

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 #: 3445

Corresponding Measures:

De.2. Measure Title: All-cause inpatient admission rate for Medicaid beneficiaries with complex care needs and high costs (BCNs)

Co.1.1. Measure Steward: Centers for Medicare & Medicaid Services, Centers for Medicaid & CHIP Services

De.3. Brief Description of Measure: All-cause inpatient admission rate for adult Medicaid beneficiaries who meet BCN population eligibility criteria. The measure is calculated as the number of inpatient admissions per 1,000 beneficiary months and is intended to be reported at the state level.

For the purpose of this measure, the BCN population is defined as Medicaid beneficiaries who are age 18 to 64 during the lookback year (the 12 months prior to the measurement year) and the measurement year and have at least one inpatient admission and at least two chronic conditions, as defined by the Chronic Conditions Data Warehouse (CCW), during the lookback year. Beneficiaries dually enrolled in Medicaid and Medicare and beneficiaries who had fewer than 10 months of Medicaid eligibility in the lookback year are not included in the analytic sample because we did not have enough utilization data to include them in testing. We further limited the analytic file to beneficiaries that met the BCN definition criteria described above.

1b.1. Developer Rationale: The BCN population is heterogeneous, with varying medical, behavioral, and psychosocial care needs. Consistent across the BCN population, however, is a pattern of health care consumption characterized by a disproportionately high use of inpatient and ED services, often coupled with underutilization of preventive and other types of outpatient care. We also see significant variation in the BCN-2 measure at the state level (see 1b.2) and by beneficiary subgroups (see 1b.4). Frequent inpatient admissions among BCNs--especially for ambulatory care sensitive conditions--are very costly and may signal poor access to primary care, suboptimal care coordination, and/or lack of supportive services across transitions in care settings. Therefore, measuring and subsequently reducing inpatient admissions through improved care coordination and access to community-based care represents an opportunity to improve both quality and cost of care for BCNs (Agency for Healthcare Research and Quality 2014; Gao et al. 2014; Harris et al. 2016; Lewis et al. 2012; Misky et al. 2010; Peikes et al. 2012; Schrag et al. 2006; Xing et al. 2015). This inpatient admission measure should be paired with the all-cause ED visit measure (BCN-1) under development by CMS/Mathematica to assess overall hospital-based care. Both measures are intended to be used for state-level monitoring and quality improvement activities.

References:

Agency for Healthcare Research and Quality. "Measures of Care Coordination: Potentially Avoidable Hospitalizations." Chartbook on Care Coordination. Rockville, MD: AHRQ, 2015. Available at <https://www.ahrq.gov/research/findings/nhqrdr/2014chartbooks/carecoordination/carecoord-measures3.html>. Accessed July 28, 2016.

Gao, J., E. Moran, Y.F. Li, and P.L. Almenoff. "Predicting Potentially Avoidable Hospitalizations." *Medical Care*, vol. 52, no. 2, 2014, pp. 164–171.

Harris, L.J., I. Graetz, P.S. Podila, J. Wan, T.M. Waters, and J.E. Bailey. "Characteristics of Hospital and Emergency Care Super-Utilizers with Multiple Chronic Conditions." *Journal of Emergency Medicine*, vol. 50, no. 4, 2016, pp. 203–214.

Lewis, V.A., B.K. Larson, A.B. McClurg, R.G. Boswell, and E.S. Fisher. "The Promise and Peril of Accountable Care for Vulnerable Populations: A Framework for Overcoming Obstacles." *Health Affairs*, vol. 31, no. 8, 2012.

Misky, G.J., H.L. Wald, and E.A. Coleman. "Post-Hospitalization Transitions: Examining the Effects of Timing of Primary Care Provider Follow-Up." *Journal of Hospital Medicine*, vol. 5, no. 7, 2010, pp. 392–397.

Peikes, D., A. Zutshi, J. Genevro, K. Smith, M. Parchman, and D. Meyers. "Early Evidence on the Patient-Centered Medical Home." AHRQ Publication no. 12-0020-EF. Rockville, MD: Agency for Healthcare Research and Quality, February 2012.

Xing, J., C. Goehring, and D. Mancuso. "Care Coordination Program for Washington State Medicaid Enrollees Reduced Inpatient Hospital Costs." *Health Affairs*, vol. 34, no. 4, 2015, pp. 653–661.

S.4. Numerator Statement: The sum of unique inpatient admissions and observation stays in the measurement year among adult Medicaid beneficiaries who meet BCN population eligibility criteria.

S.6. Denominator Statement: Number of Medicaid-eligible months ("beneficiary months") among adult Medicaid beneficiaries who meet BCN population eligibility criteria.

S.8. Denominator Exclusions: Not applicable

De.1. Measure Type: Outcome

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:

3444: All-cause hospital utilization for Medicaid beneficiaries with complex care needs and high costs (BCNs)

De.4. IF PAIRED/GROUPED, what is the reason this measure must be reported with other measures to appropriately interpret results? BCN-2 is part of a paired measure set titled "All-cause hospital utilization for Medicaid BCNs." The other measure in the pair is all-cause emergency department (ED) utilization rate for BCNs, referred to as "BCN-1." The BCN-1 and BCN-2 measures are intended for voluntary use by states to monitor and improve the quality of care provided to the Medicaid BCN population.

Monitoring BCN-2 in conjunction with the paired indicator for ED visits (BCN-1) can identify meaningful differences in overall hospital utilization and help ensure that reductions in inpatient admissions accurately reflect true increases in quality care. Examining either measure in isolation has the potential to produce inaccurate inferences about states' performance due to the potential for the substitution effect. For example, if an accountable entity decreases ED utilization among the BCN population by keeping patients in the hospital overnight, thus shifting the utilization to an inpatient admission, the ED measure concept alone would understate the accountable entity's overall impact on hospital-based care. Conversely, a successful BCN intervention may decrease inpatient utilization (or the length of an inpatient admission) but increase ED utilization, appearing to have worsened outcomes despite reducing overall rates of hospital-based care. Indeed, several Medicaid BCN initiatives have successfully reduced inpatient admissions but increased ED

utilization. For example, Washington State's Chronic Care Management program resulted in significant reductions in inpatient admissions and spending, and increases in ED utilization, though not at a statistically significant rate (Xing et al. 2015). If measured solely on ED utilization, Washington State might appear to have worsened outcomes, despite reducing overall rates of hospital-based care.

Reference: Xing, J., C. Goehring, and D. Mancuso. "Care Coordination Program for Washington State Medicaid Enrollees Reduced Inpatient Hospital Costs." *Health Affairs*, vol. 34, no. 4, 2015, pp. 653-661.

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 measure of inpatient utilization for Medicaid beneficiaries with complex care needs and high costs (BCNs) assesses a heterogeneous population with disproportionately high use of inpatient and ED use.
- The developer notes that improvement on this outcome may involve strengthening beneficiaries' relationships with health care providers in the community, improved care coordination, and chronic disease management.

Question for the Committee:

o 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 demonstrates an adjusted performance range of 75.4 admissions per 1,000 beneficiary months to 375.2 admissions per 1,000 beneficiary months.

Disparities

The developer examined Medicaid claims data across 10 states and presented a breakdown of performance by a number of subpopulations.

Table of Risk-adjusted measure rate distribution by subgroup

Subgroup	# of Beneficiaries	Weighted Mean	Minimum	25th percentile	50th percentile	75th percentile	Maximum
Aged 18 to 24	17,781	66.88	59.39	60.39	67.03	73.13	485.2
Aged 25 to 44	58,949	83.2	58.43	73.87	82.86	88.88	285.6
Aged 45 to 64	65,463	117	94.48	115.8	117.7	125.7	442.5
Male	49,798	112.4	99.22	106.4	111	120.1	458.1
Female	92,395	88.21	57.77	84.21	90.17	93.27	330.3
White	82,536	83.35	57.85	81.75	86.98	89.73	472.4
Black	41,627	125.5	98.56	115.7	126.9	134.4	304.1
Hispanic	10,647	86.69	0.00	64.24	73.9	81.25	103.4
Other/unknown	7,383	100.5	0.00	83.71	98.51	106.7	287.1
Aged/Blind/Disabled	80,569	124.1	94.22	115.9	126.3	128.3	494.2
Adult	58,450	59.85	44.4	54.94	60.13	103.8	112.6
Child	3,174	42.74	22.21	40.08	57.91	63.53	106.8
1 or more behavioral health conditions	113,051	100.7	78.54	99.51	103.2	106.3	323
No behavioral health conditions	29,142	80.07	64.47	74.72	78.04	84.57	394.7

Source: Mathematica analysis of 2013 and 2014 MAX PS, LT, OT, and IP files.

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

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.

- Comments are the same as for 3443 thanks

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?

- See 3443

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:

This measure was evaluated by the Scientific Methods Panel and discussed on their call. A summary of the measure and the Panel discussion is provided below. This measure is paired with the all-cause emergency department utilization rate for BCNs, referred to as “BCN-1” (measure #3443).

In their preliminary analyses, Methods Panel subgroup members did not reach consensus on the validity of the measure. The discussion for this measure, for the most part, paralleled that of the discussion regarding measure #3443. Specifically, subgroup members expressed concern regarding the risk-adjustment approach, including inclusion of risk factors that are not statistically significant or are “protective” in nature, and also noted that risk of over-fitting was not assessed. Members also were concerned that comparability between state Medicaid populations and the ease of enrollment in Medicaid are potential threats to validity. There was also some concern regarding the construct validation analysis because the external measure used in that analysis targets a different population (Medicare and commercial plan beneficiaries rather than Medicaid plan

beneficiaries). Ultimately, the subgroup did not reach consensus on the validity criterion. The All-Cause Admissions and Readmissions Standing Committee will evaluate this measure in the Fall 2018 cycle.

Standing Committee Action Item(s):

- The Standing Committee will need to discuss validity (particularly the concerns articulated by the Scientific Methods Panel). 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.
- The Standing Committee can discuss reliability or accept the ratings of the Scientific Methods Panel.

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:

- The Scientific Methods Panel did not reach consensus on validity for the measure. Do you have any concerns regarding the validity of the measure (e.g., exclusions, risk-adjustment approach, etc.)?

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

Scientific Acceptability

Measure Number: 3445

Measure Title: All-cause inpatient admission rate for Medicaid beneficiaries with complex care needs and high costs (BCNs)

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.

- Some Methods Panel members expressed concerns about the specifications being precise, unambiguous, and complete.
 - Please note that to be eligible for a moderate rating per NQF’s reliability algorithm submitted specifications must be specifications precise, unambiguous, and complete so that they can be consistently implemented.
- The developer provided several clarifying comments on the measure specifications to address the Methods Panel members concerns.
 - The developer noted that the exclusions in the numerator and denominator description are not measure exclusions. Rather, they reflect the way the analytic file was constructed given that the developer did not have access to Medicare data.
 - The developer noted that when it comes to the testing population, Medicaid beneficiaries who are dual eligible during the lookback or measurement year are excluded, regardless of months of eligibility. Non-dual Medicaid beneficiaries were excluded from the testing population if they had fewer than 10 months of eligibility during the lookback year.
 - The developer also clarified that when it comes to implementation and how states will calculate the measure, dual eligible beneficiaries are included in the measure if they have at least 10 months of Medicaid eligibility during the lookback year. This approach aligns with the Medicaid Core Set.
 - The developer noted that this measure set (BCN-1 NQF #3443 and BCN-2 NQF #3445) targets the Medicaid BCN population. Therefore, ED visits not covered by Medicaid are not intended to be included in the measure
 - A summary of the Methods Panel members feedback is provided in item 2 below. Please note that this summary is intended to inform Standing Committee discussion.

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

PANEL MEMBER 1: BCN population restrictions are noted in the brief description of the measure. This is a utilization measure that may be an effective way to monitor the impact of systemic/programmatic changes on utilization—especially when compared to its partner ED days measure.

The purpose of the BCN1 (All Cause ED) and BCN2 (All Cause Inpatient Hosp) is “The BCN-1 and BCN-2 measures are intended for voluntary use by states to monitor and improve the quality of care provided to the Medicaid BCN population.”

PANEL MEMBER 2: None.

PANEL MEMBER 3: The developer listed several exclusions in the details of the numerator and denominator but there are none listed in the exclusion section of the testing form.

PANEL MEMBER 4: Unclear how inpatient admissions/observation stays are identified in patients when they are not covered by Medicaid

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**
- Please note that NQF does not require data element reliability testing if data element validity has been demonstrated.
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

- Developer conducted signal-to-noise (SNR) reliability testing for BCN-2 using MAX data from 10 states.
- Testing was not precisely conducted for the measure as specified. Specifically, dual-eligible beneficiaries were not included in the testing due to data unavailability, but would be included in the measure if implemented.
- Panel members, in a future submission, would like to see analyses demonstrating the reliability of the data elements used in the measure. This is important because of the probable differences in the quality of Medicaid data across states.
 - The developer noted that the states selected for the testing sample had the highest quality data and were most likely to provide generalizable testing results. The developer also clarified that the BCN population definition is intended to be applied uniformly across states in an effort to minimize differences in state-specific populations.
 - Additionally, the developer conducted a qualitative missingness analysis of the measure's key data elements using MAX anomaly tables (see section 2b6.2. in the Testing Attachment). Given the relatively small amount of missing information (key fields were missing less than 5% of the time) used to identify the BCN population and calculate the BCN measures, the developer does not believe there is any systematic bias in their testing. The developer also notes that states implementing the measure with their own data will likely have even fewer missing fields because they are better equipped to account for state-specific codes when identifying the BCN population and constructing the measure.
- 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 ratio (SNR) used; this is appropriate; sample of 10 states contains 2 small states and 8 larger states
 - **PANEL MEMBER 2:** Developers conducted signal to noise testing at the entity (state) level scores.
 - **PANEL MEMBER 3:** Developer used signal-to-noise ratio to assess reliability.
 - **PANEL MEMBER 4:** Measure signal to noise ratio
 - **PANEL MEMBER 5:** Signal to noise

7. **Assess the results of reliability testing**

Submission document: Testing attachment, section 2a2.3

- Average signal-to-noise reliability estimate = 0.99 (ranging between 0.95 to 0.99 across the ten states in the sample).
- 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 are very strong.
 - **PANEL MEMBER 2:** The risk-adjusted measure is shown to be highly reliable, with an overall (mean) signal-to-noise measure reliability of 0.99. The SNR ranged from 0.95 to 0.99 across the

ten states in the sample. The overall reliability of 0.92 indicates the measure is highly reliable and can discern performance differences between states.

- o **PANEL MEMBER 3:** Acceptable.
- o **PANEL MEMBER 4:** State-level signal-to-noise ratio mean was 0.99, consistent with excellent reliability
- o **PANEL MEMBER 5:** Highly reliable at the state level.

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)

- Ultimately, the Methods Panel gave this measure an overall rating of reliability of moderate. Individual Methods Panel reviews responses ranged from low to high. A summary of the reviewers' rationales can be found in item 11 below.

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:** Very clearly described methodology and excellent SNR results.
- **PANEL MEMBER 2:** While the measure scores appear to have high reliability, the developers did not discuss reliability of the individual data elements in the measure and risk adjustment models. This seems particularly important for this measure given the probable differences in quality of Medicaid data across states.
- **PANEL MEMBER 3:** Specifications are not complete.
- **PANEL MEMBER 4:** State-level signal-to-noise ratio mean was 0.99, consistent with excellent reliability
- **PANEL MEMBER 5:** Highly reliable, likely because of the large sample size and straightforward claims-based outcome.

VALIDITY: ASSESSMENT OF THREATS TO VALIDITY

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

Submission document: Testing attachment, section 2b2.

