risk factor	IRR	IRR (95% CI)
Chronic Condition Interaction: Diabetes and Congestive Heart Failure	8.31	1.01	(0.95,1.09)	8.29	0.99	(0.92,1.06)	8.30	1.00	(0.95,1.05)
Chronic Condition Interaction: Congestive Heart Failure and COPD	5.95	1.02	(0.95,1.09)	5.93	0.99	(0.92,1.07)	5.94	1.01	(0.96,1.06)
Chronic Condition Interaction: Cancer and Immune Disorders	0.30	0.97	(0.79,1.19)	0.29	0.95	(0.76,1.20)	0.30	0.96	(0.82,1.12)
Chronic Condition Interaction: Aspiration and Specified Bacterial Pneumonias and Pressure Ulcer	0.13	1.00	(0.80,1.24)	0.13	0.86	(0.71,1.06)	0.13	0.93	(0.80,1.08)
Chronic Condition Interaction: Sepsis and Aspiration and Specified Bacterial Pneumonias	0.86	0.97	(0.84,1.11)	0.88	1.00	(0.87,1.14)	0.87	0.98	(0.89,1.08)
Chronic Condition Interaction: Schizophrenia and COPD	1.24	1.00	(0.88,1.13)	1.18	1.01	(0.89,1.15)	1.21	1.00	(0.92,1.10)
Disability Interaction: HCC6 Opportunistic Infections	0.22	1.18	(0.74,1.90)	0.24	0.84	(0.57,1.22)	0.23	0.97	(0.72,1.30)
Disability Interaction: HCC34 Chronic Pancreatitis	0.20	1.01	(0.77,1.31)	0.20	0.95	(0.74,1.24)	0.20	0.98	(0.81,1.18)
Disability Interaction: HCC39 Bone/Joint/Muscle Infections/Necrosis	1.13	0.98	(0.81,1.20)	1.14	0.99	(0.82,1.19)	1.14	0.98	(0.86,1.13)

	2014–2015 development sample n = 13,960			2014–2015 validation sample n = 13,900			2014–2015 full sample N = 27,860		
Risk factor	**Percentage of dual eligible beneficiaries with this risk factor**	**IRR**	**IRR (95% CI)**	**Percentage of dual eligible beneficiaries with this risk factor**	**IRR**	**IRR (95% CI)**	**Percentage of dual eligible beneficiaries with this risk factor**	**IRR**	**IRR (95% CI)**
Disability Interaction: HCC46 Severe Hematological Disorders	0.26	1.05	(0.71,1.55)	0.27	0.94	(0.66,1.34)	0.27	0.99	(0.76,1.29)
Disability Interaction: HCC54 Drug/Alcohol Psychosis	0.52	1.18	(0.87,1.60)	0.51	1.07	(0.80,1.42)	0.51	1.12	(0.91,1.38)
Disability Interaction: HCC55 Drug/Alcohol Dependence	1.32	1.03	(0.82,1.30)	1.29	1.03	(0.84,1.27)	1.30	1.03	(0.89,1.20)
Disability Interaction: HCC77 Multiple Sclerosis	1.37	1.14	(0.85,1.53)	1.35	0.98	(0.74,1.31)	1.36	1.06	(0.86,1.30)
Disability Interaction: HCC85 Congestive Heart Failure	7.07	1.01	(0.95,1.07)	7.08	0.98	(0.92,1.04)	7.07	0.99	(0.95,1.04)
Disability Interaction: HCC157 Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	0.43	0.93	(0.71,1.22)	0.46	1.17	(0.88,1.55)	0.45	1.04	(0.86,1.27)
Disability Interaction: HCC158 Pressure Ulcer of Skin with Full Thickness Skin Loss	0.48	1.07	(0.84,1.36)	0.48	1.01	(0.80,1.28)	0.48	1.03	(0.87,1.22)
Disability Interaction: HCC161 Chronic Ulcer of Skin, Except Pressure	2.66	1.02	(0.92,1.14)	2.65	1.04	(0.93,1.15)	2.66	1.03	(0.96,1.11)
Disability Interaction: HCC176 Complications of Specified Implanted Device or Graft	2.25	0.99	(0.92,1.06)	2.30	1.03	(0.96,1.11)	2.27	1.01	(0.96,1.06)
Number of Chronic Conditions: 0-2	44.34	0.99	(0.92,1.07)	44.46	1.01	(0.94,1.08)	44.40	1.00	(0.95,1.05)

	2014–2015 development sample n = 13,960				2014–2015 validation sample n = 13,900				2014–2015 full sample N = 27,860		
Risk factor	Percentage of dual eligible beneficiaries with this risk factor	IRR	IRR (95% CI)		Percentage of dual eligible beneficiaries with this risk factor	IRR	IRR (95% CI)		Percentage of dual eligible beneficiaries with this risk factor	IRR	IRR (95% CI)
Number of Chronic Conditions: 3-5	24.59	1.02	(0.93,1.11)		24.56	1.03	(0.94,1.12)		24.57	1.02	(0.96,1.09)
Number of Chronic Conditions: 6-10	8.82	1.05	(0.92,1.19)		8.79	1.02	(0.90,1.16)		8.81	1.03	(0.94,1.13)
Number of Chronic Conditions: 11+	1.01	1.04	(0.86,1.26)		1.02	1.02	(0.84,1.23)		1.02	1.03	(0.90,1.18)

Source: Mathematica analysis of Dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: Expected values are generated from the risk-adjustment model. Observed values are the unadjusted, actual measurements.

Sample: Full sample for the HCBS users with at least one acute ACSC admission (n = 27,860).

ACSC = ambulatory care sensitive conditions

CI = confidence interval

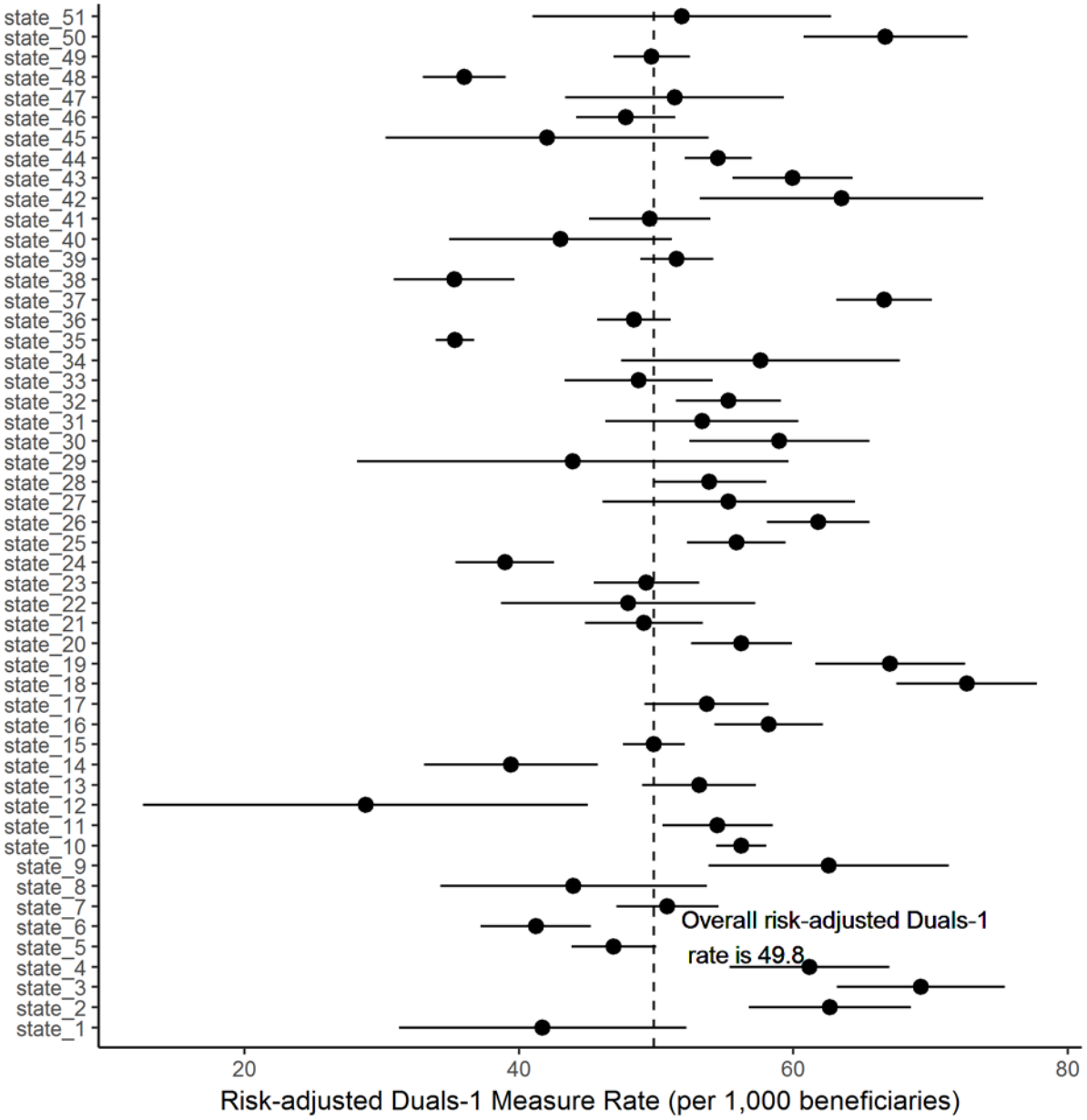
HCBS = home and community-based services

IRR = Incidence rate ratio.