- Methods Panel members raised a number of concerns with the measure exclusions. The measure developer provided a number of clarifications to address these concerns.
 - The developer noted that the exclusions in the numerator and denominator description are not measure exclusions. Rather, they reflect the way the analytic file was constructed given that the developer did not have access to Medicare data.
 - The developer noted that when it comes to the testing population, Medicaid beneficiaries who are dual eligible during the lookback or measurement year are excluded, regardless of months of eligibility. Non-dual Medicaid beneficiaries were excluded from the testing population if they had fewer than 10 months of eligibility during the lookback year.
 - The developer also clarified that when it comes to implementation and how states will calculate the measure, dual eligible beneficiaries are included in the measure if they have at least 10 months of Medicaid eligibility during the lookback year. This approach aligns with the Medicaid Core Set.
 - The developer noted that state-specific coding and other idiosyncrasies can still affect the interpretability of certain analyses of MAX data. The developer clarified that they required states in the testing sample to be free of data anomalies that could limit the ability to interpret testing results. The developer also required that states align with national benchmarks to confirm that the FFS population in each state was broadly representative and that state-specific coding conventions accurately captured hospital-based utilization in claims. The developer noted that if they included states that did not meet these criteria, they would not be able to tell whether differences in measure performance between states were meaningful or driven by the states' population composition, data anomalies, or inability to identify utilization due to proprietary coding. The states selected for the testing sample have the highest quality data and are most likely to provide generalizable testing results.
 - The developer clarified their strategies to reduce the influence of differential enrollment/disenrollment patterns across state Medicaid populations. The BCN population definition is intended to be applied uniformly across states in an effort to minimize differences in state-specific populations. Specifically, the BCN population definition requires 10 months of Medicaid eligibility in the definition year; this enrollment threshold is as inclusive as possible while preserving enough data to determine whether one could be considered part of the BCN population.
- A summary of Methods Panel members feedback is provided below. This summary is intended to inform the Standing Committee's discussion.
 - **PANEL MEMBER 1:** BCN population is already restrictive compared with the entire Medicaid population.
 - **PANEL MEMBER 2:** The exclusions appear to be reasonable.
 - **PANEL MEMBER 3:** No exclusions cited by developer although there are a number of them listed in the numerator/denominator details e.g., "beneficiaries dually enrolled in Medicaid and Medicare and beneficiaries who had fewer than 10 months of Medicaid eligibility in the previous 12 months" (due to inadequate data sample), etc. (No testing done on exclusions either)
 - **PANEL MEMBER 4:** NA
 - **PANEL MEMBER 5:** An analysis of the individuals excluded for less than a year of Medicaid enrollment would be helpful just to see how they differ, though agree that since endpoints can't be ascertained they can't be included. Concern is that states with different ease of enrollment have differential churn, meaning a differential population going on and off Medicaid in any given year. Further, since churn may be linked to any number of health or

social issues, these individuals may have higher event rates and thus states with higher churn would artificially look better. Would look at these folks state by state and for major demographics.

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 noted the following concerns regarding the measure's ability to identify meaningful differences in performance.
 - **PANEL MEMBER 1:** Generalizability of the measure results may be problematic given the limited data across all 50 states. Only 15 states had MAX data and 5 of these states were dropped from the analyses due to failing one or more of their data quality criteria. The authors should be applauded for their specification of these data quality criteria. What constitutes "meaningful differences" vs. simply a difference across the states is not explicit in the document.
 - **PANEL MEMBER 2:** See other discussion which describes concerns in several areas
 - **PANEL MEMBER 3:** Reviewed 10 states and only 3 were different from the mean while 7 states that were "statistically indistinguishable from the average performance in the sample."
 - **PANEL MEMBER 4:** None. Wide variability in outcome consistent w/ability to detect meaningful differences
 - **PANEL MEMBER 5:** Only exclusions as above.

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 noted a concern regarding comparability of results.
 - **PANEL MEMBER 5:** Information on comparability of populations across states would be helpful, since data are presumably coming in differentially for FFS versus managed care.

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

Submission document: Testing attachment, section 2b6.

- Methods Panel members noted the following concerns regarding missing data:
 - **PANEL MEMBER 1:** See previous statement about generalizability (and reportability) of results given the large number of states without data to analyze.
 - **PANEL MEMBER 3:** Developer indicated via Table 9 the percent of claims to identify primary diagnosis and Table 10 via the percent of claims with a procedure code and place of service for IP, LT, and OT claims. Developer indicates that "given the relatively small amount of missing information used to identify the BCN population and calculate the BCN-2 measure, we do not believe there is any systematic bias in our testing." No analysis completed on population with missing data.
 - **PANEL MEMBER 4:** Negligible amount of missing data

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

PANEL MEMBER 4: Measure focuses on Medicaid population which is a high social-risk group.

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? ☒ Yes ☐ No

16d.4 Do analyses indicate acceptable results (e.g., acceptable discrimination and calibration)
☒ Yes ☐ No

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

- Methods Panel members provided disagreeing responses to this question.

16e. Assess the risk-adjustment approach

- The risk-adjustment approach was developed using data from 10 states. The risk-adjustment model included 69 risk factors. The Panel's concerns about the risk-adjustment approach included:
 - o Several risk factors are included that are neither statistically nor clinically significant. However, the risk of over-fitting was not assessed.
 - o The risk-adjustment model includes a factor noted as "child". This is confusing given the measure is limited to individuals ages 18-64.
 - o Poly-pharmacy was not included as a risk factor.
 - o 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.
 - o Concern with excluding prior hospital-based care utilization as a risk factor.
 - o Concern around using the chronic conditions data warehouse (CCW) fields to identify comorbidities used in the risk adjustment model. However, there was no supporting literature cited to support this decision and no validation of those variables (e.g., re-abstracting chart data) was conducted. Because this is a new measure, data element validation is not required. If endorsed, developers should consider presenting this type of analysis when the measure comes back for re-evaluation.
- The developer noted that they included all predictors that were theoretically associated with the measure, including those that were not statistically significant or "protective" in nature. The developer stated that in general, the risk factors associated with a *lower* adjusted risk of ED utilization reflected more serious conditions (e.g. colorectal cancer). This lower risk likely reflects higher substitution away from ED care towards inpatient care. Because BCN-1 will ultimately be paired with a measure of inpatient care, the developer believed it was important to include the "protective" risk factors in the BCN-1 risk adjustment model.
- The developer clarified that the measure only includes beneficiaries who are 18-63 years of age as of the beginning of the definition year. However, it is possible for a young beneficiary to retain the eligibility category of "child" for some time after turning 18. This is a normal artifact of Medicaid administrative data, as states' enrollment files are updated on a different frequency as claims files.
- The developers provided information in the testing attachment about the risk of overfitting. Specifically, the developer noted that after the exploratory data analysis, they split the analytic sample into two randomly selected half samples. One served as the development sample supporting their model building and exploration work, and 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 their model performs well on the validation sample provides assurance that the model will generalize well to other samples, and is not primarily driven by such idiosyncratic fluctuations. The risk factors exhibiting coefficient instability (for example, Alzheimer's disease and traumatic brain injury) typically exhibited very low sample prevalence and imprecisely estimated null associations with the outcome. As a result, it is reasonable to conclude that coefficient differences were driven by statistical noise as opposed to potentially more worrisome overfitting bias.

- A summary of Methods Panel Feedback is provided below. This summary is intended to inform Standing Committee discussion.
 - **PANEL MEMBER 1:** The methodology used to develop and test the list of 69 risk factors was described in excellent detail. The negative binomial stratified by decile level showed very strong results.
 - **PANEL MEMBER 2:** Developers used bivariate exploratory analyses to identify potential risk factors. They split the sample into 2 randomly selected half samples and used one as development sample and other as validation sample. They also plotted the relationship between the number of inpatient admissions and observations stays and the number of months enrolled to determine whether to include an offset term in our final model. Based on the results, they chose the negative binomial regression with an offset term reflecting the number of enrolled months per beneficiary.

The final risk adjustment model included 69 risk factors and an intercept term. The factors included sociodemographic indicators (mean-centered age and its square as it had quadratic relationship, sex, and Medicaid eligibility category), along with the entire set of CCW condition indicators in the risk adjustment model. Other variables indicated whether a beneficiary had physical health conditions only (reference), behavioral health conditions only, or both types of conditions (an interaction of the previous two).

The developers excluded area-level socioeconomic status (SES). They indicate that this decision was motivated by the findings from the recent two-year National Quality Forum (NQF) effort, which 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. I do not believe that was the intent of the NQF conclusion, and that in this case, state level variables may have indeed proven significant given the disparities in median income, poverty, education and other SES across states. We do not know which states are included here, but I do not believe we can say these results are generalizable to other states.

Polypharmacy was also excluded and could potentially have a large impact on the results especially given the current opioid crisis and other issues around medication adherence and high use of medications in the Medicaid population, many of whom are disabled and/or have a large number of chronic conditions (more than the 2 used for cutoff here).

I do not necessarily agree with the rationale for excluding prior hospital-based care utilization as a risk factor. A prior hospital stay is a well -documented predictor of future stay. While the developers argue that inclusion may set inappropriate care incentives by rewarding poorly performing entities with a lower bar for expected performance in future years. The problem described is that it increases the predicted inpatient admission rate for entities whose beneficiaries previously had more inpatient admissions or ED visits. Thus, entities with previous high inpatient admission rates are expected to have higher inpatient admission rates in the measurement year compared with entities whose patients did not, effectively setting a lower standard for entities with previous poor performance. Therefore, they excluded prior hospital-based care utilization from consideration. An alternative theory is that prior hospital

visits indicate the patient has higher level of severity or risk factors that are not captured in the model, such as additional social risk factors that are not measureable in claims data.

They were also unable to include dual status in the model due to lack of data and this could serve as a good proxy for social risk factors that are not included.

- **PANEL MEMBER 3:** I agree with the CCW condition indicators inclusion and that sociodemographic indicators should be included in the risk model, but am at a loss as to why include “child” in the model when the measure population is 18 to 64 years old. Is the developer indicating that field as “age range”?
- **PANEL MEMBER 4:**
 - Use of non-hierarchical negative binomial model is a reasonable approach, although logistic regression modelling is more often used when the outcome is binary (instead of using count model). Model fit is more difficult to assess in negative binomial model because McFadden Rsq is not as easily interpretable compared to C statistic in logistic regression model.
 - Unclear whether CCW comorbidity time-stamp was used to only include risk factors present before ED visit
 - The inclusion of risk factors that lower the risk of the outcome is not a standard practice in risk adj models.
 - Calibration plot and deciles table suggest acceptable calibration.
- **PANEL MEMBER 5:** Extensive list of comorbidities and characteristics. Would have been nice to see some SES testing using area-level variables.

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

- Developer conducted convergent validity testing by examining the correlation between this measure and the HEDIS inpatient hospital utilization measure (IHU).
 - The IHU measure targets beneficiaries of commercial plans and Medicare rather than the Medicaid population (and the specifications of the measures differed slightly).
- The developer clarified that the main difference between the BCN-2 inpatient admission measure and HEDIS IHU is that BCN-2 includes inpatient admissions of all causes; HEDIS IHU excludes inpatient events due to behavioral health conditions and maternity. The developer noted for the purposes of the validity assessment, they adapted the HEDIS IHU specifications for use with Medicaid claims data. The developer calculated BCN-2 and HEDIS IHU using the same BCN sample population and then examined the correlation.
- 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:** Concurrent validity with HEDIS measure and state-level performance of a conceptually related quality (NQMC 010620)
 - **PANEL MEMBER 2:** Developers examined the correlation between state-level performance of the measure and state-level performance of a conceptually related quality measure: the HEDIS

inpatient hospital utilization measure (IHU) for members 18 years of age and older which essentially measures the same concept with a different population (Medicare and commercial enrollees) and using a slightly different specification

- o **PANEL MEMBER 3:** Used the HEDIS inpatient hospital utilization measure correlated to BCN-2 to examine convergent validity. HEDIS measures potentially the same concept as BCN-2 but uses the Medicare and commercial population and there is a difference in specifications (includes medical and surgical inpatient events and excludes inpatient events due to behavioral health conditions and maternity).
- o **PANEL MEMBER 4:** predictive validity by assessing predictive performance of risk adj model
- o **PANEL MEMBER 5:** Looked at relationship with alternative measure: of hospital utilization by state, found to be highly correlated.

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

Submission document: Testing attachment, section 2b2.3

- Overall, the Methods Panel noted a strong positive correlation between the measures.
- There was concern about whether testing against a measure that includes different beneficiaries represents a reasonable testing approach. The question was whether the high correlation (0.82, 95% CI: (0.50, 0.94)) does help to validate the measure that assesses state Medicaid program performance or if, instead, the results merely indicate similarities in care delivery within states.
- A summary of the Methods Panel members feedback is provided below:
 - o **PANEL MEMBER 1:** The correlation was 0.8—very strong.
 - o **PANEL MEMBER 2:** Results show a strong positive and statistically significant correlation ($r_s > 0.80$ with $p\text{-value} < 0.001$) between the measures.
 - o **PANEL MEMBER 3:** Developer used Spearman rho which yielded a correlation coefficient of 0.82.
 - o **PANEL MEMBER 4:** Calibration, as assessed using calibration graphs and OE ratios across different sub-groups is very good, providing strong evidence to support the predictive validity of the risk adj model.
 - o **PANEL MEMBER 5:** Since the other measure includes commercially insured and Medicare populations but finds similar patterns, does this suggest that it's not something about state Medicaid performance but rather about the state more broadly (or the healthcare delivered within it) that causes variation? Does that make the measure more or less valid?

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

Submission document: Testing attachment, section 2b1.

- Methods Panel members provided varying responses to this question. One Panel member provided the feedback below.
 - o **PANEL MEMBER 4:** Examined convergent validity by comparing this measure with a HEDIS inpatient hospital utilization measure

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)

PANEL MEMBER 4: Although validity of data elements was not tested, there are concerns around using CCW fields to identify comorbidities for use in risk adjustment model. The validity of using CCW comorbidities to describe comorbidities was not described. No supporting literature was cited. No

attempt was made to compare CCW comorbidities to an authoritative source (i.e. re-abstracting chart data).

23. OVERALL RATING OF VALIDITY taking into account the results and scope of all testing and analysis of potential threats.

- The Methods Panel did not come to consensus on an overall rating of validity for this measure. Methods Panel members ratings ranged from low to moderate.
- A summary of Methods Panel members rationales for their rating is provided 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: Empirical testing results were very strong.

PANEL MEMBER 2: No empirical testing of data element validity or score level validity. I feel further reliability testing is needed to rate this higher. Also see discussion in 16e above which outlines some concerns regarding the approach to development of the risk adjustment model. In general the results make great sense for the variables that are included. I have some concerns about some that were excluded but there is no empirical comparisons for those to make a determination.

PANEL MEMBER 3: The HEDIS measure may have some correlation to the BCN-2 measure but the populations of the measures are different enough to warrant further testing with a population appropriate measures with similar inclusions and exclusions.

PANEL MEMBER 4:

- Many outcomes (hospitalization/observation stays) may be missing since measure is based on Medicaid data set, and some or many patients may lack Medicaid coverage during full 12 months. In other words, patients who lose Medicaid during measurement period may not be counted as having an admission if they are admitted while not on Medicaid.
- Risk adj model includes many medical conditions that would lead to a decreased risk of ED visits. Use of risk factors that have a "protective" effect is non-standard and seems counter-intuitive. The explanation that TEP decided to retain these risk factors because they may be indicative of interaction effects should have been explored empirically.
- Use of CCW comorbidities to identify comorbidities may be appropriate, but no evidence is presented that these are valid data elements, or have been used previously in risk-adjusted outcome measures.

PANEL MEMBER 5: Concerns regarding exclusions and lack of SES testing (though population is more SES-homogeneous than many other measures) – I think the exclusions information should be provided if possible before moving this forward.

ADDITIONAL RECOMMENDATIONS

25. 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.

PANEL MEMBER 3: Concerned about the use of a proprietary data set to determine observation stays. HEDIS Observation Value Set is copyrighted by NCQA.

PANEL MEMBER 5: Exclusions; Lack of SES testing

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?

- See 3443

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

- See 3443

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

- See 3443

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?

- See 3443, again, there is variability between states re: MC programs and enrollment criteria; it has been my experience that some people cycle on and off MC in a given year--is this measuring what happens to beneficiaries who can manage to stay on for more or less a full year vs what strategies (ie care management, access to services) MC in that state is providing to prevent acute care utilization?

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?

- See 3443

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.

- The data elements are coded by someone other than person obtaining original information.
- All data elements are in defined fields in electronic claims.
- There are no fees.

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?

- See 3443

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

- CMS plans to use the measure for internal quality improvement (state-level monitoring and quality improvement activities), but there are no specific details yet. This measure is intended for voluntary use by states to monitor and improve the quality of care provided for the Medicaid BCN population served by CMS' Medicaid Innovation Accelerator Program. States may choose to begin implementing the measures based on their programmatic needs. This measure is intended to be paired with BCN-1, an all-cause emergency department utilization measure that was also developed specifically for the Medicaid BCN population.

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

The measure is not yet in use. The developer states that there are no formal process to share draft results with measured entities, but they invited feedback from a 19-member TEP, a 7-member risk-adjustment work group, and the public (via a public comment process).

Additional Feedback:

n/a

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

The measure is not yet in use so there are no trend data.

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

BCN-2 has not been implemented yet. There were no unexpected findings identified during testing of this measure.

Potential harms

BCN-2 has not been implemented yet. There were no unexpected findings identified during testing of this measure.

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

This measure is a new measure, thus usability results are unavailable. The measure passes the Use criteria and, since the measure is not current in use, we determined there is insufficient evidence to assess Usability; usability is not “must pass.” The measure may or may not 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?

- See 3443

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.

- See 3443

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 #: 3445

Corresponding Measures:

De.2. Measure Title: All-cause inpatient admission rate for Medicaid beneficiaries with complex care needs and high costs (BCNs)

Co.1.1. Measure Steward: Centers for Medicare & Medicaid Services, Centers for Medicaid & CHIP Services

De.3. Brief Description of Measure: All-cause inpatient admission rate for adult Medicaid beneficiaries who meet BCN population eligibility criteria. The measure is calculated as the number of inpatient admissions per 1,000 beneficiary months and is intended to be reported at the state level.

For the purpose of this measure, the BCN population is defined as Medicaid beneficiaries who are age 18 to 64 during the lookback year (the 12 months prior to the measurement year) and the measurement year and have at least one inpatient admission and at least two chronic conditions, as defined by the Chronic Conditions Data Warehouse (CCW). Beneficiaries dually enrolled in Medicaid and Medicare and beneficiaries who had fewer than 10 months of Medicaid eligibility in the lookback year are not included in the analytic sample because we did not have enough utilization data to include them in testing. We further limited the analytic file to beneficiaries that met BCN definition criteria.

1b.1. Developer Rationale: The BCN population is heterogeneous, with varying medical, behavioral, and psychosocial care needs. Consistent across the BCN population, however, is a pattern of health care consumption characterized by a disproportionately high use of inpatient and ED services, often coupled with underutilization of preventive and other types of outpatient care. We also see significant variation in the BCN-2 measure at the state level (see 1b.2) and by beneficiary subgroups (see 1b.4). Frequent inpatient admissions among BCNs--especially for ambulatory care sensitive conditions--are very costly and may signal poor access to primary care, suboptimal care coordination, and/or lack of supportive services across transitions in care settings. Therefore, measuring and subsequently reducing inpatient admissions through improved care coordination and access to community-based care represents an opportunity to improve both quality and cost of care for BCNs (Agency for Healthcare Research and Quality 2014; Gao et al. 2014; Harris et al. 2016; Lewis et al. 2012; Misky et al. 2010; Peikes et al. 2012; Schrag et al. 2006; Xing et al. 2015). This inpatient admission measure should be paired with the all-cause ED visit measure (BCN-1) under development by CMS/Mathematica to assess overall hospital-based care. Both measures are intended to be used for state-level monitoring and quality improvement activities.

References:

Agency for Healthcare Research and Quality. "Measures of Care Coordination: Potentially Avoidable Hospitalizations." Chartbook on Care Coordination. Rockville, MD: AHRQ, 2015. Available at <https://www.ahrq.gov/research/findings/nhqrdr/2014chartbooks/carecoordination/carecoord-measures3.html>. Accessed July 28, 2016.

Gao, J., E. Moran, Y.F. Li, and P.L. Almenoff. "Predicting Potentially Avoidable Hospitalizations." *Medical Care*, vol. 52, no. 2, 2014, pp. 164–171.

Harris, L.J., I. Graetz, P.S. Podila, J. Wan, T.M. Waters, and J.E. Bailey. "Characteristics of Hospital and Emergency Care Super-Utilizers with Multiple Chronic Conditions." *Journal of Emergency Medicine*, vol. 50, no. 4, 2016, pp. 203–214.

Lewis, V.A., B.K. Larson, A.B. McClurg, R.G. Boswell, and E.S. Fisher. "The Promise and Peril of Accountable Care for Vulnerable Populations: A Framework for Overcoming Obstacles." *Health Affairs*, vol. 31, no. 8, 2012.

Misky, G.J., H.L. Wald, and E.A. Coleman. "Post-Hospitalization Transitions: Examining the Effects of Timing of Primary Care Provider Follow-Up." *Journal of Hospital Medicine*, vol. 5, no. 7, 2010, pp. 392–397.

Peikes, D., A. Zutshi, J. Genevro, K. Smith, M. Parchman, and D. Meyers. "Early Evidence on the Patient-Centered Medical Home." AHRQ Publication no. 12-0020-EF. Rockville, MD: Agency for Healthcare Research and Quality, February 2012.

Xing, J., C. Goehring, and D. Mancuso. "Care Coordination Program for Washington State Medicaid Enrollees Reduced Inpatient Hospital Costs." *Health Affairs*, vol. 34, no. 4, 2015, pp. 653–661.

S.4. Numerator Statement: The sum of unique inpatient admissions and observation stays in the measurement year among adult Medicaid beneficiaries who meet BCN population eligibility criteria.

S.6. Denominator Statement: Number of Medicaid-eligible months ("beneficiary months") among adult Medicaid beneficiaries who meet BCN population eligibility criteria.

S.8. Denominator Exclusions: Not applicable

De.1. Measure Type: Outcome

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:

3444:All-cause hospital utilization for Medicaid beneficiaries with complex care needs and high costs (BCNs)

De.4. IF PAIRED/GROUPED, what is the reason this measure must be reported with other measures to appropriately interpret results? BCN-2 is part of a paired measure set titled "All-cause hospital utilization for Medicaid BCNs." The other measure in the pair is all-cause emergency department (ED) utilization rate for BCNs, referred to as "BCN-1." The BCN-1 and BCN-2 measures are intended for voluntary use by states to monitor and improve the quality of care provided to the Medicaid BCN population.

Monitoring BCN-2 in conjunction with the paired indicator for ED visits (BCN-1) can identify meaningful differences in overall hospital utilization and help ensure reductions in inpatient admissions accurately reflect true increases in quality care. Examining either measure in isolation has the potential to produce inaccurate inferences about states' performance due to the potential for the substitution effect. For example, if an accountable entity decreases ED utilization among the BCN population by keeping patients in the hospital overnight, thus shifting the utilization to an inpatient visit, the ED measure concept alone would understate the accountable entity's overall impact on hospital-based care. Conversely, a successful BCN intervention may decrease inpatient utilization (or the length of an inpatient admission) but increase ED utilization, appearing to have worsened outcomes despite reducing overall rates of hospital-based care. Indeed, several Medicaid BCN initiatives have successfully reduced inpatient admissions but increased ED utilization. For example, Washington State's Chronic Care Management program resulted in significant reductions in inpatient admissions and spending, and increases in ED utilization, though not at a statistically significant rate (Xing et al. 2015). If measured solely on ED utilization, Washington State might appear to have worsened outcomes, despite reducing overall rates of hospital-based care.

Reference: Xing, J., C. Goehring, and D. Mancuso. "Care Coordination Program for Washington State Medicaid Enrollees Reduced Inpatient Hospital Costs." *Health Affairs*, vol. 34, no. 4, 2015, pp. 653–661.

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

[BCN-2_Evidence_Attachment_FINAL_BCN_team_09.19.18.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: [All-Cause Inpatient Admission Rate for Medicaid Beneficiaries with Complex Care Needs and High Costs \(BCNs\)](#)

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

Date of Submission: [9/19/2018](#)

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 sub-criterion (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:

☐ 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:

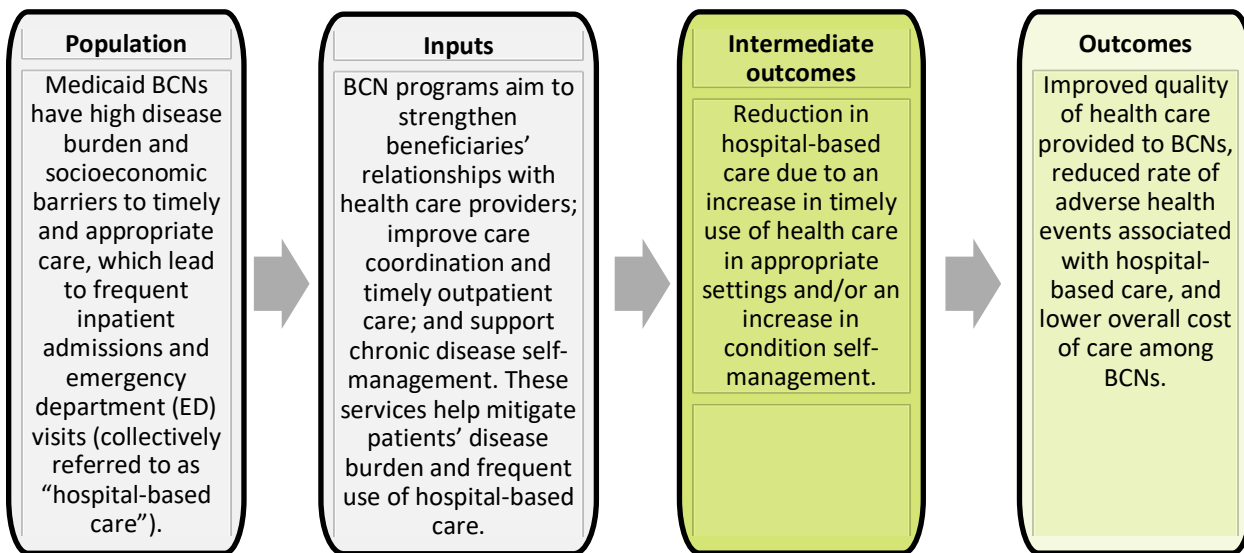
☐ Composite:

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.

Although frequent inpatient admissions and ED visits (collectively referred to as "hospital-based care") are often warranted for high-risk beneficiaries, they could also signal uncoordinated care or a lack of access to care in appropriate settings, such as primary and specialty care practices (Harris et al. 2016; Xing et al. 2015; Agency for Healthcare Research and Quality 2015; Gao et al. 2014; Peikes et al. 2012; Lewis et al. 2012; Misky et al. 2010; Schrag et al. 2006).

To reduce hospital-based utilization, most BCN programs aim to strengthen beneficiaries' relationships with health care providers in the community, improve care coordination across providers (including timely outpatient follow-up care), and support chronic disease self-management. These types of services help mitigate patients' disease burden and frequent need for hospital-based care (Dowd et al. 2014; Tsilimingras et al. 2015; Forster et al. 2003; Grinberg et al. 2016; Friedberg et al. 2010).

Thus, a decrease in the all-cause inpatient admission rate for Medicaid BCNs may represent an increase in the quality of care for BCNs, including access to appropriate health services, provision of effective care coordination, and improved health-related quality of life outcomes. It may also decrease overall health care costs among BCNs.



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

****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.

Evidence suggests that high-risk patients (those with social needs, complex medical problems, multiple chronic conditions, and multiple inpatient admissions) may experience greater benefits (such as improved care, better outcomes, and reduced costs) from care management than the average beneficiary (Harris et al. 2016; Xing et al. 2015; Peikes et al. 2012; Lewis et al. 2012; Hempstead et al. 2014; Wiener et al. 2017). Some evidence suggests that programs designed to reduce cost by decreasing hospital-based care can generate savings among Medicaid beneficiaries (California Medicaid Research Institute 2013; Smulowitz et al. 2013). In fact, the number of inpatient admissions is a key component of identifying the BCN population because of its correlation with expenditures and power to predict beneficiaries with the highest costs (Billings and Mijanovich 2007). Reductions in inpatient admissions are more likely to offset any cost increases in other areas, such as primary and specialty care services or ED visits.

The following results from BCN care management initiatives illustrate the range of potential reductions in hospital-based care and costs. Each example has a unique sample population; although none are identical to the BCN population definition used for this measure, the example populations all overlap this measure's BCN definition to some degree.

Program	Population	Impact on inpatient service utilization	Impact on emergency department service utilization	Impact on costs
Washington State's Chronic Care Management program (Xing et al. 2015)	Clinically complex Medicaid beneficiaries who were identified via risk criteria established through a predictive modeling algorithm (N=907)	Reduced inpatient utilization by 9.64 admissions per 1,000 member months	Increased ED utilization of 10.81 visits per 1,000 member months (not statistically significant)	\$318 per member per month reduction in inpatient hospital admission costs
Pilot care coordination intervention at a public hospital in New York City (Bellevue Hospital Center) (Raven et al. 2011)	A small number (N=19) of Medicaid beneficiaries who were considered high risk for hospitalization and experienced homelessness or substance use	Decreased inpatient admissions by 37.5 percent	Decreased the annual number of ED visits by a mean of 0.7 visits	Decreased annual hospital Medicaid reimbursements by 38 percent. The decrease in hospital costs was accompanied by a small increase in outpatient clinic visits.
Pilot care management program operated in Camden, New Jersey, by the Camden Coalition of Healthcare Providers (Green et al. 2010)	Patients with high hospital-based utilization and high costs (N=36), as identified through hospital discharge data. Many patients had complex medical needs, low or no income, and lack of stable shelter	Reduced the total number of monthly visits to hospitals and EDs by roughly 40 percent per month		Decreased overall costs of care of a small sample of patients by 56 percent (Hong et al. 2014)
Coordinated Care Clinic at Hennepin County Medical Center in Minnesota (Mann 2014)	Patients with complex health problems	25 percent decrease in hospitalizations during the first year of the program	38 percent decrease in ED visits during the first year of the program	23 percent reduction in total charges for medical care during the first year of the program
The California Initiative: 6 pilot sites across California (Frequent Users of Health Services Initiative 2008)	Patients had at least 4 ED visits in 12 months, and were also often afflicted with mental illness, homelessness, and/or substance abuse	Inpatient admissions decreased by 14 percent	ED visits decreased by 30 percent	Inpatient spending decreased by 8 percent, and total cost of ED services decreased by 17 percent
Transitional care program operated by Community Care of North Carolina, a large medical home system (DuBard and Jackson 2015)	Non-dual Medicaid recipients with multiple chronic or catastrophic conditions (as defined by 3M Health Information Systems Clinical Risk Group methodology)	Decreased inpatient admissions by 10 percent between 2008 and 2014	Not available.	Decreased the total cost of care by 3 percent between 2009 and 2012 (Hong et al. 2014)

Initiatives to reduce inpatient admissions typically guide patients toward more effective forms of care, such as primary and specialty care providers, while also promoting disease self-management. These avenues provide higher-quality and lower-cost care than tertiary settings, in which care often is fragmented for people with complex chronic conditions and socioeconomic issues. Specifically, people with a usual source of care (typically, a primary care physician) are more likely than others to receive preventive services, experience

greater satisfaction overall with their health care, and have lower rates of both inpatient admissions and ED use for nonurgent conditions (Friedberg et al. 2010). Although this shift in service use could increase outpatient care, particularly primary and specialty care, reliable estimates of the impact are scarce. To ensure reductions in inpatient admissions reflect increases in quality care, the inpatient admission rate should be monitored alongside indicators for ED visits (also developed by Mathematica/CMS for the Medicaid BCN population), outpatient care, and patients' ability to manage their chronic conditions. Furthermore, analysis of the inpatient admission rate should take into account that service use for the identified population might decline over time for purely statistical reasons; this is known as "regression to the mean" and does not signify improvements in health care delivery or outcomes.

References

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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)

Not applicable.

- ☐ 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.

Not applicable.

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

Not applicable.

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

Not applicable.

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.

The BCN population is heterogeneous, with varying medical, behavioral, and psychosocial care needs. Consistent across the BCN population, however, is a pattern of health care consumption characterized by a disproportionately high use of inpatient and ED services, often coupled with underutilization of preventive and other types of outpatient care. We also see significant variation in the BCN-2 measure at the state level (see 1b.2) and by beneficiary subgroups (see 1b.4). Frequent inpatient admissions among BCNs--especially for ambulatory care sensitive conditions--are very costly and may signal poor access to primary care, suboptimal care coordination, and/or lack of supportive services across transitions in care settings. Therefore, measuring and subsequently reducing inpatient admissions through improved care coordination and access to community-based care represents an opportunity to improve both quality and cost of care for BCNs (Agency for Healthcare Research and Quality 2014; Gao et al. 2014; Harris et al. 2016; Lewis et al. 2012; Misky et al. 2010; Peikes et al. 2012; Schrag et al. 2006; Xing et al. 2015). This inpatient admission measure should be paired with the all-cause ED visit measure (BCN-1) under development by CMS/Mathematica to assess overall hospital-based care. Both measures are intended to be used for state-level monitoring and quality improvement activities.