APPENDIX F

Meaningful Differences by States

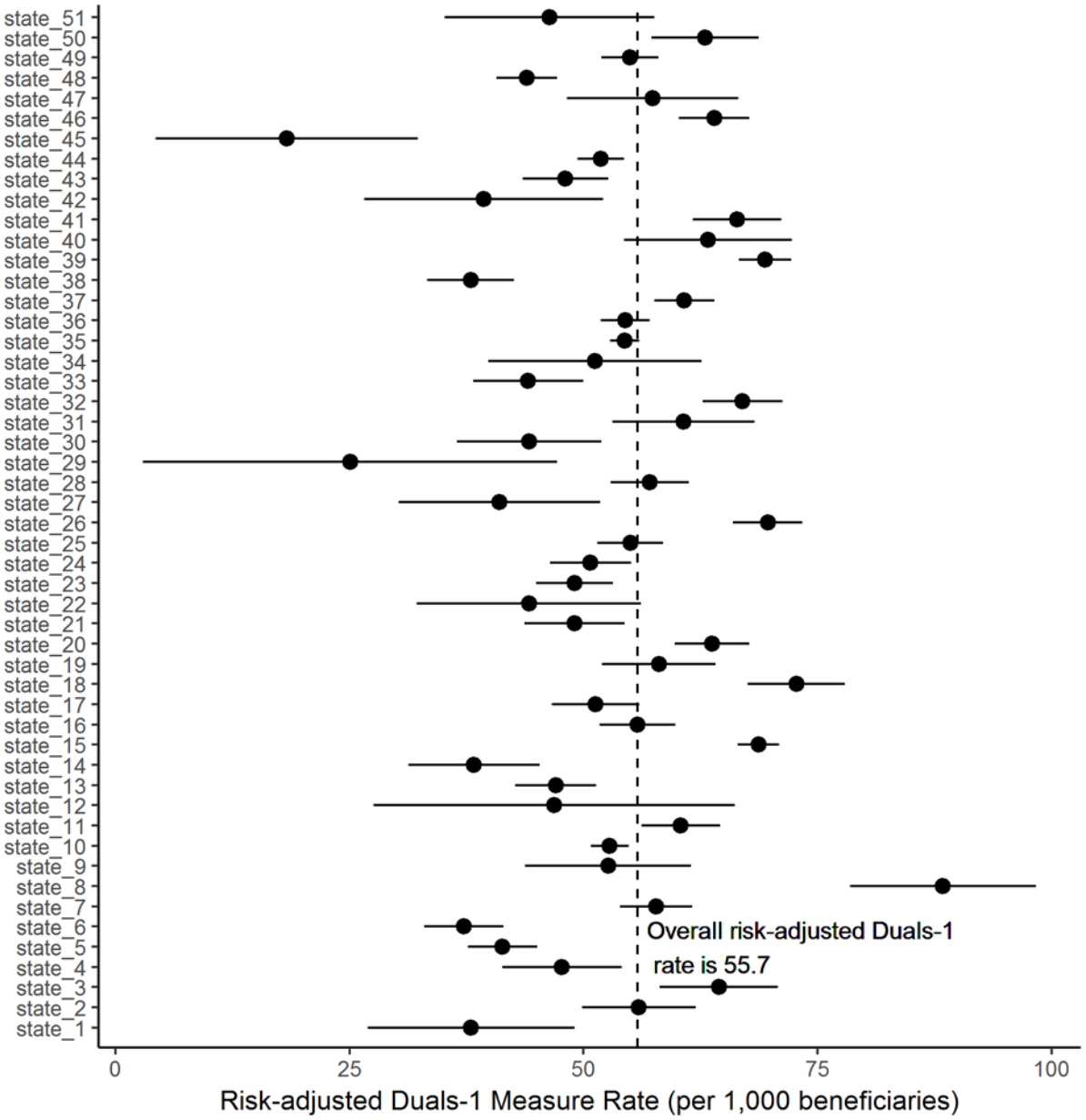
Figure F.1. Distribution of state-level measure performance for acute ACSC in HCBS beneficiaries



Source: Mathematica analysis of Dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: State-level composite rate indicated by data points, state-level composite rate 95 percent confidence interval indicated by horizontal lines, overall composite state-level composite rate indicated by vertical dashed line.

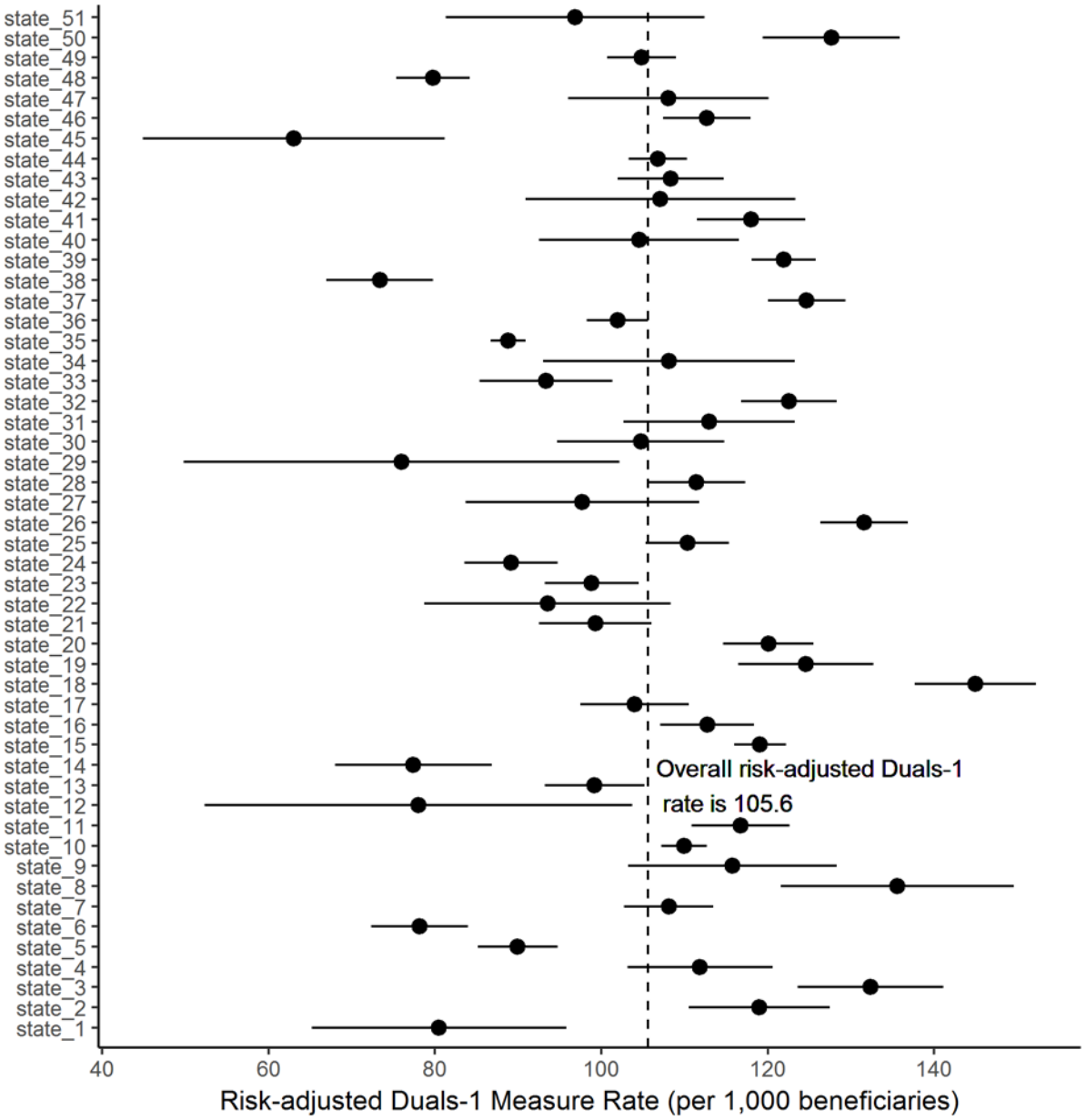
Figure F.2. Distribution of state-level measure performance for chronic ACSC in HCBS beneficiaries



Source: Mathematica analysis of Dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: State-level composite rate indicated by data points, state-level composite rate 95 percent confidence interval indicated by horizontal lines, overall composite state-level composite rate indicated by vertical dashed line.