References:

Agency for Healthcare Research and Quality. "Measures of Care Coordination: Potentially Avoidable Hospitalizations." Chartbook on Care Coordination. Rockville, MD: AHRQ, 2015. Available at <https://www.ahrq.gov/research/findings/nhqrdr/2014chartbooks/carecoordination/carecoord-measures3.html>. Accessed July 28, 2016.

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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.

We included data from 10 states in measure testing. These states had the most current Medicaid Analytic eXtract (MAX) data available at the time of measure testing and met data quality standards (see Testing Attachment Appendix). We included data on FFS beneficiaries from seven states and managed-care beneficiaries from three states. In this document, state names are redacted and referred to as State A through State J. The measurement year is 2014. Performance rates are reported as number of inpatient admissions per 1,000 beneficiary months. Measure testing details are included in the testing attachment.

Table 1. Unadjusted and risk-adjusted measure rates by state

State	Unadjusted Rate	Risk-adjusted Rate
State A	87.1	100.3
State B	513.7	375.2*
State C	111.4	98.9
State D	96.6	95.0^
State E	96.5	100.1
State F	119.9	101.2
State G	79.4	75.4
State H	82.1	85.9^
State I	135.8	98.1
State J	79.5	98.1
Overall	100.5	96.5

Source: Mathematica analysis of 2014 MAX PS, LT, OT, and IP files.

Sample: Full sample (N = 142,193)

^ Measure rate is significantly lower than the overall rate (95% CI)

* Measure rate is significantly higher than the overall rate (95% CI)

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

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.

We included data from 10 states in measure testing. These states had the most current MAX data available at the time of measure testing and met data quality standards (see Testing Attachment Appendix). We included data on FFS beneficiaries from seven states and managed-care beneficiaries from three states. In this document, state names are redacted and referred to as State A through State J. The measurement year is 2014. Performance rates are reported as number of inpatient admissions per 1,000 beneficiary months. Measure testing details are included in the testing attachment.

Table 2. Risk-adjusted measure rate distribution by population subgroup

Subgroup	Mean	25th pctl	50th pctl	75th pctl
Aged 18 to 24	66.88	60.39	67.03	73.13
Aged 25 to 44	83.2	73.87	82.86	88.88
Aged 45 to 64	117	115.8	117.7	125.7
Male	112.4	106.4	111	120.1
Female	88.21	84.21	90.17	93.27
White	83.35	81.75	86.98	89.73
Black	125.5	115.7	126.9	134.4
Hispanic	86.69	64.24	73.9	81.25
Other/unknown	100.5	83.71	98.51	106.7
Aged/Blind/ Disabled	124.1	115.9	126.3	128.3
Adult	59.85	54.94	60.13	103.8
Child	42.74	40.08	57.91	63.53
1+ behavioral health conditions	100.7	99.51	103.2	106.3
No behavioral health conditions	80.07	74.72	78.04	84.57

Source: Mathematica analysis of 2013 and 2014 MAX PS, LT, OT, and IP files.

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

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.

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.)

The measure does not yet have published specifications and there is not a URL link.

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: [BCN-2_Value_Set_Attachment_09.19.18.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.

No

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).

The sum of unique inpatient admissions and observation stays in the measurement year among adult Medicaid beneficiaries who meet BCN population eligibility criteria.

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).

The numerator is calculated as the sum of inpatient admissions and observation stays (of any length) in the measurement year. All events that resulted in an inpatient admission were counted in the numerator (even if they began as ED visits or observation stays). Observation stays contribute to the monthly count only if they did not result in an inpatient admission (and therefore not already counted as an inpatient admission).

Inpatient admissions are identified by using institutional claims for inpatient hospital services.

Observation stays are identified in two ways:

1. Procedure codes in the 2015 Healthcare Effectiveness Data and Information Set (HEDIS) Observation Value Set. HEDIS value sets are trademarked by the National Committee for Quality Assurance.
2. Revenue and procedure codes created by the Centers for Medicare & Medicaid Services (CMS) to identify observation stays. We identify observation stays of any length.

Claims are deduplicated to ensure there is no more than one inpatient admission or observation stay per beneficiary per day.

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

Number of Medicaid-eligible months ("beneficiary months") among adult Medicaid beneficiaries who meet BCN population eligibility criteria.

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).

The denominator is calculated as the number of Medicaid-eligible months during the measurement year among adult beneficiaries who meet BCN population eligibility criteria. The measurement period is 12 months. An additional 12 months of lookback data is needed to identify the BCN population, for a total of 24 months of data.

BCNs are defined as Medicaid beneficiaries who are age 18 to 64 during the lookback and measurement years and who have at least one inpatient admission and at least two chronic conditions (as defined by the CCW) in the lookback year. Inpatient admissions are identified by using institutional claims where type of service = 01 (for "inpatient"). Observation stays are not included in the sum of inpatient admissions used to identify the denominator population.

Beneficiaries dually enrolled in Medicaid and Medicare and beneficiaries who had fewer than 10 months of Medicaid eligibility in the lookback year are not in the analytic sample because we did not have enough utilization data to include them in testing.

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

Not applicable

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.)*

Not applicable

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.)*

Not applicable

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.)

UNADJUSTED RATE

Step 1: Determine eligible denominator population and number of eligible beneficiary months among BCNs.

BCNs are defined as Medicaid beneficiaries who are age 18 to 64 during the lookback and measurement years and who have at least one inpatient admission and at least two chronic conditions (defined by the CCW), in the lookback year.

Inpatient admissions are identified by using institutional claims where type of service = “01” (for “inpatient”). Observation stays are not included in the sum of inpatient admissions used to identify the denominator population. CCW condition algorithms are publicly available at <https://www.ccwdata.org>; they are also available in the BCN-2 Value Sets Attachment.

An eligible beneficiary month is one in which the beneficiary is enrolled in Medicaid fee-for-service (FFS) or managed care. Sum eligible months across all beneficiaries.

Step 2: Determine the number of inpatient admissions and observation stays among BCNs.

The numerator is calculated as the sum of inpatient admissions and observation stays in the measurement year. All events that resulted in an inpatient admission are counted in the numerator (even if they began as ED visits or observation stays). Observation stays contribute to the monthly count only if they did not result in an inpatient admission (and are therefore not already counted as an inpatient admission).

Inpatient admissions are identified by using institutional claims where type of service = 01 (for “inpatient”).

Observation stays are identified in inpatient or outpatient claims in two ways:

(1) Procedure codes in the Observation Value Set (HEDIS 2015)

(2) Revenue and procedure codes created by CMS to identify observation stays.

Deduplicate inpatient admissions and observation stays to ensure there is no more than one inpatient admission or observation stay counted per beneficiary per day. Sum unique inpatient admissions and observation stays across all beneficiaries.

Step 3: Calculate the inpatient admission rate among BCNs.

Divide the number of inpatient admissions and observation stays (from Step 2) by the number of enrollee months (from Step 1), and multiply the resulting ratio by 1,000, as follows:

$$(\text{Number of inpatient admissions and observation stays} / \text{Number of enrollee months}) \times 1,000 = \text{Unadjusted inpatient admission rate}$$

RISK-ADJUSTED RATE

Step 1: Calculate the observed number of inpatient admissions.

Calculate the observed number of inpatient admissions (as described in Unadjusted Rate Step 2) for each beneficiary identified as a BCN. Sum the observed number of inpatient admissions across beneficiaries. This “observed” value will be used as the numerator in the observed-to-expected (O/E) calculation in Step 3.

Step 2: Calculate the expected number of inpatient admissions.

For each beneficiary identified as a BCN,

- a) Determine the value of each of the 69 risk factors as described in the BCN-2 Value Set attached to question S. 2b.

- b) NOTE: The weights were based on the BCN population used during testing: adult, non-dual Medicaid beneficiaries with FFS or managed care claims data from 10 states in 2013 and 2014 (i.e., the development population). These coefficients will be revised using updated Medicaid claims data at the time of NQF endorsement maintenance review.
- c) Multiply each nonzero risk factor value by the weight provided in the BCN-2 Value Set Attachment.
- d) NOTE: The reference category for each factor has a value of zero. For example, beneficiaries who are female (the reference category for sex) would have a beneficiary value of zero for sex when computing the sum of coefficient estimates. Beneficiaries who are male (the included category for sex) have a beneficiary value of one for sex.
- e) Sum the products that resulted from multiplying risk factor values and coefficients.
- f) Exponentiate the resulting sum (from Step 2.c) and multiply it by the number of enrolled months as follows:

$[\# \text{ months}] \times e^{(\text{sum from Step 2.c})} = \# \text{ of expected inpatient admissions}$

Sum the expected inpatient admission rate (from Step 2.d) across all beneficiaries in the population. This “expected” value will be used as the denominator in the O/E ratio calculation in Step 3.

Step 3: Calculate the state’s O/E ratio.

Divide the state’s observed number of inpatient admissions (from Step 1) by the state’s expected number of inpatient admissions (from Step 2) to obtain this state’s O/E ratio.

NOTE: The O/E ratio calculation does not require dividing the observed (numerator) or expected (denominator) counts by the total number of enrolled months because these terms would cancel out in the division.

Step 4: Calculate the state’s risk-adjusted inpatient admission rate.

Multiply the state’s O/E ratio by the national benchmark rate of 100.5 inpatient admissions per 1,000 beneficiary months:

$(\text{O/E for state}) \times (\text{national benchmark rate}) = \text{Risk-adjusted inpatient admission rate for state}$

NOTE: The national benchmark BCN-2 rate is equivalent to the unadjusted national BCN-2 rate. This value will change over time and as the BCN population characteristics change.

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.

Medicaid claims data: person-summary (PS), inpatient (IP), other services (OT), and long-term care (LTC) files

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)

Inpatient/Hospital

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.)

Not applicable

2. Validity – See attached Measure Testing Submission Form

[BCN-2_Testing_Attachment_07.30.18.docx](#), [BCN-2_Testing_Attachment_Supplemental_Material_SUBMITTED_09.26.18.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.

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

Measure Number (if previously endorsed): NA

Measure Title: [All-cause inpatient admission rate for Medicaid beneficiaries with complex care needs and high costs \(BCNs\)](#)

Note to NQF staff and reviewers: This measure is referred to as “BCN-2.” BCN-2 is part of a paired measure titled “All-cause hospital utilization for Medicaid BCNs.” The other measure in the pair is All-cause emergency department utilization rate for BCNs, referred to as “BCN-1.” The BCN-1 and BCN-2 measures are intended for voluntary use by states to monitor and improve the quality of care provided to the Medicaid BCN population.

Date of Submission: [8/1/2018](#)

Type of Measure:

☒ Outcome (including PRO-PM)	☐ Composite – STOP – use composite testing form
☐ Intermediate Clinical Outcome	☐ Cost/resource
☐ Process (including Appropriate Use)	☐ Efficiency
☐ Structure	

Instructions

- 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.*
- For all measures, sections 1, 2a2, 2b1, 2b2, and 2b4 must be completed.
- For outcome and resource use measures, section 2b3 also must be completed.
- If specified for multiple data sources/sets of specifications (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) 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 (*including 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.

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 decisionmaking) 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.

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 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

Measure Specified to Use Data From: (must be consistent with data sources entered in S.17)	Measure Tested with Data From:
☐ abstracted from electronic health record	☐ abstracted from electronic health record
☐ eMeasure (HQMf) implemented in EHRs	☐ eMeasure (HQMf) implemented in EHRs
☐ other:	☐ other:

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).

We used Medicaid Analytic eXtract (MAX) claims to obtain the data elements needed for testing. Specifically, we used the MAX person summary (PS), inpatient (IP), long-term care (LT), and other therapy (OT) files. The PS, IP, LT, and OT files served as the primary source of information for the measure denominator, and the IP and OT files enabled us to identify the numerator events. The PS file contained additional demographic and enrollment information, such as age, sex, and race or ethnicity.

1.3. What are the dates of the data used in testing?

We analyzed MAX data from 2013 (the *lookback year*) and 2014 (the *measurement year*). We used data in the *measurement year* to calculate eligible inpatient admissions, observation stays, and eligible enrollment months, and data in the *lookback year* to define the BCN population to be used in the measurement year. The years of data used for testing were based on the most current MAX data available at the time that testing began.

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)

We included data from 10 states in measure testing. These states had the most current MAX data available at the time of measure testing and met data quality standards (see Testing Attachment Appendix 1). We included data on fee-for-service beneficiaries from seven states and managed-care beneficiaries from three states. In this document, state names are redacted and referred to as State A through State J.

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 measure is intended to be reported among adult Medicaid beneficiaries at the state level. Beneficiaries dually enrolled in Medicaid and Medicare and beneficiaries who had fewer than 10 months of Medicaid

eligibility in the previous 12 months are not included in the analytic sample because we did not have enough utilization data to include them in testing. We further limited the analytic file to beneficiaries that met BCN definition criteria. For the purpose of this measure, BCNs are defined as Medicaid beneficiaries who have at least one inpatient admission and at least two chronic conditions, as defined by the Chronic Conditions Data Warehouse (CCW)¹, in the past 12 months (the lookback year). The final analytic sample comprises 142,193 beneficiaries classified as BCNs across 10 states (Table 1).

Table 1. Analytic sample: Geographical distribution and sociodemographic composition

Characteristic	Number of BCNs (N = 142,193)	Percentage of BCN population
State		
State A	19,862	14.0
State B	201	0.1
State C	40,214	28.3
State D	19,054	13.4
State E	15,271	10.7
State F	11,443	8.0
State G	120	0.1
State H	27,228	19.1
State I	8,025	5.6
State J	775	0.5
Gender		
Male	49,798	35.0
Female	92,395	65.0
Age		
18-24	17,781	12.5
25-44	58,949	41.5
45-64	65,463	46.0
Race/ethnicity		
White, non-Hispanic origin	82,536	58.0
Black, non-Hispanic origin	41,627	29.3
Hispanic	10,647	7.5
Other/unknown	7,383	5.2
Eligibility category		
Aged/blind/disabled	80,569	56.7
Adult	58,450	41.1
Child	3,174	2.2
Plan type		
Fee-for-service	59,480	41.8
Managed care	82,713	58.2

Source: Mathematica analysis of 2013 and 2014 MAX PS, LT, OT, and IP files.

BCN = Beneficiaries with complex care needs and high costs

¹ The CCW contains 44 physical health conditions and 18 behavioral health conditions. The CCW algorithm calls for lookback periods of up to three years for some conditions. However, we used a consistent, one-year reference period across all conditions to avoid excluding enrollees on the basis of a more stringent, longer continuous-enrollment requirement.

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.

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.

As shown in section 1.6, we collected information on the following variables from MAX 2013 and 2014 files: Medicaid eligibility category, age, sex, and race/ethnicity. We included most of these factors in risk adjustment (see section 2b3) and assessed disparities in performance rate for key subgroups (see section 2b4).

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)

☐ **Critical data elements used in the measure** (e.g., inter-abstractor reliability; data element reliability must address ALL critical data elements)

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

2a2.2. For each level checked above, 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)

We conducted signal-to-noise (SNR) reliability for BCN-2. The SNR statistic, R (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 (for example, due to measurement or sampling error). If $R=0$, 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 $R=1$, all entity scores are free of sampling error, and all variation represents real differences between entities in the measure result.

To calculate the SNR reliability for the risk-adjusted BCN-2 measure, we first estimated the “noise” (within-state variability) by calculating the variance of the $\frac{\sum O_i}{\sum E_i} \cdot \bar{Y}$ within each state, where the randomness is contributed by the observed inpatient stays of each beneficiary within the state. We next estimated the “signal” (between-state variance) iteratively, using a maximum likelihood estimation approach by Morris.² We computed the SNR statistic, R , as the ratio of the signal variance (which is common across all entities) to the sum of the signal variance and the noise variance (which varies by entity):
$$R = \frac{\sigma_{between}^2}{\sigma_{between}^2 + \sigma_{within}^2}$$

2a2.3. For each level of testing checked above, 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)

² Morris, C. N. (1983) Parametric Empirical Bayes Inference: Theory and Applications. Journal of the American Statistical Association, 78:381, 47-55

The risk-adjusted BCN-2 measure is shown to be highly reliable, with an overall (mean) signal-to-noise measure reliability of 0.99. The SNR ranged from 0.95 to 0.99 across the ten states in the sample.

Table 2. Performance and signal-to-noise reliability of the risk-adjusted BCN-2 measure, by state

State	Risk-adjusted BCN-2 performance (inpatient admissions per 1,000 member-months)	Risk-adjusted BCN-2 signal-to-noise reliability
State A	100.3	0.99
State B	375.2	0.95
State C	98.9	0.99
State D	95.0	0.99
State E	100.1	0.99
State F	101.2	0.99
State G	75.4	0.96
State H	85.9	0.99
State I	98.1	0.99
State J	98.1	0.99
Overall (mean)^a	96.5	0.99

Source: Mathematica analysis of 2013 and 2014 MAX PS, LT, OT, and IP files.

Note: The SNR coefficients for States A, C, D, E, F, H, I, and J were truncated to 0.99 rather than rounded to 1.00 to reflect the uncertainty in the estimates.

^a The overall signal-to-noise measure reliability is estimated by first calculating the mean noise across all states and using that as the overall noise to derive the final SNR reliability. The results are close to what is calculated using the mean value of the state-specific reliability across states, but less sensitive to outliers.

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 risk-adjusted BCN-2 measure is highly reliable overall and for each state in the sample. The overall (mean) signal-to-noise measure reliability of 0.99 is higher than the reliability threshold of 0.9 in the literature, of which one can discern the performance differences between individual reporting entities.³

2b1. VALIDITY TESTING

2b1.1. What level of validity testing was conducted? (may be one or both levels)

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

☒ **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.

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)

³ Adams, J.L. 2009. The Reliability of Provider Profiling. A Tutorial.

http://www.rand.org/pubs/technical_reports/TR653.html (accessed February 23, 2017)

BCN-2 is intended for voluntary use by states to monitor and improve the quality of care provided to the Medicaid BCN population. To examine convergent validity of BCN-2, we examined the correlation between state-level performance of BCN-2 and state-level performance of a conceptually related quality measure: the HEDIS inpatient hospital utilization measure (IHU) for members 18 years of age and older (NQMC:010620). IHU measures the same concept as BCN-2 but with a different population (Medicare and commercial enrollees) and using a slightly different specification (it includes medical and surgical inpatient events and excludes inpatient events due to behavioral health conditions and maternity).

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

We observed a strong positive and statistically significant correlation ($r_s > 0.80$ with $p\text{-value} < 0.001$) between the BCN-2 and the IHU (Table 3).

Table 3. Convergent validity results for BCN-2

	Spearman correlation	95% CI lower	95% CI upper	p-value
BCN-2 and IHU	0.82	0.50	0.94	< .0001

Source: Mathematica analysis of 2013 and 2014 MAX PS, LT, OT, and IP files. N = 14 states.

CI = confidence interval; IHU = inpatient hospital utilization; N = number of beneficiaries.

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?)

The convergent validity of BCN-2 is strong, showing states with high or low BCN-2 rates, respectively, in general tend to have high or low rates on IHU. The Spearman correlation between BCN-2 and IHU was 0.82 ($p\text{-value} < 0.0001$). This indicates a strong correlation between the measures.

2b2. EXCLUSIONS ANALYSIS

☒ no exclusions — skip to section [2b3](#)

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)

Not applicable.

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)

Not applicable.

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*)

Not applicable.

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

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?

- ☐ No risk adjustment or stratification
- ☒ Statistical risk model with 69 risk factors
- ☐ Stratification by risk categories

□ Other,

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

We began with a graphical inspection of the outcome measure and its bivariate relationships with potential risk factors. We found that the BCN-2 outcome exhibited a high prevalence of zero values (specifically, 61 percent of beneficiaries in the sample did not have an inpatient admission in the measurement period); the relationship between age and inpatient admission was quadratic; and the number of admissions was appreciably higher for beneficiaries with both physical and behavioral health conditions. We accounted for each of these findings in the model development work.

After the exploratory data analysis, we split the analytic sample into two randomly selected half samples. One served as the development sample supporting our model building and exploration work, and the other served as the validation sample against which we assessed the final model's performance.⁴ Finding that our model performs well on the validation sample provides assurance that the model will generalize well to other samples, and is not primarily driven by such idiosyncratic fluctuations.

We also plotted the relationship between the number of inpatient admissions and observation stays and the number of months enrolled to determine whether to include an offset term in our final model. The plot indicated an approximately constant rate, providing reassurance regarding the appropriateness of the offset assumption. After this assessment, we chose the negative binomial regression with an offset term reflecting the number of enrolled months per beneficiary. This method fit the data well and exhibited fewer potential computational challenges for implementers relative to alternative methods. Specifically, the observed number of inpatient admissions for a beneficiary i , denoted by O_i , follows a negative binomial distribution:

$O_i \sim NB\left(\frac{1}{k}, \frac{m_i}{k^{-1} + m_i}\right)$ where k is called the dispersion parameter and m_i is the expected number of inpatient admissions for beneficiaries with the same risk factor values as beneficiary i : $m_i = E(O_i | t_i, \beta) = t_i \cdot \exp\{\beta X_i\}$. t_i is the number of eligible BCN months during the measure period, X_i is the vector of the risk factor values for beneficiary i , and β is the vector of coefficients for the risk factors.

The final BCN-2 risk adjustment model included 69 risk factors and an intercept term (Table 4). We included sociodemographic indicators (mean-centered age and its square, sex, and Medicaid eligibility category), along with the entire set of CCW condition indicators in the risk adjustment model. We also included variables indicating whether a beneficiary had physical health conditions only (reference), behavioral health conditions only, or both types of conditions (an interaction of the previous two).

Table 4. Final model specification: Risk factor weights (raw coefficients)

Risk factor	Beta
Intercept	-3.739
2014 centered age	-0.006
2014 centered age squared	0.000*
Aged/blind/disabled	0.453
Child	-0.085
Male	0.105
Acquired hypothyroidism	-0.035
Acute myocardial infarction	-0.025
ADHD, conduct disorders, hyperkinetic syndrome	0.018
Alcohol use disorder	0.343

⁴ 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.

Risk factor	Beta
Alzheimer's disease	-0.137
Alzheimer's disease and related disorders	-0.067
Anemia	0.275
Anxiety disorders	0.180
Asthma	0.241
Atrial fibrillation	0.132
Autism spectrum disorders	-0.242
Benign prostatic hyperplasia	0.071
Bipolar disorder	0.072
Cataract	-0.017
Cerebral palsy	0.049
Chronic kidney disease	0.352
Colorectal cancer	0.309
COPD and bronchiectasis	0.247
Cystic fibrosis, other metabolic disorders	0.209
Depression	-0.024
Depressive disorders	0.147
Diabetes	0.274
Drug use disorder	0.284
Endometrial cancer	0.396
Epilepsy	0.261
Female/male breast cancer	0.213
Fibromyalgia, chronic pain, and fatigue	0.361
Glaucoma	-0.073
Heart failure	0.371
Hip/pelvic fracture	-0.147
HIV/AIDS	0.138
Hyperlipidemia	-0.020
Hypertension	0.192
Intellectual disabilities and related conditions	-0.019
Ischemic heart disease	0.264
Learning disabilities	-0.122
Leukemias and lymphomas	0.334
Liver disease, cirrhosis, other liver conditions	0.325
Lung cancer	0.494
Migraine and chronic headache	0.160
Mobility impairments	0.110
Multiple sclerosis and transverse myelitis	0.248
Muscular dystrophy	-0.279
Obesity	0.007
Osteoporosis	0.111
Other developmental delays	0.042
Peripheral vascular disease	0.019

Risk factor	Beta
Personality disorders	0.187
Posttraumatic stress disorder	-0.070
Pressure and chronic ulcers	0.297
Prostate cancer	-0.035
Rheumatoid arthritis, osteoarthritis	-0.031
Schizophrenia	0.031
Schizophrenia, other psychotic disorders	0.145
Sensory—blindness and visual impairment	0.157
Sensory—deafness and hearing impairment	-0.060
Spina bifida, other congenital anomalies	0.144
Spinal cord injury	0.090
Stroke/transient ischemic attack	0.048
Tobacco use	0.095
Traumatic brain Injury	-0.001
Viral hepatitis	0.143
Has only behavior condition, no physical condition	-0.203
Has both physical and behavior condition	-0.042

Sources: Mathematica analysis of 2013 and 2014 MAX PS, LT, OT, and IP files. Full sample (N = 142,193).

Note: The values in the beta column represent the raw regression coefficients generated by the risk adjustment model. These values are often referred to as “risk adjustment weights,” and may be used to compute beneficiary-level risk scores.

* Denotes rounded value.

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.

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?

The choice of predictors was guided by Andersen’s Behavioral Model of Health Services Use, which frames the determinants of health care utilization into the following: factors such as demographic characteristics like age and sex that predispose individuals to use care; factors such as income and distance to a clinic that enable individuals to seek care; and factors such as the presence of chronic conditions and/or functional limitations that drive individuals to need care.⁵ 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 selected risk factors for inclusion in the risk adjustment model based on the four criteria: (1) likely predictive importance, (2) feasibility, (3) appropriate care incentives, and (4) ability to construct the factor using claims and encounter data in MAX files.

⁵ Andersen, R.M. “Revisiting the Behavioral Model and Access to Medical Care: Does It Matter?” Journal of Health and Social Behavior, vol. 36, no. 1, March 1995, pp. 1–10.

Likely predictive importance was assessed by reviewing previous risk adjustment algorithms and the related health services literature. Using this criterion, we excluded area-level socioeconomic status (SES). This decision was motivated by the findings from a recent two-year National Quality Forum (NQF) effort, which 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.⁶ Feasibility reflects a project team assessment regarding whether constructing the measure would entail a reasonable scope of work, given time and resource constraints. Polypharmacy was excluded under this criterion, as extracting and cleaning the requisite MAX pharmacy data would require significant additional resources and time. Finally, we assessed whether the inclusion of a measure was consistent with the aim of setting appropriate care incentives. For example, including prior inpatient admissions or ED visits would likely increase the predictive capacity of the risk adjustment model, but at the cost of rewarding poorly performing entities with a lower bar for expected performance in future years. Specifically, if beneficiaries with prior inpatient admissions or ED visits are more likely to have an inpatient admission during the measurement year, including prior inpatient admissions or ED visits in the model improves its ability to predict inpatient admissions in the measurement year. The problem is that it increases the predicted inpatient admission rate for entities whose beneficiaries previously had more inpatient admissions or ED visits. Thus, entities with previous high inpatient admission rates are expected to have higher inpatient admission rates in the measurement year compared with entities whose patients did not, effectively setting a lower standard for entities with previous poor performance. Therefore, we excluded prior hospital-based care utilization from consideration.

The subsequent model development and testing was limited to the following variables that were rated “high” across all three categories: sex, age, eligibility category, and the presence of chronic conditions. We did not include race in the model for two reasons: the data are of poor quality for many states and, as described in “A Blueprint for the CMS Measures Management System” (subsequently referred to as “the Blueprint”), the inclusion of race can potentially mask important disparities across racial/ethnic groups.^{7,8}

We also examined the model fit for specifications accounting for comorbidities across physical and behavioral health conditions, as earlier beta-testing activities indicated that beneficiaries with comorbidities across physical and behavioral domains exhibit uniquely high levels of hospital-based care utilization and health care costs.⁹ The model fit improved when we accounted for interactions between physical and behavioral health comorbidities.

We convened a risk adjustment expert workgroup to review the risk factors, model development, and approach, and the workgroup agreed with the final set of risk factors and risk adjustment model.

⁶ National Quality Forum. “Measure Evaluation Criteria and Guidance for Evaluating Measures for Endorsement.” Washington, DC: National Quality Forum, August 2017. Available at http://www.qualityforum.org/Show_Content.aspx?id=322. Accessed February 6, 2018.

⁷ Ruttnier, L., R. Borck, J. Nysenbaum, and S. Williams. “Guide to MAX Data.” Medicaid Policy Brief No. 21. Prepared for the Centers for Medicare & Medicaid Services. Mathematica Policy Research, August 2015. Available at https://www.cms.gov/Research-Statistics-Data-and-Systems/Computer-Data-and-Systems/MedicaidDataSourcesGenInfo/Downloads/MAX_IB21_MAX_Data_Guide.pdf. Accessed November 30, 2016.

⁸ Centers for Medicare & Medicaid Services. “Blueprint for the CMS Measures Management System, Version 13.0.” Baltimore, MD: Centers for Medicare & Medicaid Services, May 2017. Available at <https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/MMS/Downloads/Blueprint-130.pdf>. Accessed September 4, 2017.

⁹ Hula, L., C. Stepanczuk, L. Leininger, B. Marder, L. Hughey, A. Collins, C. Bobst, E. Geil, M. Head, A. Keshaviah, X. Lin, L. Lu, K. Miller, S. Nelson, D. Poznyak, M. Smith, K. Sredl, A. B. Tehrani, F. Xing, and B. Yu. “All-Cause Emergency Department Utilization Rate for Medicaid Beneficiaries with Complex Care Needs and High Costs (BCN-1) Measure Testing Report.” Princeton, NJ: Mathematica Policy Research, 2017.

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)**

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

We estimated the model separately for the development and the validation half samples, in addition to the pooled sample (Table 5). For ease of interpretation, we present model coefficients as incident rate ratios (IRR); IRRs less than one indicate that a risk factor is associated with a lower risk of the outcome, and IRRs greater than one indicate that a risk factor is associated with a greater risk of the outcome. The coefficient magnitudes are comparable across the development and validation samples. The risk factors exhibiting coefficient instability (for example, Alzheimer's disease and traumatic brain injury) typically exhibited very low sample prevalence and imprecisely estimated null associations with the outcome. As a result, it is reasonable to conclude that coefficient differences were driven by statistical noise as opposed to potentially more worrisome overfitting bias.

Six conditions (Autism spectrum disorder, glaucoma, hip/pelvic fracture, muscular dystrophy, posttraumatic stress disorder, and rheumatoid arthritis/osteoarthritis) were associated with statistically significant decreases in an inpatient admission. These risk factors include a diverse set of conditions. Because we are not accounting for the interaction of other risk factors that may accompany these conditions, it is difficult to interpret these negative associations as signaling a truly protective effect for inpatient admission. Expert workgroup members recommended continued inclusion of risk factors that were associated with a lower adjusted risk of inpatient admission.