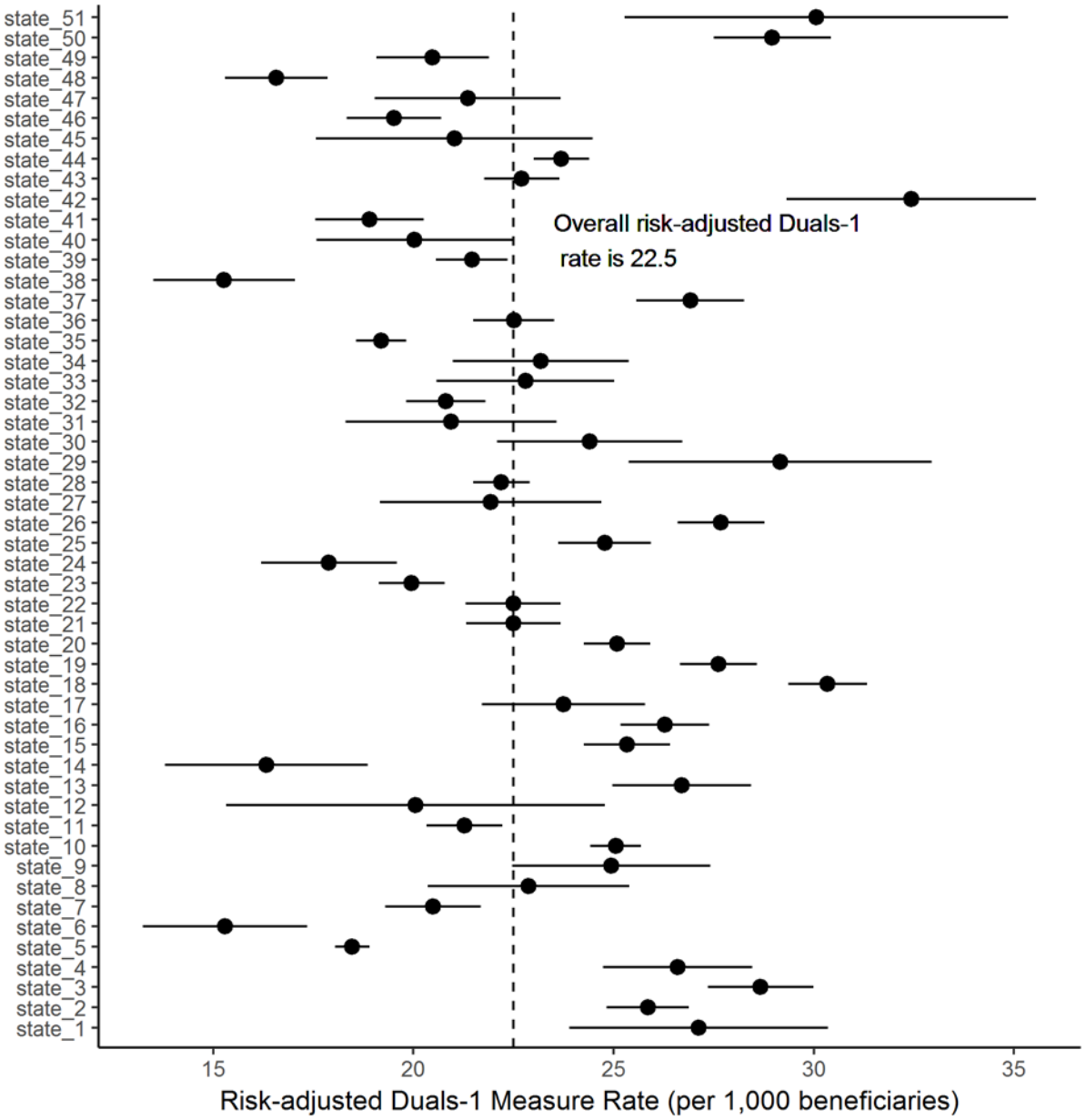
Figure F.3. Distribution of state-level measure performance for total ACSC in HCBS beneficiaries



Source: Mathematica analysis of Dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: State-level composite rate indicated by data points, state-level composite rate 95 percent confidence interval indicated by horizontal lines, overall composite state-level composite rate indicated by vertical dashed line.

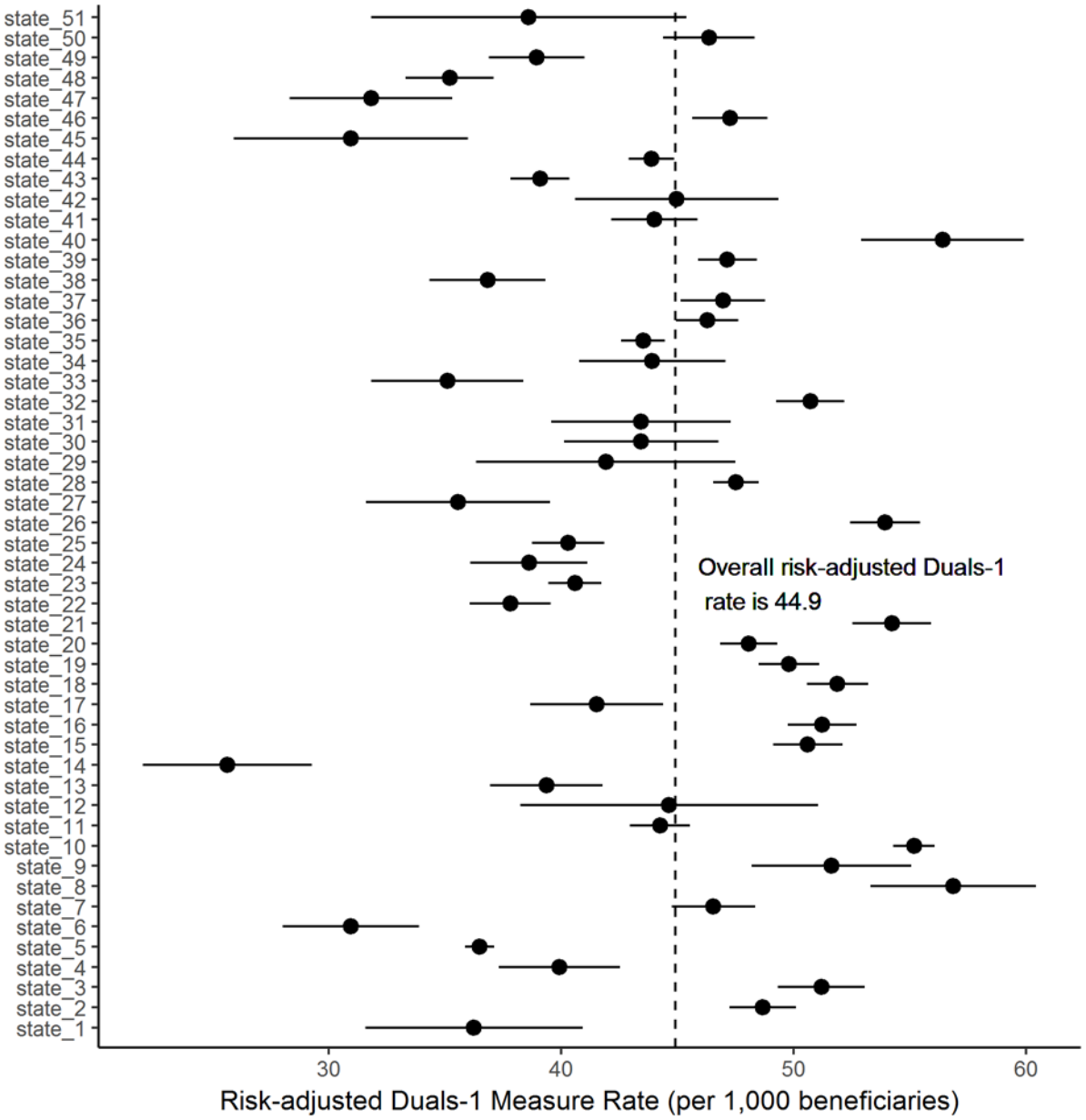
Figure F.4. Distribution of state-level measure performance for acute ACSC in non-HCBS beneficiaries



Source: Mathematica analysis of Dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: State-level composite rate indicated by data points, state-level composite rate 95 percent confidence interval indicated by horizontal lines, overall composite state-level composite rate indicated by vertical dashed line.

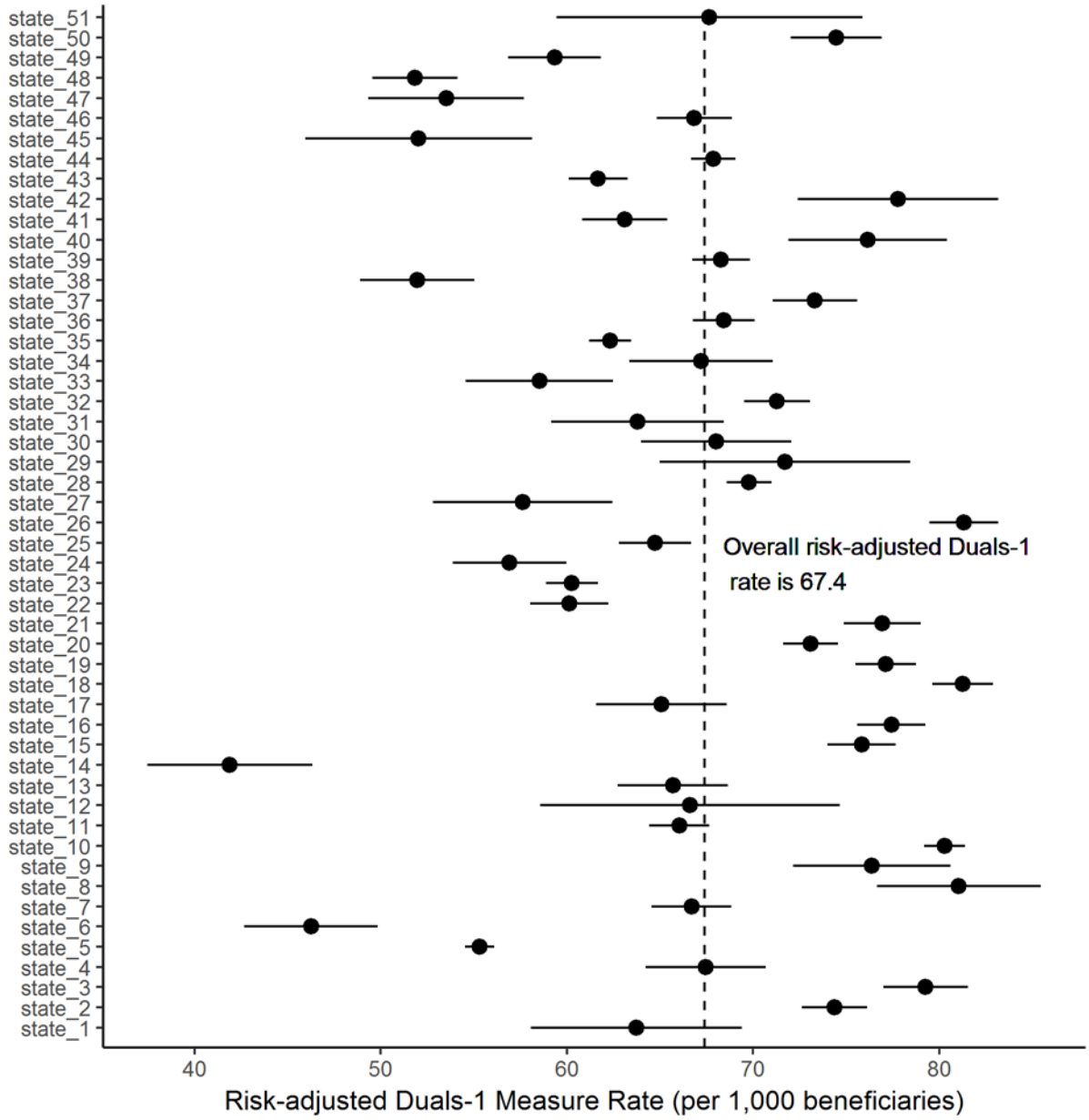
Figure F.5. Distribution of state-level measure performance for Chronic ACSC in non-HCBS beneficiaries



Source: Mathematica analysis of Dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: State-level composite rate indicated by data points, state-level composite rate 95 percent confidence interval indicated by horizontal lines, overall composite state-level composite rate indicated by vertical dashed line.

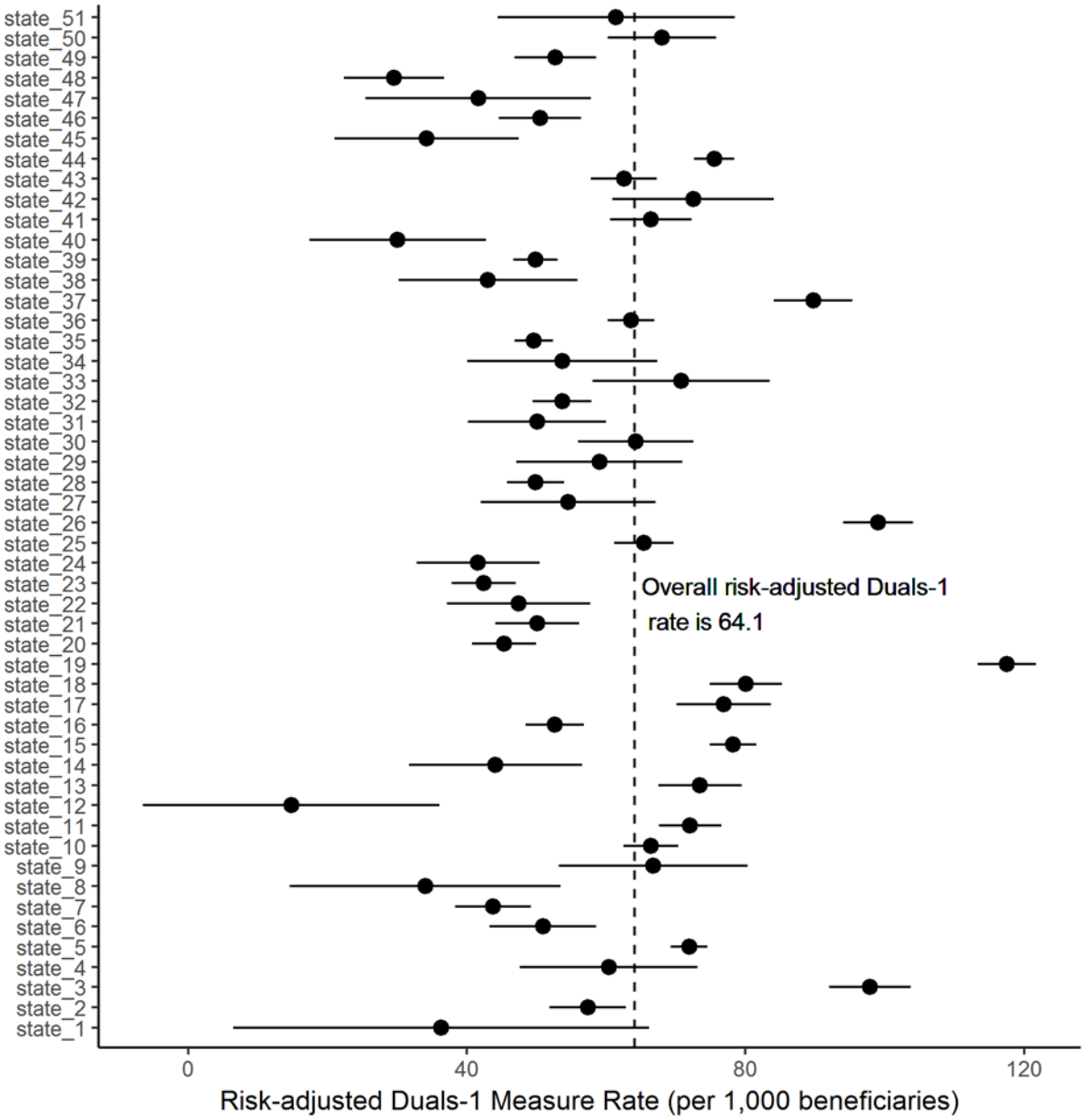
Figure F.6. Distribution of state-level measure performance for Total ACSC in non-HCBS beneficiaries



Source: Mathematica analysis of Dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: State-level composite rate indicated by data points, state-level composite rate 95 percent confidence interval indicated by horizontal lines, overall composite state-level composite rate indicated by vertical dashed line.