Table 5. Final model specification: Risk factor prevalence and incident rate ratios

	Development sample n = 71,096			Validation sample n = 71,097			Full sample N = 142,193		
Risk factor	% of beneficiaries	IRR	IRR (95% CI)	% of beneficiaries	IRR	IRR (95% CI)	% of beneficiaries	IRR	IRR (95% CI)
2014 centered age		0.99	(0.99, 1.00)		0.99	(0.99, 1.00)		0.99	(0.99, 1.00)
2014 centered age squared		1.00	(1.00, 1.00)		1.00	(1.00, 1.00)		1.00	(1.00, 1.00)
Aged/blind/disabled	56.72	1.56	(1.51, 1.62)	56.60	1.59	(1.53, 1.64)	56.66	1.57	(1.54, 1.61)
Child	2.20	0.90	(0.80, 1.01)	2.26	0.94	(0.84, 1.05)	2.23	0.92	(0.85, 0.99)
Male	34.89	1.10	(1.06, 1.13)	35.15	1.12	(1.09, 1.16)	35.02	1.11	(1.09, 1.13)
Acquired hypothyroidism	9.95	0.96	(0.92, 1.00)	9.64	0.97	(0.93, 1.02)	9.79	0.97	(0.94, 1.00)
Acute myocardial infarction	1.77	0.98	(0.89, 1.08)	1.80	0.97	(0.89, 1.07)	1.78	0.98	(0.91, 1.04)
ADHD, conduct disorders, hyperkinetic syndrome	4.85	1.01	(0.94, 1.07)	5.03	1.03	(0.96, 1.09)	4.94	1.02	(0.97, 1.06)

	Development sample n = 71,096			Validation sample n = 71,097			Full sample N = 142,193		
Risk factor	% of beneficiaries	IRR	IRR (95% CI)	% of beneficiaries	IRR	IRR (95% CI)	% of beneficiaries	IRR	IRR (95% CI)
Alcohol use disorder	15.33	1.42	(1.36, 1.48)	15.65	1.40	(1.35, 1.46)	15.49	1.41	(1.37, 1.45)
Alzheimer's disease	0.29	1.03	(0.81, 1.32)	0.28	0.71	(0.55, 0.91)	0.29	0.87	(0.73, 1.04)
Alzheimer's disease and related disorders	2.22	0.95	(0.87, 1.04)	2.13	0.92	(0.84, 1.01)	2.17	0.94	(0.88, 1.00)
Anemia	30.29	1.32	(1.28, 1.36)	30.31	1.31	(1.27, 1.35)	30.30	1.32	(1.29, 1.34)
Anxiety disorders	30.15	1.17	(1.14, 1.21)	30.13	1.22	(1.18, 1.26)	30.14	1.20	(1.17, 1.23)
Asthma	21.09	1.29	(1.25, 1.34)	20.67	1.25	(1.21, 1.29)	20.88	1.27	(1.24, 1.30)
Atrial fibrillation	3.40	1.11	(1.04, 1.19)	3.25	1.17	(1.09, 1.26)	3.32	1.14	(1.09, 1.20)
Autism spectrum disorders	0.83	0.87	(0.74, 1.02)	0.79	0.70	(0.60, 0.83)	0.81	0.79	(0.70, 0.88)
Benign prostatic hyperplasia	0.67	1.13	(0.98, 1.32)	0.68	1.02	(0.88, 1.18)	0.68	1.07	(0.97, 1.19)
Bipolar disorder	21.56	1.07	(1.03, 1.11)	21.19	1.08	(1.04, 1.12)	21.37	1.07	(1.05, 1.10)
Cataract	3.07	0.94	(0.88, 1.01)	3.01	1.03	(0.95, 1.10)	3.04	0.98	(0.93, 1.04)
Cerebral palsy	1.43	1.00	(0.89, 1.13)	1.35	1.10	(0.98, 1.25)	1.39	1.05	(0.96, 1.14)
Chronic kidney disease	16.16	1.42	(1.37, 1.48)	16.20	1.42	(1.37, 1.47)	16.18	1.42	(1.39, 1.46)
Colorectal cancer	0.86	1.46	(1.27, 1.67)	0.82	1.26	(1.10, 1.45)	0.84	1.36	(1.23, 1.50)
COPD and bronchiectasis	22.31	1.27	(1.23, 1.31)	21.95	1.29	(1.25, 1.34)	22.13	1.28	(1.25, 1.31)
Cystic fibrosis, other metabolic disorders	0.91	1.32	(1.16, 1.50)	0.94	1.15	(1.02, 1.31)	0.92	1.23	(1.13, 1.35)
Depression	43.54	0.98	(0.93, 1.03)	43.53	0.97	(0.92, 1.03)	43.54	0.98	(0.94, 1.01)
Depressive disorders	34.69	1.15	(1.09, 1.21)	34.91	1.17	(1.11, 1.23)	34.80	1.16	(1.12, 1.20)
Diabetes	25.54	1.31	(1.27, 1.35)	25.54	1.32	(1.28, 1.37)	25.54	1.31	(1.29, 1.35)
Drug use disorder	25.64	1.34	(1.29, 1.38)	25.77	1.32	(1.28, 1.37)	25.71	1.33	(1.30, 1.36)

	Development sample n = 71,096			Validation sample n = 71,097			Full sample N = 142,193		
Risk factor	% of beneficiaries	IRR	IRR (95% CI)	% of beneficiaries	IRR	IRR (95% CI)	% of beneficiaries	IRR	IRR (95% CI)
Endometrial cancer	0.29	1.69	(1.34, 2.12)	0.31	1.30	(1.04, 1.63)	0.30	1.49	(1.26, 1.75)
Epilepsy	9.06	1.30	(1.24, 1.36)	9.07	1.30	(1.24, 1.36)	9.06	1.30	(1.26, 1.34)
Female/male breast cancer	1.56	1.24	(1.11, 1.38)	1.53	1.24	(1.11, 1.39)	1.55	1.24	(1.15, 1.34)
Fibromyalgia, chronic pain, and fatigue	18.94	1.44	(1.39, 1.49)	19.03	1.43	(1.38, 1.48)	18.99	1.43	(1.40, 1.47)
Glaucoma	2.43	0.93	(0.86, 1.02)	2.41	0.93	(0.85, 1.01)	2.42	0.93	(0.88, 0.99)
Heart failure	11.68	1.47	(1.41, 1.54)	11.74	1.43	(1.37, 1.49)	11.71	1.45	(1.41, 1.49)
Hip/pelvic fracture	0.60	0.86	(0.73, 1.02)	0.64	0.87	(0.74, 1.02)	0.62	0.86	(0.77, 0.97)
HIV/AIDS	2.75	1.12	(1.03, 1.21)	2.71	1.18	(1.09, 1.27)	2.73	1.15	(1.09, 1.21)
Hyperlipidemia	24.71	0.97	(0.94, 1.00)	24.39	0.99	(0.96, 1.03)	24.55	0.98	(0.96, 1.00)
Hypertension	46.85	1.23	(1.19, 1.27)	46.92	1.19	(1.16, 1.23)	46.88	1.21	(1.18, 1.24)
Intellectual disabilities and related conditions	4.04	1.00	(0.93, 1.08)	3.95	0.96	(0.89, 1.04)	4.00	0.98	(0.93, 1.04)
Ischemic heart disease	16.21	1.31	(1.26, 1.36)	16.41	1.30	(1.25, 1.35)	16.31	1.30	(1.27, 1.34)
Learning disabilities	0.29	0.72	(0.55, 0.93)	0.27	1.06	(0.83, 1.36)	0.28	0.89	(0.74, 1.06)
Leukemias and lymphomas	0.85	1.36	(1.19, 1.57)	0.87	1.43	(1.25, 1.63)	0.86	1.40	(1.27, 1.54)
Liver disease, cirrhosis, other liver conditions	7.88	1.40	(1.33, 1.47)	7.86	1.38	(1.31, 1.44)	7.87	1.38	(1.34, 1.43)
Lung cancer	0.99	1.68	(1.48, 1.91)	0.95	1.60	(1.41, 1.83)	0.97	1.64	(1.50, 1.80)
Migraine and chronic headache	7.66	1.15	(1.10, 1.21)	7.45	1.20	(1.14, 1.26)	7.56	1.17	(1.13, 1.22)
Mobility impairments	4.16	1.10	(1.03, 1.18)	4.21	1.13	(1.05, 1.21)	4.19	1.12	(1.06, 1.17)
Multiple sclerosis and transverse myelitis	0.98	1.28	(1.13, 1.45)	1.07	1.28	(1.14, 1.45)	1.03	1.28	(1.17, 1.40)

	Development sample n = 71,096			Validation sample n = 71,097			Full sample N = 142,193		
Risk factor	% of beneficiaries	IRR	IRR (95% CI)	% of beneficiaries	IRR	IRR (95% CI)	% of beneficiaries	IRR	IRR (95% CI)
Muscular dystrophy	0.21	0.81	(0.60, 1.09)	0.22	0.71	(0.53, 0.95)	0.21	0.76	(0.61, 0.93)
Obesity	20.08	1.01	(0.98, 1.05)	19.80	1.00	(0.97, 1.04)	19.94	1.01	(0.98, 1.03)
Osteoporosis	1.49	1.11	(1.00, 1.23)	1.42	1.12	(1.01, 1.25)	1.46	1.12	(1.04, 1.20)
Other developmental delays	0.56	1.01	(0.85, 1.20)	0.56	1.08	(0.91, 1.29)	0.56	1.04	(0.92, 1.18)
Peripheral vascular disease	4.84	1.00	(0.95, 1.07)	4.98	1.03	(0.97, 1.09)	4.91	1.02	(0.98, 1.06)
Personality disorders	5.15	1.18	(1.11, 1.25)	4.97	1.23	(1.16, 1.31)	5.06	1.21	(1.16, 1.26)
Posttraumatic stress disorder	5.35	0.92	(0.86, 0.98)	5.41	0.95	(0.89, 1.01)	5.38	0.93	(0.89, 0.97)
Pressure and chronic ulcers	4.78	1.36	(1.28, 1.44)	4.76	1.34	(1.26, 1.42)	4.77	1.35	(1.29, 1.40)
Prostate cancer	0.41	0.88	(0.72, 1.08)	0.37	1.06	(0.87, 1.31)	0.39	0.97	(0.84, 1.11)
Rheumatoid arthritis/osteoarthritis	15.80	0.97	(0.94, 1.01)	15.97	0.97	(0.93, 1.00)	15.89	0.97	(0.94, 0.99)
Schizophrenia	10.92	1.04	(0.97, 1.11)	10.94	1.03	(0.96, 1.10)	10.93	1.03	(0.98, 1.08)
Schizophrenia, other psychotic disorders	16.00	1.17	(1.10, 1.24)	16.10	1.15	(1.08, 1.22)	16.05	1.16	(1.11, 1.21)
Sensory—blindness and visual impairment	0.48	1.13	(0.94, 1.35)	0.48	1.21	(1.01, 1.44)	0.48	1.17	(1.03, 1.33)
Sensory—deafness and hearing impairment	1.82	1.00	(0.91, 1.10)	1.82	0.88	(0.80, 0.97)	1.82	0.94	(0.88, 1.01)
Spina bifida, other congenital anomalies	0.64	1.17	(1.00, 1.37)	0.69	1.13	(0.97, 1.33)	0.67	1.16	(1.03, 1.29)
Spinal cord injury	0.74	1.13	(0.98, 1.31)	0.73	1.05	(0.91, 1.22)	0.73	1.09	(0.99, 1.22)
Stroke/transient ischemic attack	5.78	1.05	(0.99, 1.11)	5.68	1.05	(0.99, 1.11)	5.73	1.05	(1.01, 1.09)
Tobacco use	37.33	1.12	(1.08, 1.15)	37.58	1.08	(1.05, 1.12)	37.46	1.10	(1.08, 1.12)

	Development sample n = 71,096			Validation sample n = 71,097			Full sample N = 142,193		
Risk factor	% of beneficiaries	IRR	IRR (95% CI)	% of beneficiaries	IRR	IRR (95% CI)	% of beneficiaries	IRR	IRR (95% CI)
Traumatic brain injury	0.79	1.06	(0.92, 1.22)	0.81	0.94	(0.82, 1.08)	0.80	1.00	(0.90, 1.11)
Viral hepatitis	5.57	1.12	(1.06, 1.19)	5.33	1.19	(1.12, 1.26)	5.45	1.15	(1.11, 1.20)
Has only behavior condition, no physical condition	9.31	0.82	(0.76, 0.88)	9.50	0.82	(0.76, 0.88)	9.41	0.82	(0.78, 0.86)
Has both physical and behavior conditions	70.08	0.97	(0.93, 1.01)	70.11	0.95	(0.91, 0.99)	70.10	0.96	(0.93, 0.99)

Source: Mathematica analysis of 2013-2014 MAX PS, LT, OT, and IP files.

ADHD = Attention deficit hyperactivity disorder; CI = Confidence interval; COPD = Chronic obstructive pulmonary disease; IRR = Incidence rate ratio.

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.

We did not select social risk factors (see 2b3.3a). Our expert workgroup also reached broad agreement that it was appropriate to exclude area-level indicators of SES because of the lack of likely predictive capacity.

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)

We used a discrimination statistic (McFadden's adjusted R-squared), risk decile plots, and observed to expected ratios to develop and validate the adequacy of the model (see 2b3.6.).

If stratified, skip to 2b3.9

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

We used a negative binomial model for risk adjustment. The interpretation of R-squared as the proportion of the variation explained by the model is limited to ordinary linear regression, and the count model analogs to R-squared cannot be appropriately interpreted as such. Therefore, we estimated McFadden's R-squared as an analogue. The McFadden's R-squared is defined as $1 - \frac{\log l(model)}{\log l(null)}$, where $\log l(model)$ is the log likelihood value for the fitted model and $\log l(null)$ is the log likelihood for the null model which includes only an intercept as predictor in the risk adjustment model. We found that the risk adjustment model had a McFadden's R-squared of 0.06. As a note, the McFadden's adjusted R-squared takes on values much closer to zero relative to the traditional R-squared measure.¹⁰

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

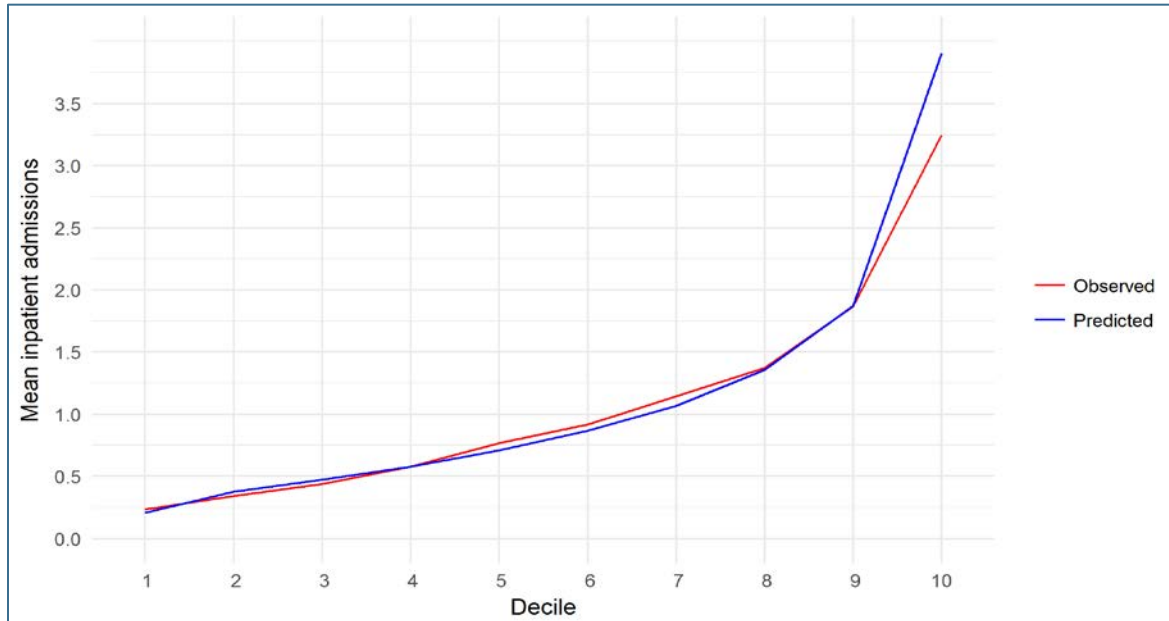
¹⁰ T. Domencich and D.L. McFadden. 1996. "Urban Travel Demand: A Behavioral Analysis." New York, New York: Elsevier. Available at <https://eml.berkeley.edu/~mcfadden/travel.html>. Accessed April 30, 2017.

The Hosmer-Lemeshow statistic is not applicable on the BCN-2 risk adjustment model because the outcome is count-valued. Instead, we used risk decile plots to assess model calibration.

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

We used risk decile plots to assess negative binomial model calibration. The decile plot depicted in Figure 1 indicates that the negative binomial generated well-calibrated predictions across the BCN-2 distribution

Figure 1. Negative binomial decile plot



Source: Mathematica analysis of 2014 MAX PS, LT, OT, and IP files. Model development half sample (n = 71,097).

Note: This figure shows the average predicted and observed rates for each decile of the predicted risk distribution, as estimated using negative binomial regression.

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 6, the predicted and observed outcomes are similar in magnitude at most deciles, scaling proportionately as predicted risk thresholds increase. The predicted outcome does not perform as well for the 10th decile, but overall, the similarity across predicted and observed values across the majority of the distribution indicates that the model is well calibrated.

Table 6. Negative binomial decile table

Decile	Number of beneficiaries	Observed mean inpatient admissions	Predicted mean inpatient admissions
1 (lowest)	7,109	0.22	0.21
2	7,110	0.36	0.38
3	7,115	0.43	0.47
4	7,105	0.59	0.58
5	7,109	0.76	0.71
6	7,110	0.94	0.87
7	7,110	1.15	1.07
8	7,110	1.40	1.36
9	7,110	1.87	1.88
10 (highest)	7,109	3.33	3.92

Source: Mathematica analysis of 2014 MAX PS, LT, OT, and IP files. Model validation half sample (n =71,097).

Note: Deciles are classified on the basis of the predicted number of inpatient admissions from the risk adjustment model.

We also calculated a series of observed versus expected (O/E) ratios to assess how well the model performed for important subgroups. A ratio of one indicates that the expected (synonymous with “adjusted” or “predicted”) values are approximately equivalent to the observed (synonymous with “unadjusted”) values for the subgroup, the desired finding. A ratio greater than one indicates that the observed values are greater than the predicted values, reflecting underprediction of the model. Conversely, a ratio less than one 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 beneficiaries with multiple comorbidities would inadvertently penalize accountable entities for serving this vulnerable subgroup. Taken as a whole, the results in Table 7 provide reassurance that the model does not suffer from major subgroup-specific prediction errors. The largest absolute deviation from one is 0.09 and the remaining deviations fall within 0.07.