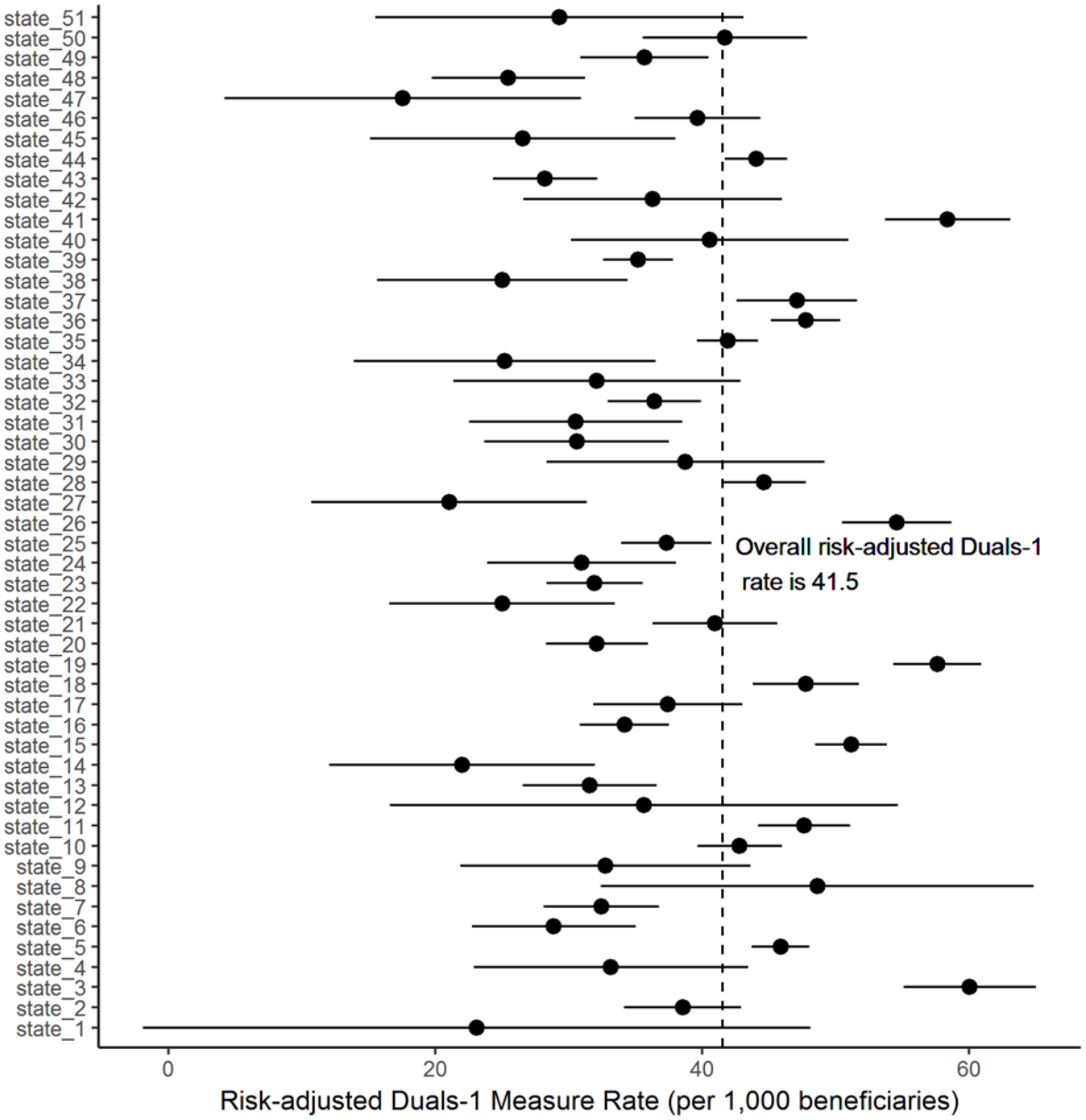
Figure F.7. Distribution of state-level measure performance for acute ACSC in institutionalized beneficiaries



Source: Mathematica analysis of Dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: State-level composite rate indicated by data points, state-level composite rate 95 percent confidence interval indicated by horizontal lines, overall composite state-level composite rate indicated by vertical dashed line.

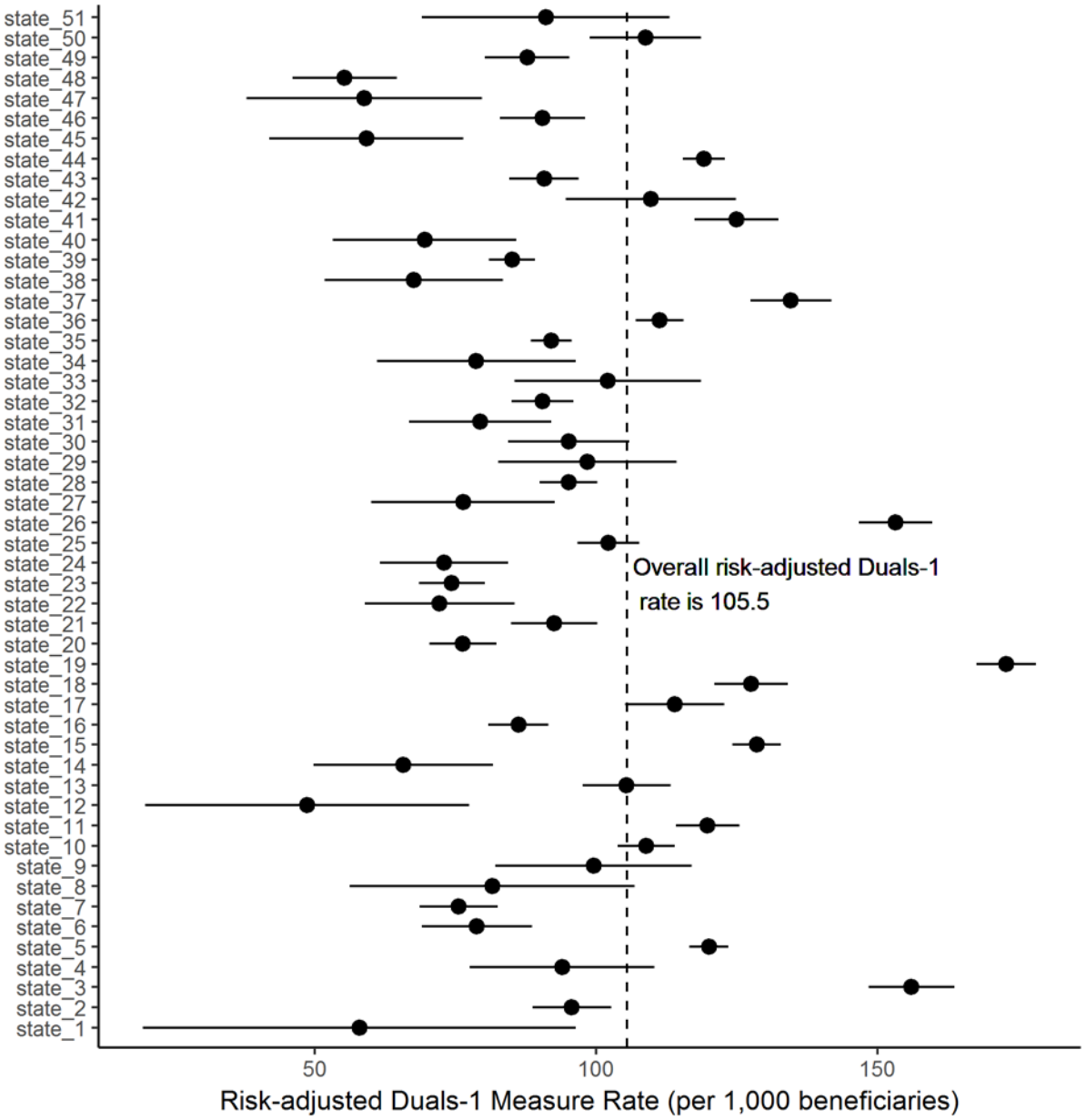
Figure F.8. Distribution of state-level measure performance for chronic ACSC in institutionalized beneficiaries



Source: Mathematica analysis of Dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: State-level composite rate indicated by data points, state-level composite rate 95 percent confidence interval indicated by horizontal lines, overall composite state-level composite rate indicated by vertical dashed line.

Figure F.9. Distribution of state-level measure performance for total ACSC in institutionalized beneficiaries



Source: Mathematica analysis of Dual eligible beneficiaries with at least 18 months of FFS and dual eligible enrollment from April 1, 2014 through September 30, 2015, and Medicare FFS discharges from October 1, 2014 through September 30, 2015.

Note: State-level composite rate indicated by data points, state-level composite rate 95 percent confidence interval indicated by horizontal lines, overall composite state-level composite rate indicated by vertical dashed line.

3. Feasibility

Extent to which the specifications including measure logic, require data that are readily available or could be captured without undue burden and can be implemented for performance measurement.

3a. Byproduct of Care Processes

For clinical measures, the required data elements are routinely generated and used during care delivery (e.g., blood pressure, lab test, diagnosis, medication order).

3a.1. Data Elements Generated as Byproduct of Care Processes.

Coded by someone other than person obtaining original information (e.g., DRG, ICD-9 codes on claims).

If other:

3b. Electronic Sources

The required data elements are available in electronic health records or other electronic sources. If the required data are not in electronic health records or existing electronic sources, a credible, near-term path to electronic collection is specified.

3b.1. To what extent are the specified data elements available electronically in defined fields (*i.e., data elements that are needed to compute the performance measure score are in defined, computer-readable fields*) Update this field for **maintenance of endorsement**.

ALL data elements are in defined fields in electronic claims.

3b.2. If ALL the data elements needed to compute the performance measure score are not from electronic sources, specify a credible, near-term path to electronic capture, OR provide a rationale for using other than electronic sources. For **maintenance of endorsement**, if this measure is not an eMeasure (eCQM), please describe any efforts to develop an eMeasure (eCQM).

3b.3. If this is an eMeasure, provide a summary of the feasibility assessment in an attached file or make available at a measure-specific URL. Please also complete and attach the NQF Feasibility Score Card.

Attachment:

3c. Data Collection Strategy

Demonstration that the data collection strategy (e.g., source, timing, frequency, sampling, patient confidentiality, costs associated with fees/licensing of proprietary measures) can be implemented (e.g., already in operational use, or testing demonstrates that it is ready to put into operational use). For eMeasures, a feasibility assessment addresses the data elements and measure logic and demonstrates the eMeasure can be implemented or feasibility concerns can be adequately addressed.

3c.1. Required for maintenance of endorsement. Describe difficulties (as a result of testing and/or operational use of the measure) regarding data collection, availability of data, missing data, timing and frequency of data collection, sampling, patient confidentiality, time and cost of data collection, other feasibility/implementation issues.

IF instrument-based, consider implications for both individuals providing data (patients, service recipients, respondents) and those whose performance is being measured.

This is a new measure and has not yet been implemented. However, the testing of this measure did not suggest any feasibility issues, as the datasets used to conduct the analyses are defined fields in electronic claims and had minimal missing data.

3c.2. Describe any fees, licensing, or other requirements to use any aspect of the measure as specified *(e.g., value/code set, risk model, programming code, algorithm)*.

Value sets included in the attached Value Set Directory (VSD) are developed by and are owned by the National Committee for Quality Assurance ("NCQA"). NCQA holds a copyright in the value sets and may rescind or alter the value sets at any time. Users shall not have the right to alter, enhance or otherwise modify the value sets, and shall not disassemble, recompile or reverse engineer the value sets. Anyone desiring to use or reproduce the value sets without modification for a non-commercial purpose may do so without obtaining any approval from NCQA. All commercial uses or requests for alteration must be approved by NCQA and are subject to a license at the discretion of NCQA. The value sets are provided "as is" without warranty of any kind.

Proprietary coding is contained in the attached list of codes. Users of the proprietary code sets should obtain all necessary licenses from the owners of these code sets.

4. Usability and Use

Extent to which potential audiences (e.g., consumers, purchasers, providers, policy makers) are using or could use performance results for both accountability and performance improvement to achieve the goal of high-quality, efficient healthcare for individuals or populations.

4a. Accountability and Transparency

Performance results are used in at least one accountability application within three years after initial endorsement and are publicly reported within six years after initial endorsement (or the data on performance results are available). If not in use at the time of initial endorsement, then a credible plan for implementation within the specified timeframes is provided.

4.1. Current and Planned Use

NQF-endorsed measures are expected to be used in at least one accountability application within 3 years and publicly reported within 6 years of initial endorsement in addition to performance improvement.

Specific Plan for Use	Current Use (for current use provide URL)
Public Reporting Quality Improvement (external benchmarking to organizations) Quality Improvement (Internal to the specific organization)	

4a1.1 For each CURRENT use, checked above (update for maintenance of endorsement), provide:

- Name of program and sponsor
- Purpose
- Geographic area and number and percentage of accountable entities and patients included
- Level of measurement and setting

Not applicable. This is a new measure which has not yet been implemented.

4a1.2. If not currently publicly reported OR used in at least one other accountability application (e.g., payment program, certification, licensing) what are the reasons? (*e.g., Do policies or actions of the developer/steward or accountable entities restrict access to performance results or impede implementation?*)

The measure under evaluation is a newly developed measure which has not yet been implemented. The measure is intended for use by states. Testing used all available data without missing data elements in 50 states and the District of Columbia. Although this is a new measure, results from testing suggest that the measure is feasible, usable, and effective.

As with all measures, there may be unintended consequences. For this measure, unintended consequences could include: (1) the incentive to keep patients in the outpatient setting when inpatient admission may be appropriate, and (2) to transfer patients to another inpatient facility.

In order to minimize these unintended consequences, the measure excludes hospitalizations that are transfers from another acute care facility, and it excludes hospitalizations for patients that have other related conditions for which hospitalization could be appropriate.

4a1.3. If not currently publicly reported OR used in at least one other accountability application, provide a credible plan for implementation within the expected timeframes -- any accountability application within 3 years and publicly reported within 6 years of initial endorsement. (*Credible plan includes the specific program, purpose, intended audience, and timeline for implementing the measure within the specified timeframes. A plan for accountability applications addresses mechanisms for data aggregation and reporting.*)

This is a new measure which has not yet been implemented. This measure is planned for implementation in CMS Financial Alignment Initiative (FAI) core measure set for Medicare-Medicaid Plans (MMPs). This set of measures is used to monitor and evaluate the quality of care provided in MMPs participating in the FAI. These measures will be publicly reported and used for quality improvement. At a future point, this measure could also be used for payment incentives as part of a quality withhold arrangement and for states participating in the Managed fee-for-service arm of the FAI demonstration.

4a2.1.1. Describe how performance results, data, and assistance with interpretation have been provided to those being measured or other users during development or implementation.

How many and which types of measured entities and/or others were included? If only a sample of measured entities were included, describe the full population and how the sample was selected.

Measure specification and performance results from testing have been presented to a Technical Expert Panel (TEP) a clinical workgroup, and risk-adjustment workgroup. The measure specifications also received feedback from two health plans through a three-week public comment period hosted on CMS's online public comment system.

Measure performance results specific to each state were not provided back to state agencies. However, representatives from states participated in the TEP and workgroup described above and provided feedback on the measure importance and construction.

4a2.1.2. Describe the process(es) involved, including when/how often results were provided, what data were provided, what educational/explanatory efforts were made, etc.

During measure development, the clinical workgroup was convened twice to provide input on the measure specification and testing results, the risk-adjustment workgroup was convened once to provide input on the specification and risk adjustment model, and the TEP was convened once to provide input on the measure specification following testing. Members were presented with the measure description, intent, detailed specifications, and findings (from testing). The risk-adjustment workgroup was provided additional information related to risk factors and the risk-adjustment model. Materials posted for public comment included the measure specification and justification, as well as questions related to importance, use, and denominator population/exclusions.

4a2.2.1. Summarize the feedback on measure performance and implementation from the measured entities and others described in 4d.1.

Describe how feedback was obtained.

Feedback from the workgroup and TEP was obtained with open discussion following presentation of the measure specification and testing results. For the TEP, we also distributed a survey to the members following the presentation to ask about potential alternative methods of constructing the measure.

Feedback on the measure was also received through a three-week public comment period hosted on CMS's online public comment system. The public comment period was open and broadcast to all interested parties, including state agencies.

4a2.2.2. Summarize the feedback obtained from those being measured.

Not applicable. Measure performance results specific to each state were not provided to state agencies.

4a2.2.3. Summarize the feedback obtained from other users

Public commenters requested the measure be harmonized with existing measures and made suggestions for revisions to the specification. Specifically, one commenter recommended removing bacterial pneumonia and

chronic obstructive pulmonary disease (COPD) from the numerator and two commenters recommended including neurological diseases, cognitive impairments, and infection from knee, hip, and joint replacements.

The clinical workgroup provided feedback on conditions included in the numerator, exclusions, stratification, and how to handle admissions from non-acute inpatient facilities (SNFs and inpatient rehabilitation facilities).The workgroup agreed with the inclusion of diabetes, hypertension, COPD, asthma, bronchitis, congestive heart failure, urinary tract infection (UTI), pressure ulcer, cellulitis, bacterial pneumonia, but recommended not including dehydration in the acute composite. There was also general consensus to include admissions from skilled nursing facilities and custodial nursing facilities in the measure. The workgroup supported the exclusion of hospice and acute to acute transfers but did not support the exclusion of end stage renal disease (ESRD), and suggested excluding those that are immunocompromised, pending a clear definition for this population. The workgroup supported the stratification of the measure into three groups (community-dwelling non-HCBS users, community-dwelling HCBS-users and institutional dwelling). The workgroup's consensus was that if the groups are relatively stable, use of status at the beginning of the year was sufficient but should be clearly explained in the definition.

The risk-adjustment workgroup provided feedback on the specifications, risk factors and model development. They suggested UTI be excluded from the numerator conditions due to concerns about UTI prevalence dominating the acute composite. For risk factor selection, the workgroup recommended including risk factors capturing disability and excluding area-level socioeconomic status indicators from the set. They also suggested prioritizing clinical rationale over the results of interactive statistical testing in choosing risk factors. The workgroup recommended using a two-step regression model method in developing the risk-adjustment model and estimating an R-squared measure to assess model fit.

The TEP provided feedback on the conditions to include in the numerator and whether immunocompromised populations should be excluded. TEP members had divergent opinions regarding whether urinary tract infections (UTIs) should be included among the ACSCs in the measure, with some members noting individuals with immunocompromised conditions (e.g., organ transplant, HIV), who are at higher risk of infection and therefore are more likely to be hospitalized at a low threshold of illness, should be included in the measure. The TEP agreed that the measure should account for this population but had mixed opinions regarding whether this should be addressed through a measure stratification or risk adjustment.

4a2.3. Describe how the feedback described in 4a2.2.1 has been considered when developing or revising the measure specifications or implementation, including whether the measure was modified and why or why not.

Feedback received from the TEP, workgroup, and public comment were incorporated into the testing plan and final measure specifications:

Public commenters requested the measure be harmonized with existing measures and made suggestions for revisions to the specification. We worked to harmonize this measure with similar measures (i.e., AHRQ Prevention Quality Indicator [PQI] and HEDIS Hospitalization for Potentially Preventable Complications [HPC]) and communicated with CMS programs to identify how the measure could be harmonized with measures in these reporting programs. We reviewed the suggested changes to numerator conditions and stratifications with our clinical workgroup and TEP. We did not add the additional conditions, as this would reduce harmonization with the PQI and HPC, and we did not remove COPD due to workgroup and TEP feedback. Other comments and requests for clarifications were responded to with a public posting following the close of the public comment period.

Input from the workgroups and TEP was used to finalize the measure specification including numerator conditions and exclusions. Analyses completed for risk factor selection and model development aligned with the suggestions of the risk-adjustment workgroup. Because of the groups' feedback and results of testing, we excluded beneficiaries with a diagnosis code indicating an immunocompromised state, we finalized the list of conditions in the composite (including UTI but not including dehydration), excluded acute-to-acute facility transfers, and stratified the measure by HCBS status given the relative stability of beneficiaries' status over the

measurement period. We did not exclude UTI from the numerator conditions (recommended by the risk-adjustment workgroup) due to input from the clinical workgroup and TEP. These changes help the measure to align with the measure's intent and minimize unintended consequences.

Improvement

Progress toward achieving the goal of high-quality, efficient healthcare for individuals or populations is demonstrated. If not in use for performance improvement at the time of initial endorsement, then a credible rationale describes how the performance results could be used to further the goal of high-quality, efficient healthcare for individuals or populations.

4b1. Refer to data provided in 1b but do not repeat here. Discuss any progress on improvement (trends in performance results, number and percentage of people receiving high-quality healthcare; Geographic area and number and percentage of accountable entities and patients included.)

If no improvement was demonstrated, what are the reasons? If not in use for performance improvement at the time of initial endorsement, provide a credible rationale that describes how the performance results could be used to further the goal of high-quality, efficient healthcare for individuals or populations.

This measure is not yet implemented, so longitudinal data is not available. Measurement of hospitalization due to ambulatory care sensitive conditions can provide valuable information to health plans, consumers, and stakeholders as to how well a system of care helps individuals' access resources to prevent hospitalizations (i.e., treatment in outpatient settings). Performance results can be used to help health plans identify areas for improvement and target interventions to dual eligible beneficiaries who may be at an increased risk for hospitalization. The health plan can play a central role in improving hospitalization rates by increasing access to ambulatory care and improving care coordination. Earlier identification of complications from acute or chronic conditions and initiation of or referral to treatment can reduce hospitalization rates, improve quality of life, and reduce risk of hospital-related adverse events.

4b2. Unintended Consequences

The benefits of the performance measure in facilitating progress toward achieving high-quality, efficient healthcare for individuals or populations outweigh evidence of unintended negative consequences to individuals or populations (if such evidence exists).

4b2.1. Please explain any unexpected findings (positive or negative) during implementation of this measure including unintended impacts on patients.

Not applicable. This measure is not yet implemented.

4b2.2. Please explain any unexpected benefits from implementation of this measure.

Not applicable. This measure is not yet implemented.

5. Comparison to Related or Competing Measures

If a measure meets the above criteria and there are endorsed or new related measures (either the same measure focus or the same target population) or competing measures (both the same measure focus and the same target population), the measures are compared to address harmonization and/or selection of the best measure.

5. Relation to Other NQF-endorsed Measures

Are there related measures (conceptually, either same measure focus or target population) or competing measures (conceptually both the same measure focus and same target population)? If yes, list the NQF # and title of all related and/or competing measures.

Yes

5.1a. List of related or competing measures (selected from NQF-endorsed measures)

2886: Risk-Standardized Acute Admission Rates for Patients with Heart Failure

2887: Risk-Standardized Acute Admission Rates for Patients with Diabetes

2888: Risk-Standardized Acute Admission Rates for Patients with Multiple Chronic Conditions

5.1b. If related or competing measures are not NQF endorsed please indicate measure title and steward.

In addition to the NQF-endorsed related measures described above, there are three measures which are not NQF-endorsed that are related because they focus on hospitalization for ACSC:

(1) 2017 HEDIS HPC: Hospitalization for Potentially Preventable Complications specified for older adults in Medicare Advantage Plans (HEDIS-HPC); NCQA

(2) AHRQ PQI Composite: AHRQ Prevent Quality Indicator Composites used to describe hospitalization for ACSC at the state and regional level (AHRQ PQI), and

(3) CMS HCBS ACSC: Hospitalization for ambulatory care sensitive conditions for Medicaid beneficiaries using home and community-based services (HCBS) specified for state-level reporting (CMS HCBS).

5a. Harmonization of Related Measures

The measure specifications are harmonized with related measures;

OR

The differences in specifications are justified

5a.1. If this measure conceptually addresses EITHER the same measure focus OR the same target population as NQF-endorsed measure(s):

Are the measure specifications harmonized to the extent possible?

Yes

5a.2. If the measure specifications are not completely harmonized, identify the differences, rationale, and impact on interpretability and data collection burden.

This measure is related to several NQF-endorsed measures which examine hospitalization in different populations. The most closely related measures look at all cause hospitalization in specific high-risk populations.

- NQF #2887: Rate of risk-standardized acute, unplanned hospital admissions among Medicare fee-for-service (FFS) patients 65 years and older with diabetes
- NQF #2886: Rate of risk-standardized acute, unplanned hospital admissions among Medicare fee-for-service (FFS) patients 65 years and older with heart failure
- NQF #2888: Rate of risk-standardized acute, unplanned hospital admissions among Medicare fee-for-service (FFS) patients 65 years and older with multiple chronic conditions (MCCs)

These measures are related because they focus on hospitalization but are not competing because they do not focus specifically on hospitalization for ambulatory care sensitive conditions. These measures include all-cause hospitalization including those which may be related to trauma or events unrelated to the underlying chronic condition, unlike the proposed measure. These measures also focus on a different population, older adults in Medicare FFS, and dual eligible beneficiaries age 18 years and older in the Hospitalization for Ambulatory Care Sensitive Conditions for Dual Eligible Beneficiaries measure. The related measures above are also specified for a different setting (ACO) in contrast to this measure (state). Overall the measures serve different purposes – providing information about potentially preventable hospitalization in the Hospitalization for Ambulatory Care Sensitive Conditions for Dual Eligible Beneficiaries measure and providing information about overall unplanned hospital utilization in the related measures. In addition to the NQF-endorsed related measures described above, there are three measures which are not NQF-endorsed that are related because they focus on hospitalization for ACSC: (1) 2017 HEDIS HPC: Hospitalization for Potentially Preventable Complications specified for older adults in Medicare Advantage Plans (HEDIS-HPC), (2) AHRQ PQI Composite: AHRQ Prevent Quality Indicator Composites used to describe hospitalization for ACSC at the state and regional level (AHRQ PQI), and (3) CMS HCBS ACSC: Hospitalization for ambulatory care sensitive conditions for Medicaid beneficiaries using home and community-based services (HCBS) specified for state-level reporting (CMS HCBS). These related measures were used as the basis for this measure and therefore are harmonized where

appropriate. In the testing attachment (section 2d2.1) we describe in greater detail the decisions that were made to deviate from the specifications for these measures at the time of development. Below is a list of how the measures deviate:

- This measure includes two conditions which are more prevalent in the elderly and institutional-dwelling population which are included in the 2017 HEDIS-HPC measure but not in the AHRQ PQI or CMS HCBS measures: cellulitis and pressure ulcers.
- This measure does not include dehydration which is not included in the 2017 HEDIS-HPC measure but is included in the AHRQ PQI and CMS HCBS measures (see Testing Attachment section 2d2.1 for rationale).
- This measure includes all dual eligible beneficiaries age 18 years and older, which is similar to the AHRQ PQI and CMS HBCS measures which include all adults age 18 years and older; the 2017 HEDIS HPC measure is specific only to older adults.
- This measure counts all hospitalizations for the denominator population similar to the 2017 HEDIS-HPC and CMS HCBS measure. The AHRQ PQI composite only counts one hospitalization per person in the denominator (i.e., if someone is hospitalized for an ACSC more than once in the measurement year, only one hospitalization is counted toward the numerator).
- This measure includes all hospital admissions including those from the institutional setting. All three related measures exclude these hospital admissions.
- The risk-adjustment approach for this measure follows the same approach from the 2017 HEDIS-HPC measure but is specific to the dual eligible population.
- This measure is stratified by use of long-term services and supports. All three related measures are not stratified.

5b. Competing Measures

The measure is superior to competing measures (e.g., is a more valid or efficient way to measure);
OR
Multiple measures are justified.

5b.1. If this measure conceptually addresses both the same measure focus and the same target population as NQF-endorsed measure(s):

Describe why this measure is superior to competing measures (e.g., a more valid or efficient way to measure quality); OR provide a rationale for the additive value of endorsing an additional measure. (Provide analyses when possible.)

There are no competing NQF-endorsed measures.

Appendix

A.1 Supplemental materials may be provided in an appendix. All supplemental materials (such as data collection instrument or methodology reports) should be organized in one file with a table of contents or bookmarks. If material pertains to a specific submission form number, that should be indicated. Requested information should be provided in the submission form and required attachments. There is no guarantee that supplemental materials will be reviewed.

Attachment Attachment: Duals1_Testing_Appendix_6_28_18_CLEAN.docx

Contact Information

Co.1 Measure Steward (Intellectual Property Owner): Centers for Medicare and Medicaid Services

Co.2 Point of Contact: Roxanne, Dupert-Frank, Roxanne.Dupert-Frank@cms.hhs.gov, 410-786-9667-

Co.3 Measure Developer if different from Measure Steward: Mathematica Policy Research

Co.4 Point of Contact: Henry, Ireys, HIreys@mathmatica-mpr.com, 202-554-7536-

Additional Information

Ad.1 Workgroup/Expert Panel involved in measure development

Provide a list of sponsoring organizations and workgroup/panel members' names and organizations. Describe the members' role in measure development.

ACSC Clinical Advisory Workgroup (July and October 2016) – advised on the measure development and testing:

1. Cheryl Phillips, MD – Senior Vice President, Public Policy and Health Services, Leading Age (TEP member)
2. Mary Barton, MD – Vice President, Performance Measurement, National Committee for Quality Assurance (CAP member)
3. Judy Bigby, MD – Senior Fellow, Mathematica Policy Research (CAP member)
4. Arlene Bierman, MD – Director, Center for Evidence and Practice Improvement, Agency for Healthcare Research and Quality
5. Carol Stocks, PhD, RN – Division of Healthcare Delivery Data, Measures and Research, Center for Delivery, Organization and Markets, Agency for Healthcare Research and Quality
6. Steven Phillips, MD – Medical Director, Sanford Center for Aging, University of Nevada, Reno
7. Sigrid Bergenstein, NP – Commonwealth Community Care Duals/HCBS Technical Expert Panel (TEP) (November 2016) – advised on the measure development and testing:

1. Ann Hwang (Community Catalyst)
2. Ari Houser (American Association of Retired Persons)
3. Balu Gadhe (CareMore)
4. Dennis Heaphy (Disability Policy Consortium)
5. Mary Lou Bourne (National Association of State Directors of Developmental Disabilities Services)
6. Joe Caldwell (National Council on Aging)
7. Steve Guenthner (Almost Family, Inc.)
8. Lisa Iezzoni (Massachusetts General Hospital Health Policy Center)
9. Raina Josberger (New York State Department of Health)
10. Patricia Kirkpatrick (AmeriGroup Corporation)
11. Bonnie Marsh (Health Services Advisory Group)
12. Diane McComb (American Network of Community Options and Resources)
13. Lauren Murray (National Partnership for Women and Families)
14. Pamela Parker (Independent Consultant-Integrated Care)
15. Cheryl Phillips (LeadingAge)
16. Maggie Nygren (American Association for People with Disabilities)
17. RoAnne Chaney (Michigan Disability Rights Coalition)
18. Carol Raphael (Manatt Health Solutions)
19. Jason Rachel (Virginia Department of Medical Assistance Services)
20. Brian Abery (University of Minnesota)

21. Val Bradley (Human Services Research Institute)

Risk-Adjustment Workgroup (March 2017) – advised on risk factor selection and model development:

1. Marguerite Burns, Ph.D., assistant professor, University of Wisconsin School of Medicine and Public Health
2. Ezra Golberstein, Ph.D., associate professor, University of Minnesota School of Public Health
3. Lisa Iezzoni, M.D., M.Sc., professor, Harvard Medical School (TEP member)
4. Joanna Jiang, Ph.D., senior social scientist, Agency for Healthcare Research and Quality
5. Zhenqiu Lin, Ph.D., director of data management and analytics, Center for Outcomes Research and Evaluation, Yale University
6. Patrick Romano, M.D., professor, University of California, Davis, School of Medicine
7. Jonathan Shaw, M.D., M.S., clinical assistant professor, Stanford University School of Medicine

Measure Developer/Steward Updates and Ongoing Maintenance

Ad.2 Year the measure was first released:

Ad.3 Month and Year of most recent revision:

Ad.4 What is your frequency for review/update of this measure? Annual

Ad.5 When is the next scheduled review/update for this measure?

Ad.6 Copyright statement: Not applicable. This measure is in the public domain.

Ad.7 Disclaimers: None

Ad.8 Additional Information/Comments: None