Table 7. Predictive performance by key beneficiary characteristics

Characteristic	Observed-to-expected ratio
Sex	
Female	0.98
Male	0.94
Age group	
18–24	1.06
25–44	1.00
45–64	0.93
Eligibility category	
Adult	1.03
Aged/blind/disabled	0.95
Child	1.05
Number of chronic conditions	
2–5	0.99
6–9	1.01
10 or more	0.91
Type of chronic conditions	
Only physical health	1.00
Only behavioral health	1.03
Both physical and behavioral health	0.96

Source: Mathematica analysis of 2014 MAX PS, LT, OT, and IP files. Model validation half sample (n = 71,097).

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

2b3.9. Results of Risk Stratification Analysis:

Not applicable. We used risk adjustment instead of risk stratification.

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)

The preferred specification was well calibrated, with predicted and observed values scaling similarly across predicted risk deciles. Importantly, the model algorithm accurately predicted admission rates for important vulnerable subgroups of interest, including beneficiaries covered under the aged/blind/disabled eligibility category and beneficiaries with numerous chronic conditions. This finding provides reassurance that the algorithm appropriately incentivizes accountable entities to serve higher-risk populations.

In summary, the BCN-2 risk adjustment algorithm employs well-established, publicly available risk factors to estimate predicted risk scores at the beneficiary level. These predicted risk scores are statistically sound, as assessed by a series of standard statistical tests. We aligned the risk adjustment approach for BCN-2 to the approach for BCN-1, and the predicted risk scores performed well for both measures. The beneficiary-level scores can be aggregated up to a different level of reporting—for example, the state-level, as detailed in this report—and subsequently translated into performance scores that account for differences across entities in their respective patient 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*)

Recognizing that small samples may be vulnerable to the influence of statistical noise, we conducted a power calculation designed to provide guidance to implementers regarding the minimum sample size required for statistically appropriate reporting. Specifically, using a two-sided test, we computed the minimum sample size necessary to detect a 0.5 percentage point (0.005) difference with 90 percent certainty, noting that the outcome distribution was scaled as a proportion (for example, 0.20 instead of 200 per 1,000) for the purposes of computing statistical power.¹¹ We chose these thresholds to reflect the standard deviation of the state-level outcome distribution, which was approximately 0.005 (again, scaled as a proportion, which is equivalent to 5 admissions per 1,000 beneficiary months). As an additional benchmark, we note that the spread of values across the interquartile range of state-level scores was approximately 0.004 (or 4 admissions per 1,000 beneficiary months).

Using the standard equation for a power calculation for a difference in rates, that is, $n = \frac{2\sigma^2(Z_{\beta} + Z_{1-\alpha/2})^2}{(p_1 - p_2)^2}$, where $p_1 - p_2$ is the desired minimum detectable difference (0.005), and $Z_{1-\alpha/2}$ is the 100(1- α /2)th percentile of the standard normal distribution. We calculate σ^2 based on $p(1-p)$, where $p = 0.097$ is chosen based on the risk adjusted BCN-2 rate from all ten states in this study. We chose $\alpha = 0.10$ as the desired significance level and $\beta = 0.8$ as the desired power.

The power calculation result indicated that at least 43,098 beneficiary months are required to reliably detect a 0.005 difference. Assuming an average enrollment length of 11 months among beneficiaries—reflecting the analytic sample average—these minimum sample sizes translate into 3,918 beneficiaries. The sample sizes of State B, State G, and State J are smaller than this minimum beneficiary threshold, suggesting considerable caution when interpreting their rates.

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

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 analyzed the distribution of the BCN-2 measure rate at the state level and among demographic and clinical subgroups of interest. We compared performance across state-level inpatient admission rates to understand

¹¹ The proportion approximation was appropriate because the outcome distribution had a lower bound of zero and its empirical maximum was considerably smaller than one.

any variation in performance. We calculated the 95% confidence interval of the inpatient admission rates for each state using a z-distribution for proportion. We then compared each state's confidence interval to the overall measure rate that uses all beneficiaries across states. State measure rates that are significantly higher than the overall rate indicate an evidence of room for improvement. We conducted similar statistical tests (using a z-test and adjusting all p-values for multiple comparisons using the Benjamini-Hochberg procedure) to understand variation in performance by subgroups such as age, sex, and race.

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)

We found that the risk-adjusted BCN-2 measure rates across the 10 states cover a wide range with meaningful variation. Specifically, the measure rate ranges from 72.3 to 360.1 inpatient admissions per 1,000 member months, with a mean of 96.5 and standard deviation of 85.5. State B exhibited significantly higher measure rates than the average performance rate (Figure 2), which suggests room for improvement in the quality of care delivered to BCNs. Two states show significantly lower measure rates than the average performance. The remaining 7 states have performance that was statistically indistinguishable from the average performance in the sample. All of the states' rates were higher than the Medicare IHU measure rate (an inpatient admission measure similar to BCN-2 that excludes inpatient events due to behavioral health conditions and maternity, as discussed in the validity section)¹² of 16.85 inpatient admissions per 1,000 member months.¹³ This gap suggests room for improvement in the quality of care provided to Medicaid BCNs.

Although evidence is mixed regarding the proportion of inpatient admissions that are potentially avoidable,¹⁴ some Medicaid and BCN-specific initiatives have been successful. Specialized care management interventions to reduce inpatient admissions among the highest-risk beneficiaries have shown decreases as high as 30 or 40 percent.^{15,16} A more plausible estimate for potential reductions in inpatient admissions among BCNs is the 15 percent reduction in utilization and/or cost that emerged from a meta-evaluation of patient-centered medical home programs for chronically ill patients.¹⁷ Indeed, Healthcare Cost and Utilization Project (HCUP) data

¹² National Committee for Quality Assurance. 2017. "Proposed Changes to Existing Measures for HEDIS[®] 2018: Inpatient Hospital Utilization (IHU) and Hospitalization for Potentially Preventable Complications (HPC)." National Committee for Quality Assurance. Accessed June 7, 2018 from: <https://www.ncqa.org/Portals/0/PublicComment/HEDIS-Ad-Hoc/3.%20Inpatient%20Hospital%20Utilization.pdf?ver=2017-07-13-092457-143>

¹³ Given the IHU criteria to only include beneficiaries with less than one 45-day gap in coverage, we assumed that the beneficiaries in the Medicare sample had an average of 11 months of enrollment. We divided the IHU measure rate (185.4 inpatient admissions per 1,000 Medicare beneficiaries) by 11 to achieve an equivalent of 16.85 inpatient admissions per 1,000 member months.

¹⁴ Soril, L., L. Leggett, D. Lorenzetti, T. Noseworthy, and F. Clement. "Reducing Frequent Visits to the Emergency Department: A Systematic Review of Interventions." PLoS One, vol. 10, no. 4, 2015.

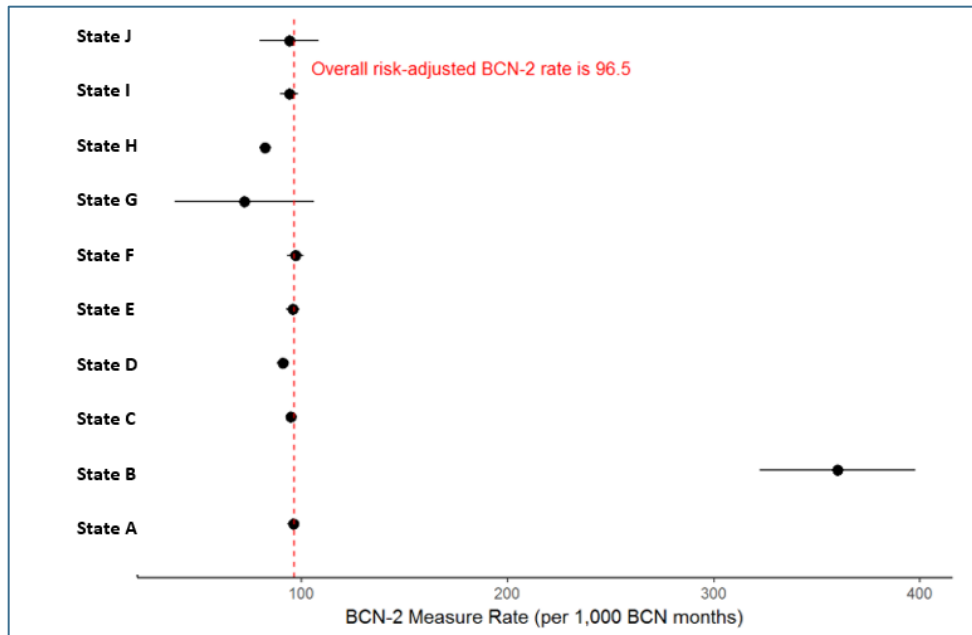
¹⁵ Raven, M.C., K.M. Doran, S. Kostrowski, C. C. Gillespie, and B.D. Elbel. "An Intervention to Improve Care and Reduce Costs for High-Risk Patients with Frequent Hospital Admissions: A Pilot Study." BMC Health Services Research, vol. 11, no. 270, 2011.

¹⁶ Green, S.R., V. Singh, and W. O'Byrne. "Hope for New Jersey's City Hospitals: The Camden Initiative." Perspectives in Health Information Management, vol. 7, spring 2010.

¹⁷ Peikes, D., S. Dale, and E. Lundquist. "Building the Evidence Base for the Medical Home: What Sample and Sample Size Do Studies Need?" AHRQ Publication no. 11-0100-EF. Rockville, MD: Agency for Healthcare Research and Quality, October 2011.

indicate that 15.6 percent of all nonmaternal and neonatal Medicaid inpatient admissions in 2012 were for ACSCs; these are “conditions for which good outpatient care can potentially prevent or reduce disease progression and the need for hospitalization.”¹⁸

Figure 2. Risk-adjusted measure rate by state



Source: Mathematica analysis of 2014 MAX PS, LT, OT, and IP files. Full sample (n = 142,193).

In general, there is a significant difference in the BCN-2 measure between all subgroups of age, sex, Medicaid eligibility, and comorbidity status; and a significant difference in BCN-2 measure between most subgroups of race (Table 8). Beneficiaries in the older age group have a higher BCN-2 rate than the younger age groups (all comparisons with p-value < 0.001). The BCN-2 measure rate is significantly higher (p-value < 0.001) for males than for females (112.4 and 88.21, respectively). BCN-2 rates exhibit significant differences for all race pairs, except for the pair of white and Hispanic (p-value = 0.107). In general, black beneficiaries have significantly higher BCN-2 rate than other race groups (125.5 versus 83.35, 86.69, and 100.5, respectively). In terms of Medicaid eligibility, aged/blind/disabled beneficiaries have a significantly (p < 0.001) higher BCN-2 measure rate as compared with adults and other/unknown. Finally, those with 1 or more behavioral health conditions have a significantly (p < 0.001) higher BCN-2 measure rate than those without a behavioral health condition (100.7 versus 80.7, respectively). This finding is consistent with the literature that shows beneficiaries with behavioral health conditions account for a disproportionate level of hospital-based utilization.^{19,20,21}

¹⁸ Lopez-Gonzalez, L., G.T. Pickens, R. Washington, and A.J. Weiss. “Characteristics of Medicaid and Uninsured Hospitalizations, 2012.” Healthcare Cost and Utilization Project Statistical Brief, no. 182. Rockville, MD: Agency for Healthcare Research and Quality, October 2014. Available at <https://www.hcup-us.ahrq.gov/reports/statbriefs/sb182-Medicaid-Uninsured-Hospitalizations-2012.pdf>. Accessed March 8, 2017.

¹⁹ Billings, J., and M.C. Raven. “Dispelling an Urban Legend: Frequent Emergency Department Users Have Substantial Burden of Disease.” *Health Affairs*, vol. 32, no. 12, 2013, pp. 2099–2108.

²⁰ Prince, J., A. Akincigil, D. Hoover, J. Walkup, S. Bilder, and S. Crystal. “Substance Abuse and Hospitalization for Mood Disorder Among Medicaid Beneficiaries.” *American Journal of Public Health*, vol. 99, no. 1, 2009, pp. 160–167. doi: 10.2105/AJPH.2007.133249.

²¹ Boyd, C., B. Leff, C. Weiss, J. Wolff, R. Clark, and T. Richards. “Clarifying multimorbidity to improve targeting and delivery of clinical services for Medicaid populations.” Princeton, New Jersey: Center for Health Care Strategies,

Table 8. Risk-adjusted measure rate distribution by subgroup

Subgroup	# of Beneficiaries	Weighted Mean	Minimum	25th percentile	50th percentile	75th percentile	Maximum
Aged 18 to 24	17,781	66.88	59.39	60.39	67.03	73.13	485.2
Aged 25 to 44	58,949	83.2	58.43	73.87	82.86	88.88	285.6
Aged 45 to 64	65,463	117	94.48	115.8	117.7	125.7	442.5
Male	49,798	112.4	99.22	106.4	111	120.1	458.1
Female	92,395	88.21	57.77	84.21	90.17	93.27	330.3
White	82,536	83.35	57.85	81.75	86.98	89.73	472.4
Black	41,627	125.5	98.56	115.7	126.9	134.4	304.1
Hispanic	10,647	86.69	0.00	64.24	73.9	81.25	103.4
Other/unknown	7,383	100.5	0.00	83.71	98.51	106.7	287.1
Aged/Blind/Disabled	80,569	124.1	94.22	115.9	126.3	128.3	494.2
Adult	58,450	59.85	44.4	54.94	60.13	103.8	112.6
Child	3,174	42.74	22.21	40.08	57.91	63.53	106.8
1 or more behavioral health conditions	113,051	100.7	78.54	99.51	103.2	106.3	323
No behavioral health conditions	29,142	80.07	64.47	74.72	78.04	84.57	394.7

Source: Mathematica analysis of 2013 and 2014 MAX PS, LT, OT, and IP files.

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?)

Overall, BCN-2 shows clinically and statistically meaningful differences among key subgroups and opportunities for improvement. The risk-adjusted BCN-2 measure rates across the 10 states cover a wide range of meaningful variation, and three of the ten states in this sample are statistically distinguishable from the overall performance rate. It is possible a broader sample of states would show more statistically significant variation.

In addition, evidence reviewed for BCN-2 suggests that monitoring and improving inpatient admission rates would improve health outcomes for BCNs. By definition, BCNs have disproportionately high levels of inpatient admissions due to their complex medical problems, which are often exacerbated by multiple chronic conditions and social needs. However, evidence suggests at least a portion (around 15%) of inpatient admissions may be avoidable. Therefore, we believe all states have an opportunity to reduce the inpatient admission rate among Medicaid BCNs by improving the quality of care for this vulnerable population.

Finally, BCN-2 shows meaningful and statistically significant variation across nearly all key subgroups tested, suggesting that the quality of care provided to these subgroups varies. The ability of BCN-2 to detect differences across these subgroups underline its importance in equalizing the care provided to these subpopulations.

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

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*)

Not applicable; we have only one set of specifications.

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*)

Not applicable; we have only one set of specifications.

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*)

Not applicable; we have only one set of specifications.

2b6. MISSING DATA ANALYSIS AND MINIMIZING BIAS

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*)

We assessed the extent of missing data using the MAX validation and anomaly tables (citations can be found in the table source notes).

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*)

The vast majority of the Medicaid eligibility and claims data elements required to both identify the Medicaid BCN population and calculate the BCN-2 measure exhibit negligible missingness in 2013-2014 MAX data for the ten states included in the analytic sample.

We used date of birth in order to calculate age in each year. Almost all states and all years had available dates of birth for enrollees; State F (2014) had the highest missing rate, but still had only 1.3% of enrollees with missing data in that field. Data were not available to assess the missingness for fields used to determine dual status.

We used monthly Medicaid eligibility data from the PS file to identify beneficiaries with at least 10 months of eligibility in the lookback year. Across all states and years, more than 95 percent of beneficiaries in the PS file with claims have Medicaid eligibility information.

We used the type of service data element to identify inpatient stays, which is critical to the utilization component of the BCN definition (at least 1 inpatient stay in the lookback period). Across all states and years, more than 95 percent of inpatient claims had a type of service of “01” (for “inpatient”), which meets expectations based on historical MAX data for the field.²²

We used the diagnosis code fields to identify chronic conditions (via the CCW algorithms), which is critical to the chronic condition component of the BCN definition (at least 2 chronic conditions in the lookback period). Across all states and years, more than 95% of IP and LT claims and more than 60% of OT claims had a primary diagnosis code (Table 9).

Table 9. Percent of total claims with a primary diagnosis code

State	Year	% of IP claims with primary diagnosis code ^a	% of LT claims with primary diagnosis code ^b	% of OT claims with primary diagnosis code ^c
State A^d	2013	100.00	100.00	88.79
	2014	NA	NA	NA
State B^d	2013	100.00	100.00	95.74
	2014	100.00	100.00	96.14
State C^e	2013	100.00	100.00	97.19
	2014	100.00	100.00	96.81
State D^d	2013	100.00	100.00	97.50
	2014	100.00	100.00	97.71
State E^e	2013	100.00	100.00	82.63
	2014	100.00	100.00	79.46
State F^d	2013	100.00	100.00	97.37
	2014	NA	NA	NA
State G^d	2013	100.00	95.83	84.21
	2014	100.00	95.56	84.41
State H^e	2013	100.00	100.00	100.00
	2014	98.10	99.99	99.93
State I^d	2013	100.00	100.00	90.67
	2014	100.00	100.00	96.93
State J^d	2013	100.00	100.00	84.77
	2014	100.00	100.00	83.50

Source: MAX validation tables. Available at < <https://www.cms.gov/Research-Statistics-Data-and-Systems/Computer-Data-and-Systems/MedicaidDataSourcesGenInfo/MAX-Validation-Reports.html> >.

^a Based on historical MAX data, the expected range for this column is 98-100%.

^b Based on historical MAX data, the expected range for this column is 95-100%.

^c Based on historical MAX data, the expected range for this column is >60%.

^d We assessed fee-for-service non-crossover claims for State A, State B, State D, State F, State G, State I, and State J.

^e We assessed managed care (encounter) claims for State C, State E, and State H.

NA = Not available

²² Source: MAX validation tables. Available at < <https://www.cms.gov/Research-Statistics-Data-and-Systems/Computer-Data-and-Systems/MedicaidDataSourcesGenInfo/MAX-Validation-Reports.html> >.

Table 10 contains missingness information related to the remaining data elements needed to identify observation stays (procedure codes and revenue codes), which are also included in the BCN-2 numerator. Revenue codes (from the OT file), procedure codes, and place of service codes may all be used to calculate the ED visits included in the BCN-1 numerator; they are included in this table for completeness.

All states and years fall within the expected range (35-70%) for the percentage of IP claims with a procedure code and one state (State F in 2013) exceeded that range. Most states and years also exceed the expected threshold (>95%) for the percentage of OT claims with a procedure code, and all states and years with available data showed that OT claims without a procedure code at least had a revenue code. Only one-third of states and years with available data have a proportion of OT files with place of service codes that exceeds the expected threshold (>95%). However, no state has below 87% of OT files with place of service codes.

Dates of service were also used in the calculation of the BCN-2 measure, to distinguish or condense hospital-based events, but they are uniformly available because they are required fields for MAX IP and OT claims.

Table 10. Percentage of total claims with data elements necessary to identify hospital utilization (inpatient admissions, observation stays, and emergency department visits)

State	Year	% of IP claims with a procedure code ^a	% of OT claims with a procedure code ^b	% of OT claims with a procedure code or UB-92 revenue code	% of OT claims with place of service code ^{b,c}
State A^d	2013	58.37	91.33	100.00	92.29
	2014	NA	NA	NA	NA
State B^d	2013	60.51	96.33	100.00	88.27
	2014	60.74	96.58	100.00	88.31
State C^e	2013	62.09	97.52	100.00	NA
	2014	62.75	97.71	100.00	NA
State D^d	2013	42.93	100.00	100.00	93.15
	2014	44.13	100.00	100.00	92.59
State E^e	2013	59.38	94.43	100.00	NA
	2014	61.66	96.28	100.00	NA
State F^d	2013	74.83	99.24	100.00	87.64
	2014	NA	NA	NA	NA
State G^d	2013	56.15	84.71	100.00	95.27
	2014	55.56	85.19	100.00	95.56
State H^e	2013	62.58	99.88	100.00	NA
	2014	60.61	99.88	100.00	NA
State I^d	2013	59.69	98.91	100.00	96.37
	2014	60.74	98.72	100.00	98.06
State J^d	2013	61.02	99.84	100.00	94.13
	2014	61.64	99.87	100.00	93.08

Source: MAX validation tables. Available at < <https://www.cms.gov/Research-Statistics-Data-and-Systems/Computer-Data-and-Systems/MedicaidDataSourcesGenInfo/MAX-Validation-Reports.html> >.

^a Based on historical MAX data, the expected range for this column is 35-70%.

^b Based on historical MAX data, the expected range for these columns is >95%.

^c Place of service was not assessed among managed care claims in the MAX validation tables, as reflected in “NA” entries for State C, State E, and State H.

^d We assessed fee-for-service non-crossover claims for State A, State B, State D, State F, State G, State I, and State J.

^e We assessed managed care (encounter) claims for State C, State E, and State H.

NA = Not available

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*)

Given the relatively small amount of missing information used to identify the BCN population and calculate the BCN-2 measure, we do not believe there is any systematic bias in our testing. States implementing the measure with their own data will likely have fewer missing fields than reported above because they are better equipped to account for state-specific codes when identifying the BCN population and constructing the measure.

APPENDIX 1 Measure Testing (subcriteria 2a2, 2b1-2b6)

The states used for testing were based on the most current MAX data available at the time that testing began and data quality checks in which we determined which states had sufficient quality of their FFS or encounter records. Specifically, we reviewed the FFS and managed care population in each of the 15 states with available 2014 MAX data (as of the beginning of testing) for inclusion in the analytic sample. We developed criteria to review each state's Medicaid fee-for-service (FFS) and managed care populations:

Selection of states with FFS data. States had to meet three criteria to be included in the analytic sample:

- (1) At least 25 percent of the state's Medicaid population had to be enrolled in FFS in 2014

This requirement ensured that each state would have a sufficient FFS population throughout the testing period. Three states did not meet this requirement.

- (2) There had to be no data anomalies that impacted our testing ability

Data anomalies limit our ability to interpret testing results. One state was excluded because the Medicaid population identified in its 2014 MAX enrollment data was significantly smaller than the 2013 and 2012 population. The drop coincided with the state's 1115 waiver demonstration, which provided newly eligible Medicaid beneficiaries premium assistance for private insurance plans on the states' marketplace.

- (3) State-level measures of inpatient admissions and ED visits had to align with national benchmarks.

We required state-level outcome measures to align with national benchmarks to confirm that the FFS population in each state was broadly representative and that state-specific coding conventions accurately captured hospital-based utilization in claims. Historically, roughly 9.5 percent of adult Medicaid beneficiaries have at least one inpatient admission per year and 31.5 percent have at least one ED visit per year.^{23 24} Using these figures as benchmarks, we eliminated four states that diverged by more than 60 percent from either hospital-based care benchmark.

Selection of states with managed care data. States had to meet three criteria to be included in the analytic sample:

- (1) Enrollment in comprehensive managed care had to be greater or equal to 50 percent of state's Medicaid population in 2014

²³ Wherry, L. R., M. E. Burns, L. J. Leininger. "Using self-reported health measures to predict high-need cases among Medicaid-eligible adults." Health Services Research, vol. 49, no. 6.1, December 2014, pp. 2147-72.

²⁴ Garcia, T.C., A.B. Bernstein, and M.A. Bush. "Emergency Department Visitors and Visits: Who Used the Emergency Room in 2007?" National Center for Health Statistics Data Brief, no. 38. Atlanta, GA: Centers for Disease Control and Prevention, 2010.

This requirement ensured that each state would have a sufficient managed care population throughout the testing period. Eight states did not meet this requirement.

(2) The state had to have quality assurance checks and policies to promote utilization reporting from all health plans

Although states fairly consistently report enrollment in managed care plans and capitation payments, encounter claims (unlike FFS claims) have been known to under report service utilization.²⁵ Insufficient utilization information in encounter claims would impede measure accuracy by undercounting the number of ED visits in the measure numerator. Four states were excluded because they did not require all health plans to submit data, impose financial penalties for failing to submit data, and/or report that they are using their data for analyses.

(3) State-level measures of inpatient admissions and ED visits had to align with national benchmarks

We required state-level outcome measures to align with national benchmarks to confirm that the FFS population in each state was broadly representative and that state-specific coding conventions accurately captured hospital-based utilization in claims. Historically, roughly 9.5 percent of adult Medicaid beneficiaries have at least one inpatient admission per year and 31.5 percent have at least one ED visit per year.^{26,27} We did not eliminate any state for this criterion.

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.

²⁵ Byrd, Vivian L. H., and Allison Hedley Dodd. "Assessing the Usability of Encounter Data for Enrollees in Comprehensive Managed Care 2010-2011." Medicaid Policy Brief No. 22. Prepared for the Centers for Medicare & Medicaid Services. Mathematica Policy Research, August 2015. Available at https://www.cms.gov/Research-Statistics-Data-and-Systems/Computer-Data-and-Systems/MedicaidDataSourcesGenInfo/Downloads/MAX_Encounter_Brief_2010_2011.pdf. Accessed December 8, 2017.

²⁶ Wherry, L. R., M. E. Burns, L. J. Leininger. "Using self-reported health measures to predict high-need cases among Medicaid-eligible adults." Health Services Research, vol. 49, no. 6.1, December 2014, pp. 2147-72.

²⁷ Garcia, T.C., A.B. Bernstein, and M.A. Bush. "Emergency Department Visitors and Visits: Who Used the Emergency Room in 2007?" National Center for Health Statistics Data Brief, no. 38. Atlanta, GA: Centers for Disease Control and Prevention, 2010.

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.

Not applicable

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).

Not applicable

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)
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

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?)
CMS is considering implementation plans for this measure. There are no identified barriers to implementation in a public reporting application.

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.)

CMS is developing measures to improve the quality of care of Medicaid populations served by CMS's Innovation Accelerator Program, which includes Medicaid BCNs. This measure is intended for use by states to monitor and improve the quality of care provided for the Medicaid BCN population. States may choose to begin implementing the measures based on their programmatic needs.

This measure is intended to be paired with BCN-1, an all-cause ED utilization measure that was also developed specifically for the Medicaid BCN population.

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.

This measure has not been implemented yet. Unlike Medicare measures, there is no formal process by which draft results for Medicaid measures are shared with measured entities. However, we invited a 19-member technical expert panel (TEP), a 7-member risk-adjustment work group, and the public (via a public comment process) to comment on the measure specifications and testing results. The TEP included at least three current or former state Medicaid officials. Refer to Ad.1. for details on the TEP and risk-adjustment work group.

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.

Not applicable

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.

Not applicable

4a2.2.2. Summarize the feedback obtained from those being measured.

Not applicable

4a2.2.3. Summarize the feedback obtained from other users

Not applicable

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.

Not applicable

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 being considered for initial endorsement. Adoption of this measure has the potential to improve the quality of care for Medicaid BCNs, especially in conjunction with the paired ED utilization measure.

Across all states, the risk-adjusted BCN-2 measure rate is 96.5 inpatient admissions per 1,000 beneficiary months, with a range of 75.4 in State G to 375.2 in State B. The inpatient admissions rate measure may be useful for monitoring the rate of inpatient admissions among BCNs and encourage states to develop interventions to decrease the rates. This is important because evidence suggests that at least a portion of these inpatient admissions may be avoidable, given adequate access to outpatient care, care coordination, and disease self-management skills (Agency for Healthcare Research and Quality 2014; Gao et al. 2014).

References:

Agency for Healthcare Research and Quality. "Measures of Care Coordination: Potentially Avoidable Hospitalizations." Chartbook on Care Coordination. Rockville, MD: AHRQ, 2015. Available at <https://www.ahrq.gov/research/findings/nhqrdr/2014chartbooks/carecoordination/carecoord-measures3.html>. Accessed July 28, 2016.

Gao, J., E. Moran, Y.F. Li, and P.L. Almenoff. "Predicting Potentially Avoidable Hospitalizations." *Medical Care*, vol. 52, no. 2, 2014, pp. 164–171.

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.

BCN-2 has not been implemented yet. There were no unexpected findings identified during testing of this measure.

4b2.2. Please explain any unexpected benefits from implementation of this measure.

BCN-2 has not been implemented yet. There were no unexpected benefits identified during testing of this measure.

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)

2503 : Hospitalizations per 1000 Medicare fee-for-service (FFS) Beneficiaries

5.1b. If related or competing measures are not NQF endorsed please indicate measure title and steward.

Non-NQF endorsed: Healthcare Effectiveness Data and Information Set (HEDIS) Inpatient Hospital Utilization (IHU) measure

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?

No

5a.2. If the measure specifications are not completely harmonized, identify the differences, rationale, and impact on interpretability and data collection burden.

Parts of the specifications for BCN-2 harmonize with the three related measures listed in question 5.

Differences between BCN-2 and the other measures, described below, do not impose additional data collection burden to states, because the data elements are available in administrative data and are consistent with some measures states are already likely collecting.

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.)

Not applicable; 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.

No appendix Attachment:

Contact Information

Co.1 Measure Steward (Intellectual Property Owner): Centers for Medicare & Medicaid Services, Centers for Medicaid & CHIP 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: Melissa, Azur, mazur@mathematica-mpr.com, 202-250-3518-

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.

The Technical Expert Panel (TEP) members advised on the development of the initial measure concept and preliminary specifications; reviewed testing results and feedback obtained during public comment; and advised on the refinements of the technical specifications.

TEP members:

Consumers or consumer representatives

Carol McDaid, Capitol Decisions, Inc.

Janice Tufte, Patient-Centered Outcomes Research Institute (PCORI) ambassador

Kayte Thomas, PCORI ambassador

State officials

David Mancuso, Washington State Department of Social and Health Services

Roxanne Kennedy, New Jersey Division of Mental Health and Addiction Services

Health plans

Alonzo White, Aetna Medicaid

Deb Kilstein, Association for Community Affiliated Plans

Jim Thatcher, Mass. Behavioral Health Partnership, Beacon Health Options

Provider organizations

Daniel Bruns, Health Psychology Associates

Aaron Garman, Coal Country (ND) Community Health Center (and American Academy of Family Practice Comm. on Quality & Practice)

Annette DuBard, Aledade, Inc.

Joe Parks, National Council for Behavioral Health (formerly of Missouri HealthNet Division-- Medicaid)

Subject matter experts and researchers

Andrew Bindman, University of California San Francisco School of Medicine

Alex Sox-Harris, Department of Veterans Affairs

Benjamin Miller, Farley Health Policy Center, University of Colorado School of Medicine

Kimberly Hepner, RAND Corporation

Mady Chalk, Treatment Research Institute

Federal agency officials

DEB Potter, Office of the Assistant Secretary for Planning and Evaluation

Laura Jacobus-Kantor, Substance Abuse and Mental Health Services Administration, Center for Behavioral Health Statistics and Quality

The Risk Adjustment Work Group members advised on the development of the initial risk-adjustment models, reviewed risk-adjusted testing results, and advised on the refinements of the risk-adjustment model.

Risk Adjustment Work Group members:

Marguerite Burns, PhD (Assistant Professor, University of Wisconsin School of Medicine and Public Health)

Ezra Golberstein, PhD (Associate Professor, University of Minnesota School of Public Health)

Lisa Iezzoni, MD, MSc (Professor, Harvard Medical School)

Joanna Jiang, PhD (Senior Social Scientist, Agency for Healthcare Research and Quality)

Zhenqiu Lin, PhD (Director of Data Management and Analytics, Center for Outcomes Research and Evaluation, Yale University)

Patrick Romano, MD (Professor, University of California, Davis, School of Medicine)

Jonathan Shaw, MD, MS (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?

Ad.5 When is the next scheduled review/update for this measure?

Ad.6 Copyright statement: The International Classification of Diseases, 10th Revision, Clinical Modification (ICD-10-CM) is published by the World Health Organization (WHO). ICD-10-CM is an official Health Insurance Portability and Accountability Act standard.

The International Classification of Diseases, 10th Revision, Procedure Coding System (ICD-10-PCS) is published by the World Health Organization (WHO). ICD-10-PCS is an official Health Insurance Portability and Accountability Act standard.

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Ad.7 Disclaimers: This performance measure is not a clinical guideline and does not establish a standard of medical care, and has not been tested for all potential applications. The measure and specifications are provided without warranty.

Ad.8 Additional Information/Comments: