2024 Condition-Specific Excess Days in Acute Care Measures Updates and Specifications Report

Acute Myocardial Infarction — Version 9.0
Heart Failure — Version 9.0
Pneumonia — Version 8.0

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1. HOW TO USE THIS REPORT

This report describes the Centers for Medicare & Medicaid Services' (CMS's) condition-specific excess days in acute care (EDAC) measures that are publicly reported here on Medicare.gov. The measures are used to calculate hospital-level 30-day risk-standardized EDAC following acute myocardial infarction (AMI), heart failure (HF), and pneumonia admissions. This report serves as a single source of information about these measures for a wide range of readers. Reports describing other outcome measures can be found here on *QualityNet*.

Specifications that define cohort inclusions and exclusions, risk-adjustment variables, and the planned readmission algorithm described in this report are detailed in the following supplemental files:

- 2024 AMI EDAC Measure Code Specifications
- 2024 HF EDAC Measure Code Specifications
- 2024 Pneumonia EDAC Measure Code Specifications

These supplemental files are posted here on *QualityNet.*

This report includes:

- **Section 2 — An overview of the AMI, HF, and pneumonia EDAC measures:**
  - Background
  - Cohort inclusions and exclusions
    - Included and excluded hospitalizations
    - How transferred patients are handled
  - Outcome
  - Risk-adjustment variables
  - Data sources
  - EDAC calculation
  - Categorization of hospitals' performance scores

- **Section 3 — 2024 measure updates**

- **Section 4 — 2024 measure results**

- **Section 5 — Glossary**

The appendices include:

- Appendix A: Statistical approach to calculating EDAC
- Appendix B: Data quality assurance (QA)
- Appendix C: Annual updates to the measures since measure development
- Appendix D: Cohort inclusion/exclusion criteria, outcome criteria, and ED visit and observation stay definition codes
- Appendix E: Overview of the planned readmission algorithm

The measure methodology reports as well as the prior updates and specifications reports are available in the "Methodology" section and "Archived Measure Methodology" section (under "Resources") on the EDAC measures page here on *QualityNet*.

For a list of the supporting resource files for the 2024 EDAC measures that are available on *QualityNet* (including hyperlinks to the resources), or to review the 2024 Frequently Asked Questions document, refer to the "Resources" section on the EDAC measures page here on *QualityNet.*

If you have questions about the information in this report or the complementary supplemental files, please submit your inquiry using the QualityNet Q&A tool: https://cmsqualitysupport.servicenowservices.com/qnet_qa?id=ask_a_question > Program: Inpatient Claims-Based Measures > Excess Days in Acute Care (EDAC) > Understanding Measure Methodology. **Do *NOT* submit patient-identifiable information (for example, date of birth, Social Security number, Medicare Beneficiary Identifier, and encounter dates such as admission dates, discharge dates, procedure dates, and emergency department [ED]/observation dates) into this tool.**

2. BACKGROUND AND OVERVIEW OF MEASURE METHODOLOGY

2.1. Background on EDAC Measures

In July 2017, CMS began publicly reporting 30-day EDAC for AMI and HF for the nation's non-federal short-term acute care hospitals (including Indian Health Service hospitals) and critical access hospitals (CAHs). In July 2018, CMS began publicly reporting an additional EDAC measure; namely, pneumonia. This measure also includes admissions to non-federal short-term acute care hospitals (including Indian Health Service hospitals) and CAHs.

In 2020, CMS and the VHA collaborated to include admissions in Veterans Administration (VA) hospitals in all three EDAC measures.

Results for all three of these EDAC measures are posted and updated annually here on Medicare.gov.

CMS contracted with the Yale New Haven Health Services Corporation — Center for Outcomes Research and Evaluation (YNHHSC/CORE) to update the AMI, HF, and pneumonia EDAC measures for 2024 public reporting through a process of measure reevaluation.

2.2. Overview of Measure Methodology

The 2024 risk-adjusted EDAC measures use specifications from the original measure methodology reports posted here on *QualityNet*, with refinements to the measures as listed in Appendix C and described in the measures' updated measure methodology reports and prior updates and specifications reports posted here on *QualityNet.* An overview of the methodology is presented in this section.

For more information on the CMS programs that use these measures for fiscal year (FY) 2025, as well as their use in future FYs, please refer to the FY 2024 Inpatient Prospective Payment System (IPPS) Final Rule posted here on the CMS website.

2.2.1 Cohort

Index Admissions Included in the Measures

An index admission is the hospitalization to which the EDAC outcome is attributed and includes admissions for patients:

- having a principal discharge diagnosis of AMI, HF, or pneumonia for each respective measure;
  - The pneumonia measure cohort also includes admissions that meet ALL of the following criteria:
    - A principal discharge diagnosis of sepsis (that is not severe)
    - A secondary diagnosis of pneumonia coded as present on admission (POA)
    - No secondary diagnosis of sepsis that is both severe and coded as POA

- enrolled in Medicare Fee-For-Service (FFS) Part A and Part B for the 12 months prior to the date of the admission and Part A during the index admission (not applicable to VA hospitalizations);
- aged 65 or over;
- discharged alive from a non-federal short-term acute care hospital or VA hospital; and
- not transferred to another acute care facility.

The International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM) codes used to define the cohort inclusions for each measure are listed in the 2024 supplemental files posted here on *QualityNet*.

Index Admissions Excluded from the Measures

The EDAC measures exclude index admissions for patients:

- without at least 30 days of post-discharge enrollment in Medicare FFS (not applicable to VA hospitalizations);
- discharged against medical advice; or
- with a principal diagnosis code of COVID-19 (ICD-10-CM code U07.1) **or** with a secondary diagnosis code of COVID-19 coded as POA on the index admission claim. These code specifications are outlined in the 2024 supplemental files here on *QualityNet.* [Of note, patients with a COVID-19 principal diagnosis code are inherently not included in these measures, by definition.]

An additional exclusion criterion for the AMI cohort is that patients admitted and discharged from a hospital on the same calendar day are excluded as index admissions because it is unlikely that these patients had clinically significant AMIs.

Additionally, for the HF cohort, patients with an International Classification of Diseases, Tenth Revision (ICD-10) code indicating left ventricular assist device (LVAD) implantation or heart transplantation either during the index admission or up to 12 months prior to the index admission are excluded as index admissions because these patients represent a clinically distinct group. Claims/VA data from January 1, 2020 through June 30, 2020 hospitalizations were not used due to the declared COVID-19 public health emergency (PHE), as discussed in Section 3.2.2; as a result, the pre-index admission time frame would be less than 12 months for some patients, depending on their index admission date. The ICD-10 codes used to identify LVAD and heart transplant cases in claims are provided in the 2024 HF EDAC Measure Code Specifications supplemental file posted here on *QualityNet*.

Admissions for a condition within 30 days of discharge from an index admission for that same condition are excluded as index admissions.

As a part of data processing prior to the measure calculation, records are removed for non-short-term acute care facilities, such as psychiatric facilities, rehabilitation facilities, or long-term care hospitals. Additional data cleaning steps for non-VA hospitalizations include removing claims with stays longer than one year, claims with overlapping dates,

claims for patients not listed in the Medicare Enrollment Database, and records with ineligible provider IDs.

The percentage of admissions excluded based on each criterion is shown in Section 4 in Figure 4.2.1.1, Figure 4.3.1.1, and Figure 4.4.1.1, for AMI, HF, and pneumonia, respectively.

Patients Transferred between Hospitals

The measures consider multiple hospitalizations that result from hospital-to-hospital transfers as a single acute episode of care. Transfer patients are identified by tracking claims for inpatient short-term acute care hospitalizations over time. To qualify as a transfer, the second inpatient admission must occur on the same day or the next calendar day following discharge from the first inpatient admission at a short-term acute care hospital. Cases that meet this criterion are considered transfers regardless of whether the first institution indicates intent to transfer the patient in the discharge disposition code or whether the second inpatient admission is for the same condition.

To include an admission in the measure cohort, the patient must ultimately be discharged to a non-acute care setting (for example, to home or a skilled nursing facility). Thus, for patients transferred from one short-term acute care hospital to another, only the last admission in the series of transfers is eligible for inclusion in the cohort. The previous admissions are not included. For example, if a patient is admitted to Hospital A, transferred to Hospital B, and then discharged from Hospital B to a non-acute care setting, the Hospital B admission would be included in the cohort, and all ED visits, observation stays, and unplanned readmissions within 30 days of discharge from the Hospital B admission would be counted in Hospital B's outcome.

2.2.2 Outcome

All-Cause Days in Acute Care

The measures assess the number of days the patient spends in acute care in the 30 days after discharge. Days in acute care are defined as days spent in an ED, admitted to observation status, or admitted as an unplanned readmission for any cause to a short-term acute care hospital.

Each ED visit is counted as one whole day. See Table D.4.1 in Appendix D for the code definitions for ED visits.

Observation stays are recorded in terms of hours and converted for the measure into whole days (rounded up). For example, if a patient's stay in observation totaled 28 hours, that observation event is counted as two full days. See Table D.4.1 in Appendix D for the code definitions for observation stays. The codes capture post-discharge observation stays using facility and, in the case of Medicare FFS, physician data. Physician claims are used only in cases when facility claims are not available.

A readmission is defined as any unplanned short-term acute care hospitalization within 30 days of the discharge date for the index admission. Note that if a patient is readmitted to the **same** hospital on the **same** calendar day of discharge for the **same condition** as the index admission, the measure considers the patient to have had one single continuous admission (that is, one index admission). This methodology is employed to assist hospitals who might bill two separate claims in such cases, instead of adjusting the original claim and combining both the original and subsequent stay onto a single claim, as directed by Medicare. In effect, this added step prevents the second stay from being captured as a readmission (if unplanned). If the condition is **different** from the index admission, this is considered a readmission in the measure, if unplanned. For complete details on the same hospital/day/condition methodology used by the measures, please refer to the SAS analytic packages (SAS packs). Guidance on how to request SAS packs is provided in Section 3.3.

"Planned" readmissions are those planned by providers for anticipated medical treatment or procedures that must be provided in the inpatient setting. To exclude planned readmissions, the planned readmission algorithm developed for the publicly reported CMS 30-day AMI, HF, and pneumonia readmission measures is used, as described in the condition-specific readmission measures updates and specifications report posted here on *QualityNet*. For more detail about how planned readmissions are defined, refer to Figure E.1 in Appendix E. Each unplanned readmission is counted according to the length of stay. Each full or partial calendar day spent in an unplanned readmission is counted as one whole day. Admissions that extend beyond the 30-day outcome period are truncated on day 30; thus, only the portion of the admission that occurs within the 30 days is included in the outcome. An unplanned readmission that follows a planned readmission is still counted.

ED visits, observation stays, and readmissions with a principal diagnosis code of COVID-19 (U07.1) on the claim **or** with a secondary diagnosis code of COVID-19 on the claim (and coded as POA, in the case of readmissions) are not eligible for the EDAC outcome and are excluded. These code specifications are outlined in the 2024 supplemental files here on *QualityNet*.

When an ED visit, observation stay, or readmission overlaps with another event on the same day, only the most severe of the overlapping events is counted. For example, only a readmission day is counted if the readmission and either an observation stay or ED visit happens on the same day; only an observation day is counted if an observation stay and an ED visit happen on the same day.

The EDAC measures capture ED visits and observation stays in addition to readmissions for several reasons:

- Having to return to the ED or spend time in the hospital under observation matters to patients.
- Including all types of acute care will provide more detailed information to patients on what to expect following discharge.

- By capturing a range of outcomes that are important to patients, a more complete picture of post-discharge outcomes can be produced that better informs patients about care quality and incentivizes global improvement in transitional care.
- The increasing use of ED visits and observation stays have raised concerns that the current CMS 30-day readmission measures do not capture the full range of unplanned acute care in the post-discharge period. In particular, there exists concern that high use of observation stays could in some cases replace readmissions, and hospitals with high rates of observation stays in the post-discharge period may therefore have low readmission rates that do not accurately reflect the quality of care.
- Current readmission measures report readmissions only as a binary outcome (that is, any versus no readmission). However, some readmissions reflect severe deterioration requiring prolonged hospitalization while others involve only a brief, less acute hospitalization. Some patients have multiple visits in 30 days. Additionally, binary metrics do not account for each patient's opportunity for readmission: Patients who die post-discharge have less opportunity for readmission but are counted as being at the same risk for readmission as those who survive the full measurement period. The EDAC measures address all of these gaps by including other outcomes (that is, ED visits and observation stays), by capturing the total amount of time patients spend in acute care, and by accounting for time at risk of an event (that is, survival time).

There are a number of reasons for assessing all-cause acute care utilization in the CMS EDAC measures. First, from the patient's perspective, acute care utilization for any cause is an adverse event. In addition, making inferences about quality issues based solely on the documented cause of an acute care event is difficult. For example, a patient with HF who develops a hospital-acquired infection may ultimately be readmitted for sepsis. In this context, considering the readmission to be unrelated to the care that the patient received for HF during the index admission would be inappropriate.

Multiple Events

All eligible outcomes occurring in the 30-day period are counted, even if they are repeat occurrences. For example, if a patient returns to the ED three times on three different days, we count each ED visit as one whole day. Similarly, if a patient has two hospitalizations within 30 days, the days spent in each are counted. This approach is taken in order to capture the full patient experience in the post-discharge period.

30-Day Time Frame

The measures assess eligible outcomes within a 30-day period from the date of discharge from an index admission. The measures use a 30-day time frame because older adult patients are more vulnerable to adverse health outcomes during this time.[1] Acute care in the post-discharge period can be influenced by hospital care and the early transition to the non-acute care setting. The 30-day time frame is a clinically meaningful period for hospitals to collaborate with their communities in an effort to reduce acute care events.[2-8]

The 30-day time frame is consistent with the existing CMS 30-day AMI, HF, and pneumonia readmission measures endorsed by the CMS consensus-based entity (CBE) and publicly reported by CMS. Note that if a readmission or observation stay extends beyond 30 days, only that portion of the stay that occurs during the 30 days is included in the outcome.

Exposure Time

Because some patients do not survive 30 days, not all patients are at risk for an acute event for the same amount of time. 'Exposure time' is calculated as the number of days each patient survived after discharge, up to 30. This exposure time was incorporated as part of the outcome to reflect differential risk for EDAC after discharge. This differs from the existing CMS AMI, HF, and pneumonia 30-day readmission measures, which consider all patients to be equally at risk for a hospital event regardless of survival time.

2.2.3 Risk-Adjustment Variables

To account for differences in case mix among hospitals, the measures include an adjustment for factors such as age, comorbid diseases, and indicators of patient frailty, which are clinically relevant and have relationships with the outcome. For each patient, risk-adjustment variables are obtained from inpatient, outpatient, and physician Medicare administrative claims data extending up to 12 months prior to the index admission, and all claims for the index admission itself. Risk-adjustment variables are also obtained from VA administrative data in the case of VA beneficiaries. Inpatient, outpatient, and physician claims/VA data from January 1, 2020 through June 30, 2020 encounters are not used due to the declared COVID-19 PHE (as discussed in Section 3.2.2); as a result, the pre-index admission time frame would be less than 12 months for some patients, depending on their index admission date.

The measures' adjustment for case mix differences among hospitals is based on the clinical status of the patient at the time of the index admission. Accordingly, only comorbidities that convey information about the patient at the time of the index admission, or any time within the preceding 12 months (or less), are included in risk adjustment. Complications that arise during the course of the hospitalization are not used in risk adjustment.

The process for determining patient comorbidities present at the time of the index admission from the index admission claim/VA data uses a POA algorithm. In brief, a secondary diagnosis ICD-10-CM code on the index admission is used in risk adjustment if **one** of the following is true:

1. The POA indicator for the secondary diagnosis code = 'Y' on the index admission.
2. The secondary diagnosis code is classified as a POA-exempt code that is considered "always POA" (as designated by our clinical experts).
3. If the index claim/VA data is void of POA coding (that is, no reported POA indicator values for any of the secondary diagnoses), then the secondary diagnosis is used in risk adjustment if it is NOT mapped to a Condition Category (CC) that is included in the potential complications list.

The POA algorithm applies only in the case of secondary diagnosis codes on the index admission that are assigned to a CC used in risk adjustment of a measure. ICD–10 code-defined risk variables such as 'History of Coronary Artery Bypass Graft (CABG)' (defined, in part, by ICD-10-CM secondary diagnosis codes on the index claim), do not use the algorithm.

Refer to the 2024 supplemental files posted here on *QualityNet* for the list of CC-defined risk-adjustment variables and the specifications for the ICD-10 code-defined risk-adjustment variables. The lists of potential complications referred to in Step 3 of the algorithm are also included in the 2043 supplemental files.

CC mappings to ICD-10-CM codes, as well as the "POA-Exempt Codes Considered Always POA for RY 2024" table (referred to in Step 2 of the algorithm), are available here on *QualityNet.*

The measures do not include an adjustment for social drivers of health because the association between social drivers of health and health outcomes can be due, in part, to differences in the quality of health care that these groups of patients receive. The intent is for the measures to adjust for patient demographic and clinical characteristics while illuminating important quality differences. The CMS CBE re-endorsed the measures without adjustment for patient-level social drivers of health in the last endorsement maintenance submission prior to 2024.

2.2.4 Data Sources

The data sources for these analyses are Medicare administrative claims, VA administrative data, and enrollment information for patients having hospitalizations with discharge dates between July 1, 2020 and June 30, 2023. The datasets also contain associated inpatient and outpatient Medicare administrative claims and VA administrative data as well as physician Medicare administrative claims from up to 12 months prior to the index admission (as discussed in Section 2.2.3) as well as the 30-day period after discharge from the index admission, for patients having hospitalizations with discharge dates in the aforementioned time period. Refer to the original methodology reports posted here on *QualityNet* for further descriptions of these data sources and an explanation of the three-year measurement period.

2.2.5 Measure Calculation

The hospital-level 30-day all-cause EDAC for each measure is estimated using a random effects hurdle model.

Specifically, CMS calculates EDAC, for each hospital, as the difference ("excess") between a hospital's "predicted days" and "expected days" per 100 discharges, as illustrated in Figure 2.2.5.1.

Figure 2.2.5.1 — Equation for EDAC Calculation

Hospital EDAC = (Predicted Days – Expected Days) x 100 Discharges

"Predicted days" is the average number of days a hospital's patients spent in acute care after adjusting for the risk factors (outlined in the supplemental files posted here on *QualityNet*). "Expected days" is the average number of risk-adjusted days in acute care a hospital's patients would have been expected to spend if discharged from an average-performing hospital with the same case mix. To be consistent with the reporting of the CMS 30-day AMI, HF, and pneumonia readmission measures, CMS multiplies the measure result by 100 such that the final EDAC measures represent EDAC per 100 discharges.

Figure 2.2.5.2 provides an example hospital's EDAC calculation.

Figure 2.2.5.2 — Calculation of Example Hospital's EDAC for the HF EDAC measure

Example Hospital EDAC = (2.3 Days – 2.5 Days) x 100 Discharges = -20 Days

In the example illustrated in Figure 2.2.5.2, this hospital had 2.3 predicted days and 2.5 expected days. An EDAC of -20 indicates that this hospital's patients experienced 20 fewer EDAC than expected per 100 discharges for the HF EDAC measure during the 2023 reporting period.

To assess hospital performance for each reporting period, we re-estimate the parameter estimates using the years of data in that time period.

The random effects hurdle models are described fully in Appendix A and in the measure methodology reports posted here on *QualityNet*.

2.2.6 Categorizing Hospital Performance

To categorize hospital performance, CMS estimates each hospital's excess "days" in acute care and the corresponding 95% credible interval (CI). Excess "days" refers to the difference between the hospital's predicted days and expected days, per 100 discharges. CMS assigns hospitals to a performance category by comparing each hospital's CI surrounding the hospital's excess "days" to zero. The reference to zero reflects the expectation that the hospital's "days" will be no different than an average-performing hospital with a similar case mix. Comparative performance for hospitals with 25 or more eligible cases (or 50 or more eligible cases, in the case of the AMI measure) is classified as follows:

- "Fewer days than average" if the entire 95% CI surrounding the hospital's days is below zero [Patients who are discharged from a hospital in this category spend fewer days in acute care than patients discharged from an average-performing hospital with a similar case mix.]

- "Average" if the 95% CI surrounding the hospital's days includes zero [Patients who are discharged from a hospital in this category spend about the same number of days in acute care after discharge as patients discharged from an average-performing hospital with a similar case mix.]
- "More days than average" if the entire 95% CI surrounding the hospital's days is above zero [Patients who are discharged from a hospital in this category spend more days in acute care than patients discharged from an average-performing hospital with a similar case mix.]

In sum, these performance categories describe how different a hospital's performance is compared to an average-performing hospital with a similar case mix.

For the HF and pneumonia EDAC measures, if a hospital has fewer than 25 eligible cases for a measure, CMS assigns the hospital to a separate category, "Number of cases too small." This category is used when the number of cases is too small (fewer than 25) to reliably conclude how the hospital is performing. If a hospital has fewer than 25 eligible cases, the hospital's EDAC and parameter estimates will not be publicly reported for the measure. For the AMI EDAC measure, the threshold is 50 eligible cases.

The distribution of hospitals by performance category in the U.S. for this reporting period is described in Section 4.2.5, Section 4.3.5, and Section 4.4.5, for AMI, HF, and pneumonia, respectively.

3. UPDATES TO MEASURES FOR 2024 PUBLIC REPORTING

3.1. Rationale for Measure Updates

Annual measure reevaluation ensures that the risk-standardized days in acute care models are continually assessed and remain valid, given possible changes in clinical practice and coding standards over time. Modifications made to measure cohorts, risk models, and outcomes are informed by review of the most recent literature related to measure conditions or outcomes, feedback from various stakeholders, empirical analyses, and assessment of coding trends that reveal shifts in clinical practice or billing patterns. Input is solicited from a workgroup composed of up to 20 clinical and measure experts, inclusive of internal and external consultants and subcontractors. As this report describes, for 2024 public reporting, we made the following modifications to the measures:

- Updated the ICD-10 code-based specifications used in the measures. Specifically, we:
  - incorporated ICD-10-CM and International Classification of Diseases, Tenth Revision, Procedure Coding System (ICD-10-PCS) code changes into the cohort definitions and risk models that occurred in the following releases:
    - October 1, 2022 (FY 2023); and
    - April 1, 2023.
  - applied a YNHHSC/CORE-modified v4.0 of the Agency for Healthcare Research and Quality (AHRQ) Healthcare Cost and Utilization's (HCUP's) beta version 2019.1 Clinical Classification Software (CCS) for ICD-10-CM/PCS to the planned readmission algorithm.
  - applied a modified version of the FY 2023 V24 CMS-Hierarchical Condition Category (HCC) crosswalk that is maintained by RTI International to the risk models.
- Updated the Current Procedural Terminology (CPT®) code-based specifications used in the measures, incorporating CPT® code changes for calendar year 2023 into the code list that defines observation stays captured in the outcome.
- Revised the methodology used to weight ED visits and observation stays in calculating the outcome:
  - increased the weight of each ED visit to one whole day; and
  - changed how we round observation stay hours, from half-days to whole days.

As a part of annual reevaluation, we also undertook the following activities:

- Monitored code frequencies to identify any warranted specification changes due to possible changes in coding practices and patterns;
- Reviewed potentially clinically relevant codes that "neighbor" existing codes used in the measures to identify any warranted specification changes;
- Reviewed select pre-existing ICD-10 code-based specifications with our workgroup to confirm the appropriateness of specifications unaffected by the updates;
- Updated the measures' SAS packs and documentation;
- Evaluated and validated model performance for the three years combined (July 2020 – June 2023); and
- Evaluated the stability of the risk-adjustment models over the three-year measurement period by examining the model variable frequencies in each year (July 2020 – June 2021, July 2021 –

June 2022, and July 2022 – June 2023) as well as the parameter estimates and performance of the models for the three years combined (July 2020 – June 2023).

3.2. Detailed Discussion of Measure Updates

3.2.1 Annual Updates to Code-Based Measure Specifications

Cohort Definitions

We examined the code sets from the two ICD-10-CM/PCS releases outlined above, with particular attention to newly added codes. We then solicited input from our workgroup to determine which, if any, of the newly implemented ICD-10 codes in the code sets should be added to the cohort definitions. We reviewed approximately 1,218 new ICD-10-CM codes and 365 new ICD-10-PCS codes. These code totals reflect new code additions since 2023 public reporting.

No changes were made as a result of these processes and the surveillance and workgroup processes described above in the Rationale for Measure Updates section.

EDAC Outcome and the Planned Readmission Algorithm

In September 2019 and December 2020, the AHRQ HCUP released new versions of the CCS for ICD-10-CM and ICD-10-PCS codes, respectively, called the CCS Refined (CCSR). The magnitude of changes from the CCS beta versions to the CCSR is extensive. Until comprehensive testing can be completed on the CCSR, we will continue utilizing the existing beta version v2019.1 of the CCS for ICD-10-CM/PCS as the basis for the planned readmission algorithm specifications, updating it as appropriate with clinical expert input.

For 2024 public reporting, we examined the new ICD-10-CM and ICD-10-PCS codes in the two code set releases to determine the most appropriate CCS categorizations for the newly implemented ICD-10 codes, using the existing YNHHSC/CORE-modified v3.0 of the AHRQ HCUP's beta version 2019.1 CCS for ICD-10-CM/PCS that was utilized in 2023 public reporting. We then solicited input from our workgroup to confirm the clinical appropriateness of the CCS categorizations of the newly implemented ICD-10 codes in relation to the planned readmission algorithm, and whether any changes were warranted. Updates to the CCS mappings included the incorporation of the new ICD-10-CM codes and ICD-10-PCS codes into approximately 49 AHRQ CCS diagnosis categories and 31 AHRQ CCS procedure categories, respectively. Additionally, two ICD-10-PCS codes were remapped from one CCS procedure category to another.

The workgroup also reviewed the newly implemented ICD-10 codes in the two ICD-10-CM/PCS code set releases to determine which, if any, should be added to the singular ICD-10 code lists that are also used in the algorithm (conditions that are not captured by AHRQ CCS categories). The intent was to maintain the clinical integrity of the algorithm.

These processes, in addition to the surveillance and workgroup processes described above, led to the following changes:

- Potentially planned procedures:
  - added one ICD-10-PCS code (associated with AHRQ CCS procedure category 49) to the singular ICD-10-PCS code list
- Acute diagnoses:
  - added ICD-10-CM codes (associated with AHRQ CCS diagnosis categories 97, 101, 106, 115, 233, 238, 244, and 662) to the singular ICD-10-CM code lists

The YNHHSC/CORE-modified mappings that were used for 2024 public reporting are posted here on *QualityNet.* They show the assignment of ICD-10 codes to the AHRQ CCS diagnosis and procedure categories, and detail the changes made for 2024 public reporting.

Additionally, we reviewed the CPT® and Healthcare Common Procedure Coding System (HCPCS) code sets released since 2023 public reporting, to determine whether any changes to the code specifications used to identify observation stays and ED visits were warranted. The resulting changes are reflected in Table D.4.1 in Appendix D.

Analyses of the changes to the specifications suggest minimal impact to EDAC measure rates.

Risk Adjustment

We reviewed RTI International's FY 2023 modified version of the V24 CMS-HCC crosswalk, examining how the newly implemented ICD-10 codes in the FY 2023 ICD-10-CM/PCS code set releases were classified and where there may be codes that RTI International reclassified from one HCC to another when they updated to the FY 2023 version. We then solicited input from our workgroup to confirm the clinical appropriateness of the HCC classifications of the newly implemented ICD-10 codes and any changes warranted due to code shifts. CC to ICD-10-CM code crosswalks were updated based on these processes, in addition to the surveillance and workgroup processes described above. The 2024 crosswalk files are available here on *QualityNet.*

The workgroup also reviewed the newly implemented ICD-10 codes in the two ICD-10-CM/PCS code set releases to determine which, if any, should be added to the singular ICD-10 code lists that are also used in risk adjustment (conditions that are not captured by CCs). No changes were made as a result of this process and the surveillance and workgroup processes described above.

Additionally, we reviewed the 1,218 new codes in the two ICD-10-CM releases and the changes made by CMS to the POA-exempt code list for FY 2023, to determine updates to the "POA-Exempt Codes Considered Always POA" table for 2024, as part of the risk-adjustment methodology used by the measures (discussed in Section 2.2.3). The resulting changes are detailed in the table posted here on *QualityNet.*

3.2.2 COVID-19

The following modifications made to the measures in prior public reporting years in response to the COVID-19 PHE will continue for 2024 public reporting:

- Claims data for January 1, 2020 through June 30, 2020 are excluded from use in the measures under CMS's Extraordinary Circumstances Exception (ECE) policy.[9-12] As a result, the typical 12-month look-back period for use of claims/VA data in risk adjustment and in identifying patients with an ICD-10 code indicating LVAD implantation or heart transplantation prior to the index admission (an exclusion for the HF readmission measure cohort) totals less than 12 months for those patients whose 12-month period includes any portion of the January 1, 2020 through June 30, 2020 time frame.
- A 'History of COVID-19' risk variable is incorporated into the risk-adjustment models for the measures.
- COVID-19 index admissions are excluded from the cohorts. COVID-19 index admissions are defined by a principal diagnosis code of COVID-19 or a secondary diagnosis code of COVID-19 coded as POA on the index admission claim.
- COVID-19 ED visits, observation stays, and readmissions are not eligible for the EDAC outcome and are excluded. COVID-19 ED visits, observation stays, and readmissions are defined by a principal diagnosis code of COVID-19 on the claim or a secondary diagnosis code of COVID-19 on the claim (and coded as POA, in the case of readmissions).

A brief summary of how COVID-19 is addressed in each measure, including code specifications, can be found in the 2024 supplemental files here on *QualityNet*.

3.2.3 Update to ED Visits and Observation Stays Outcome Methodology

Change in the Weight of ED Visits and Observation Stays

The weighting of ED visits and observation stays in calculating the outcome for the EDAC measure was changed — Specifically:

- Each ED visit is counted as one whole day. In prior public reporting years, ED visits were counted as 0.5 days.
- Observation stays are counted by hours and then converted into whole days, rounded up. In prior public reporting years, observation stay hours were converted into half-days, rounded up. For example, if a patient's stay in observation totaled 28 hours, that observation event now counts as two full days, rather than 1.5 days.

Rationale for the Changes in Weighting

Modifying the weight of ED and observation stay days helps with the production, implementation, and ongoing reevaluation of the EDAC measures and improves the performance of the statistical model. Additionally, feedback from stakeholders suggests that although the average ED treat and discharge stay is about four hours, patients

often spend an entire day from the time it takes to get to the ED, the wait time in the ED for treatment, treatment in the ED, and any trips for medication or supplies after their ED visit.

Effect of the Changes in Weighting to the Outcome

Table 3.2.3.1 summarizes the effect of the weighting change on the count of days by encounter type across the three EDAC measures. The values included in the table are the averaged days of all eligible patients, using discharges between July 1, 2019 and June 30, 2022 (excluding December 2, 2019 through June 30, 2020).

Table 3.2.3.1 — Results of Changing the Weight of ED and Observation Stays

Condition	Weighting Approach	Total Acute Care Days	Readmission Days	ED Days	Observation Days
AMI	New	1.02	0.78	0.18	0.12
	Original	0.94	0.78	0.09	0.11
HF	New	1.48	1.27	0.18	0.10
	Original	1.41	1.27	0.09	0.10
Pneumonia	New	1.27	1.09	0.16	0.07
	Original	1.21	1.09	0.08	0.06

Readmission days account for most of acute care days (approximately 80%). Changing the weight of ED and observation stays has a very limited impact on overall outcome, given how same day events are counted (as described in Section 2.2.2).

3.2.4 Additional Notes

The goal of these specification updates was to maintain the intent of the measures.

Changes made to the specifications are detailed in the following supplemental files that accompany this report:

- 2024 AMI EDAC Measure Code Specifications
- 2024 HF EDAC Measure Code Specifications
- 2024 Pneumonia EDAC Measure Code Specifications

These supplemental files are posted here on *QualityNet*.

The ICD-10 code listings in this report and the 2024 supplemental files reflect the most current descriptions for each code.

3.3. Changes to SAS Packs

We revised the measure SAS packs to accommodate the specification updates discussed in Section 3.1 and Section 3.2 above. The new SAS packs and documentation are available upon request. Please submit your request using the QualityNet Q&A tool:

https://cmsqualitysupport.servicenowservices.com/qnet_qa?id=ask_a_question > Program: Inpatient Claims-Based Measures > Excess Days in Acute Care (EDAC) > Understanding Measure Methodology. **Do *NOT* submit patient-identifiable information (for example, date of birth, Social Security number, Medicare Beneficiary Identifier, and encounter dates such as admission dates, discharge dates, procedure dates, and ED/observation dates) into this tool**.

The SAS packs include descriptions of the data files and data elements that feed the model software. Please be aware that CMS does not provide training or technical support for the software. CMS has made the SAS packs available to be completely transparent regarding the measure calculation methodology. However, note that even with the SAS packs, it is not possible to replicate the EDAC calculations without the data files, which contain the longitudinal patient data from the entire national sample of acute care hospitals that is used to calculate results.

4. RESULTS FOR 2024 PUBLIC REPORTING

4.1. Assessment of Updated Models

The hospital-level 30-day all-cause EDAC for each measure is estimated using random effects hurdle models. Refer to Section 2 for a summary of the measure methodology and model risk-adjustment variables. Refer to the prior methodology and updates and specifications reports on the EDAC measures page here on *QualityNet* for further details.

We evaluated the performance of the models using the July 2020 to June 2023 data for the 2024 reporting period. We examined the differences in the frequencies of patient risk factors and the model parameter estimates.

For each of the conditions, we assessed the overall fit of the model using posterior predictive checking (PPC) for the three-year combined period. For the logit model of zero versus non-zero days, which includes all patients in the cohort, we calculated the c-statistic. For the truncated Poisson model of non-zero days, which includes only patients with any acute care days, we calculated the deviance R^2. The deviance R^2 is computed from the difference in the log-likelihoods between the final model and an empty model (no covariates) attributed to each observation, averaged over all observations.[13]

The results of these analyses for each of the measures (AMI, HF, and pneumonia) are presented in Section 4.2, Section 4.3, and Section 4.4, respectively.

Please note that, due to seasonal fluctuations and other factors, the statistics from one individual year within these sections may not be directly comparable to the other two years.

4.2. AMI EDAC 2024 Model Results

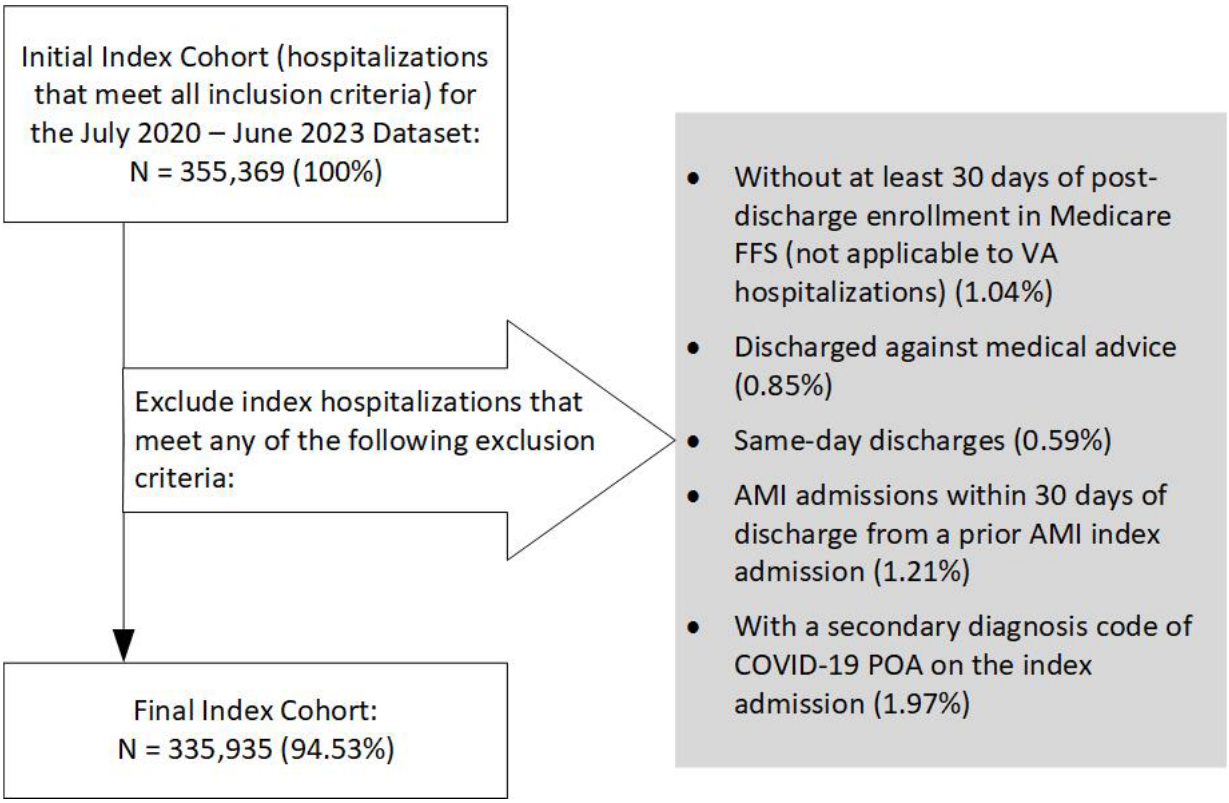
4.2.1 Index Cohort Exclusions

The exclusion criteria for this measure are presented in Section 2.2.1. The percentage of AMI admissions that met each exclusion criterion in the July 2020 – June 2023 dataset is presented in Figure 4.2.1.1.

Admissions may have been counted in more than one exclusion category because they are not mutually exclusive. The index cohort includes short-term acute care hospitalizations for patients:

- aged 65 or over;
- with a principal discharge diagnosis of AMI;
- enrolled in Medicare FFS Part A and Part B for the 12 months prior to the date of admission and Part A during the index admission (not applicable to VA hospitalizations);
- who were not transferred to another acute care facility; and
- were alive at discharge.

Figure 4.2.1.1 — AMI Cohort Exclusions in the July 2020 – June 2023 Dataset



4.2.2 Frequency of AMI Model Variables

We examined the frequencies of clinical and demographic variables. Frequencies of model variables were relatively stable over the measurement period.

Refer to Table 4.2.2.1 for more detail.

Table 4.2.2.1 — Frequency of AMI Model Variables over Different Time Periods

Variable (% unless otherwise indicated)	07/2020 – 06/2021	07/2021 – 06/2022	07/2022 – 06/2023	07/2020 – 06/2023
Total N	118,845	110,899	106,191	335,935
Mean age (SD), in years	77.3 (7.9)	77.5 (7.9)	77.5 (7.8)	77.4 (7.9)
Male	57.5	57.6	57.2	57.4
History of COVID-19	4.0	10.2	17.4	10.3
Anterior myocardial infarction	7.6	7.6	7.4	7.5
Non-anterior location of myocardial infarction	14.4	14.4	14.1	14.3
History of coronary artery bypass graft (CABG) surgery	15.6	15.4	14.8	15.3
History of percutaneous transluminal coronary angioplasty (PTCA)	25.2	26.5	26.5	26.0
Severe infection; other infectious diseases (CC 1, 3 – 7)	19.1	23.6	24.2	22.2
Metastatic cancer and acute leukemia (CC 8)	2.2	2.6	2.5	2.4
Cancer (CC 9 – 14)	16.5	20.3	20.7	19.1
Diabetes mellitus (DM) or DM complications (CC 17 – 19, 122 – 123)	46.6	47.5	47.2	47.1
Protein-calorie malnutrition (CC 21)	5.4	6.0	6.4	5.9
Other significant endocrine and metabolic disorders; disorders of fluid/electrolyte/acid-base balance (CC 23 – 24)	34.8	38.2	39.3	37.3
Iron deficiency or other/unspecified anemias and blood disease (CC 49)	36.4	40.3	41.2	39.2
Dementia or other specified brain disorders (CC 51 – 53)	13.9	15.3	15.3	14.8
Hemiplegia, paraplegia, paralysis, functional disability (CC 70 – 74, 103 – 104, 189 – 190)	5.3	6.1	6.0	5.8
Congestive heart failure (CC 85)	48.3	49.9	50.5	49.5
Acute coronary syndrome (CC 86 – 87)	30.1	32.7	32.5	31.7
Angina pectoris (CC 88)	18.8	21.2	21.5	20.4
Coronary atherosclerosis/other chronic ischemic heart disease (CC 89)	79.6	80.2	80.4	80.0
Valvular and rheumatic heart disease (CC 91)	27.9	31.8	33.1	30.9
Specified arrhythmias and other heart rhythm disorders (CC 96 – 97)	49.5	52.3	53.2	51.6
Stroke (CC 99 – 100)	4.8	6.2	6.3	5.7
Cerebrovascular disease (CC 101 – 102, 105)	15.9	19.6	19.8	18.4
Vascular or circulatory disease (CC 106 – 109)	36.2	41.0	41.1	39.3
Chronic obstructive pulmonary disease (COPD) (CC 111)	22.7	23.1	22.8	22.9
Asthma (CC 113)	6.8	7.9	8.2	7.6

Variable (% unless otherwise indicated)	07/2020 – 06/2021	07/2021 – 06/2022	07/2022 – 06/2023	07/2020 – 06/2023
Pneumonia (CC 114 – 116)	13.2	15.4	15.9	14.8
Dialysis status (CC 134)	4.2	3.9	3.8	3.9
Renal failure (CC 135 – 140)	44.1	45.2	45.1	44.8
Other urinary tract disorders (CC 145)	11.5	15.1	15.0	13.8
Decubitus ulcer or chronic skin ulcer (CC 157 – 161)	5.6	6.8	6.8	6.4

4.2.3 AMI Model Parameters and Performance

Table 4.2.3.1 shows the parameter estimates and 95% CIs for the AMI days in acute care model for the combined three-year dataset.

Table 4.2.3.1 — Median Parameter Estimates and CIs of Risk Variables from the Logit and Poisson Models for AMI (July 2020 – June 2023)

Variable	Part 1: Logit Model		Part 2: Poisson Model	
	Median	CI	Median	CI
Years over 65 (continuous)	0.008	(0.006 – 0.009)	-0.000	(-0.001 – 0.000)
Male	-0.144	(-0.158 – -0.129)	0.024	(0.017 – 0.032)
History of COVID-19	0.014	(-0.010 – 0.039)	-0.065	(-0.075 – -0.053)
Anterior myocardial infarction	0.205	(0.174 – 0.238)	0.108	(0.094 – 0.123)
Non-anterior location of myocardial infarction	0.068	(0.044 – 0.093)	0.011	(-0.002 – 0.023)
History of coronary artery bypass graft (CABG) surgery	0.023	(0.000 – 0.045)	-0.061	(-0.070 – -0.051)
History of percutaneous transluminal coronary angioplasty (PTCA)	-0.026	(-0.043 – -0.007)	-0.045	(-0.053 – -0.035)
Severe infection; other infectious diseases (CC 1, 3 – 7)	0.078	(0.058 – 0.099)	0.020	(0.012 – 0.028)
Metastatic cancer and acute leukemia (CC 8)	0.245	(0.190 – 0.296)	0.098	(0.075 – 0.119)
Cancer (CC 9 – 14)	0.054	(0.035 – 0.073)	0.001	(-0.008 – 0.011)
Diabetes mellitus (DM) or DM complications (CC 17 – 19, 122 – 123)	0.109	(0.093 – 0.128)	0.082	(0.074 – 0.089)
Protein-calorie malnutrition (CC 21)	0.116	(0.082 – 0.149)	0.122	(0.110 – 0.136)
Other significant endocrine and metabolic disorders; disorders of fluid/electrolyte/acid-base balance (CC 23 – 24)	0.144	(0.126 – 0.163)	0.116	(0.109 – 0.125)
Iron deficiency or other/unspecified anemias and blood disease (CC 49)	0.135	(0.118 – 0.155)	0.104	(0.096 – 0.112)
Dementia or other specified brain disorders (CC 51 – 53)	0.091	(0.072 – 0.112)	0.013	(0.003 – 0.022)
Hemiplegia, paraplegia, paralysis, functional disability (CC 70 – 74, 103 – 104, 189 – 190)	0.121	(0.088 – 0.157)	0.061	(0.048 – 0.075)
Congestive heart failure (CC 85)	0.172	(0.155 – 0.189)	0.201	(0.193 – 0.210)
Acute coronary syndrome (CC 86 – 87)	0.050	(0.033 – 0.067)	-0.040	(-0.047 – -0.032)
Angina pectoris (CC 88)	0.039	(0.019 – 0.059)	-0.012	(-0.022 – -0.002)

Variable	Part 1: Logit Model		Part 2: Poisson Model	
	Median	CI	Median	CI
Coronary atherosclerosis/other chronic ischemic heart disease (CC 89)	0.058	(0.038 – 0.081)	-0.000	(-0.010 – 0.010)
Valvular and rheumatic heart disease (CC 91)	0.078	(0.060 – 0.099)	0.033	(0.025 – 0.040)
Specified arrhythmias and other heart rhythm disorders (CC 96 – 97)	0.116	(0.100 – 0.135)	0.030	(0.021 – 0.038)
Stroke (CC 99 – 100)	0.070	(0.036 – 0.103)	-0.006	(-0.022 – 0.007)
Cerebrovascular disease (CC 101 – 102, 105)	0.052	(0.032 – 0.074)	0.013	(0.003 – 0.021)
Vascular or circulatory disease (CC 106 – 109)	0.092	(0.074 – 0.109)	0.050	(0.042 – 0.057)
Chronic obstructive pulmonary disease (COPD) (CC 111)	0.170	(0.150 – 0.191)	0.079	(0.071 – 0.088)
Asthma (CC 113)	0.064	(0.035 – 0.094)	-0.011	(-0.024 – 0.002)
Pneumonia (CC 114 – 116)	0.128	(0.104 – 0.153)	0.099	(0.089 – 0.109)
Dialysis status (CC 134)	0.365	(0.325 – 0.406)	0.014	(-0.001 – 0.028)
Renal failure (CC 135 – 140)	0.134	(0.114 – 0.152)	0.162	(0.153 – 0.170)
Other urinary tract disorders (CC 145)	0.113	(0.090 – 0.137)	-0.005	(-0.015 – 0.004)
Decubitus ulcer or chronic skin ulcer (CC 157 – 161)	0.116	(0.086 – 0.149)	0.074	(0.063 – 0.086)

Table 4.2.3.2 shows the PPC results for the combined three-year dataset.

Table 4.2.3.2 — PPC Results for AMI (July 2020 – June 2023)

Statistic	Observed Days in Acute Care	MCMC 95% CI for Predicted Days in Acute Care	P-Value
Variance	1.078	(0.588 – 0.778)	< 0.001
Median	0.911	(0.667 – 0.692)	< 0.001
Interquartile range (IQR)	0.740	(0.609 – 0.650)	< 0.001
Coefficient of variation	1.036	(0.975 – 1.091)	0.760

The c-statistic for the logistic part and the deviance R^2 for the truncated Poisson part are provided in Table 4.2.3.3.

Table 4.2.3.3 — AMI Generalized Linear Regression Model Performance (July 2020 – June 2023)

Characteristic	07/2020 – 06/2023
C-statistic (Logit part)	0.60
Deviance R^2 (Poisson part)	0.077

4.2.4 Distribution of Hospital Volumes and EDAC for AMI

For the individual years, the mean hospital-level *observed* days in acute care per 100 discharges were as follows:

- July 1, 2020 – June 30, 2021: 103.24
- July 1, 2021 – June 30, 2022: 102.90

- July 1, 2022 – June 30, 2023: 100.06

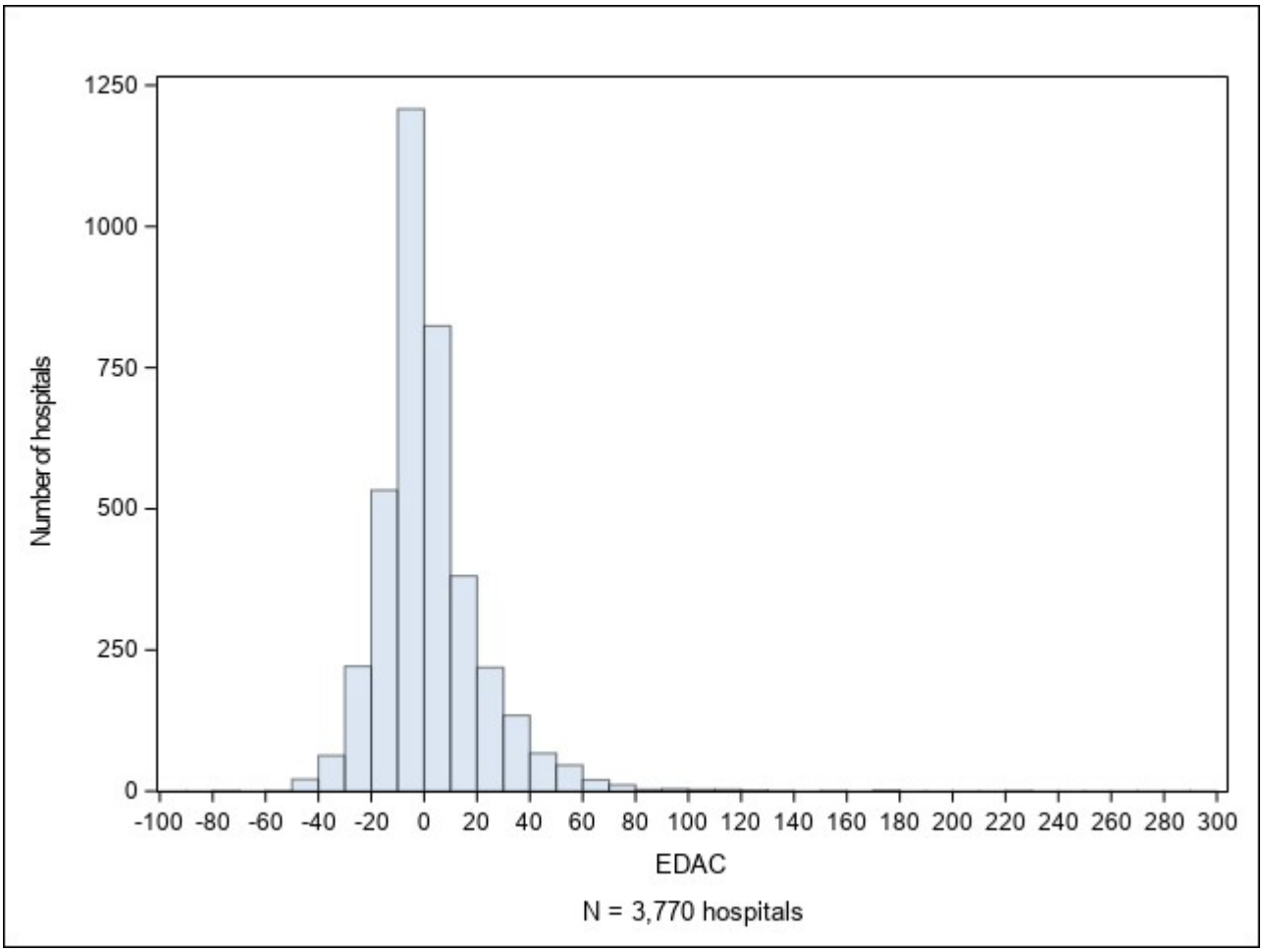
Table 4.2.4.1 shows both unadjusted (observed) days of post-discharge events per 100 discharges and EDAC per 100 discharges for AMI.

Table 4.2.4.1 — Hospital-Level Unadjusted Distribution of Overall Acute Care, ED Visits, Observation Stays, and Readmissions per 100 AMI Discharges, and Distribution of EDAC (July 2020 – June 2023)

Description	Mean (SD)	Median (Q1, Q3)	Range
Observed days in acute care	100.22 (103.81)	91.09 (49.75 – 123.73)	1,700
Days of ED visits	21.33 (26.76)	16.47 (6.25 – 25.00)	300
Days of observation stays	13.34 (26.91)	7.14 (0.00 – 14.50)	400
Days of readmissions	73.06 (96.25)	61.66 (0.00 – 96.97)	1,700
EDAC	2.12 (19.96)	-0.31 (-8.53 – 9.01)	302.41
Days of predicted	102.48 (37.41)	98.55 (80.34 – 118.99)	470.27
Days of expected	100.36 (31.55)	98.38 (85.76 – 112.05)	326.83

Figure 4.2.4.1 shows the overall distribution of the hospital EDAC for the combined three-year dataset, which indicates that the hospital EDAC results are approximately normally distributed.

Figure 4.2.4.1 — Hospital-Level EDAC per 100 Discharges for AMI for the July 2020 through June 2023 Dataset



4.2.5 Distribution of Hospitals by Performance Category in the Three-Year Dataset

Of 3,770 hospitals in the study cohort, 126 had "Fewer days than average," 1,248 were "Average," and 223 had "More days than average." 2,173 were classified as "Number of cases too small" (fewer than 50) to reliably conclude how the hospital is performing.

4.3. HF EDAC 2024 Model Results

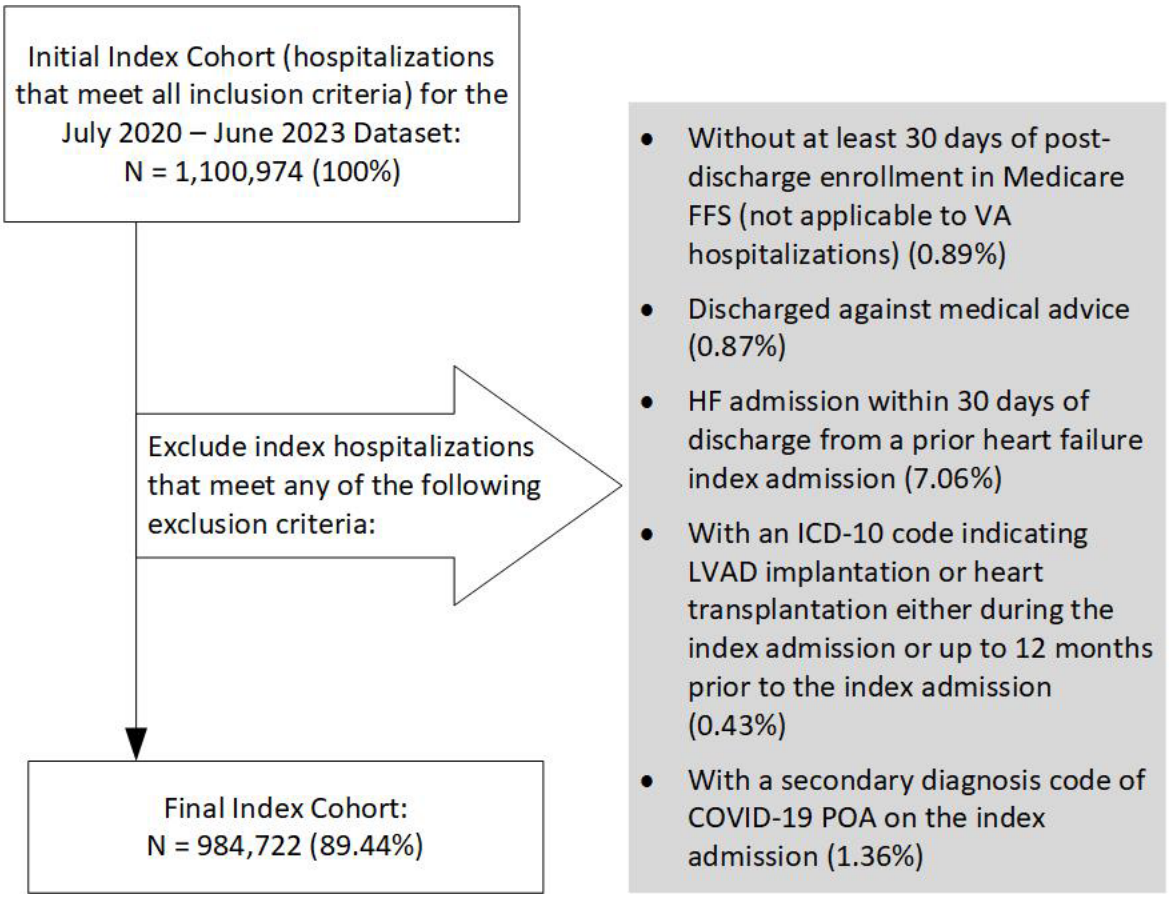
4.3.1 Index Cohort Exclusions

The exclusion criteria for this measure are presented in Section 2.2.1. The percentage of HF admissions that met each exclusion criterion in the July 2020 – June 2023 dataset is presented in Figure 4.3.1.1.

Admissions may have been counted in more than one exclusion category because they are not mutually exclusive. The index cohort includes short-term acute care hospitalizations for patients:

- aged 65 or over;
- with a principal discharge diagnosis of HF;
- enrolled in Medicare FFS Part A and Part B for the 12 months prior to the date of admission and Part A during the index admission (not applicable to VA hospitalizations);
- who were not transferred to another acute care facility; and
- were alive at discharge.

Figure 4.3.1.1 — HF Cohort Exclusions in the July 2020 – June 2023 Dataset



4.3.2 Frequency of HF Model Variables

We examined the frequencies of clinical and demographic variables. Frequencies of model variables were relatively stable over the measurement period.

Refer to Table 4.3.2.1 for more detail.

Table 4.3.2.1 — Frequency of HF Model Variables over Different Time Periods

Variable (% unless otherwise indicated)	07/2020 – 06/2021	07/2021 – 06/2022	07/2022 – 06/2023	07/2020 – 06/2023
Total N	335,118	324,693	324,911	984,722
Mean age (SD), in years	80.2 (8.5)	80.6 (8.4)	80.9 (8.4)	80.6 (8.4)
Male	49.1	48.3	48.2	48.5
History of COVID-19	6.9	14.9	24.0	15.2
History of coronary artery bypass graft (CABG) surgery	19.3	18.8	18.0	18.7
Metastatic cancer and acute leukemia (CC 8)	2.7	3.0	3.1	2.9
Cancer (CC 9 – 14)	19.5	22.8	23.5	21.9
Diabetes mellitus (DM) or DM complications (CC 17 – 19, 122 – 123)	54.6	55.2	54.7	54.8
Protein-calorie malnutrition (CC 21)	10.4	12.0	12.8	11.7
Other significant endocrine and metabolic disorders; disorders of fluid/electrolyte/acid-base balance (CC 23 – 24)	58.6	64.0	65.0	62.5
Liver or biliary disease (CC 27 – 32)	13.0	15.5	16.2	14.9
Peptic ulcer, hemorrhage, other specified gastrointestinal disorders (CC 36)	14.4	17.8	17.8	16.7
Other gastrointestinal disorders (CC 38)	59.7	66.2	66.6	64.1
Severe hematological disorders (CC 46)	1.7	1.9	1.9	1.8
Iron deficiency or other/unspecified anemias and blood disease (CC 49)	60.5	64.9	66.0	63.8
Dementia or other specified brain disorders (CC 51 – 53)	19.9	22.8	23.3	22.0
Drug/alcohol abuse/dependence/psychosis (CC 54 – 56, 202 – 203)	15.3	16.6	16.7	16.2
Major psychiatric disorders (CC 57 – 59)	9.7	12.0	12.7	11.4
Depression (CC 61)	20.1	22.0	21.8	21.3
Other psychiatric disorders (CC 63)	22.5	25.9	26.1	24.8
Hemiplegia, paraplegia, paralysis, functional disability (CC 70 – 74, 103 – 104, 189 – 190)	7.2	8.4	8.4	8.0
Cardio-respiratory failure and shock (CC 84), plus ICD-10-CM codes R09.01 and R09.02	56.5	61.3	62.5	60.1
Congestive heart failure (CC 85)	77.8	81.2	81.7	80.2
Acute coronary syndrome (CC 86 – 87)	26.3	30.9	32.3	29.8
Coronary atherosclerosis or angina (CC 88 – 89)	66.0	67.3	67.2	66.8
Valvular and rheumatic heart disease (CC 91)	49.3	56.2	57.9	54.4
Specified arrhythmias and other heart rhythm disorders (CC 96 – 97)	76.8	80.2	81.1	79.4
Other and unspecified heart disease (CC 98)	23.3	30.6	32.0	28.6

Variable (% unless otherwise indicated)	07/2020 – 06/2021	07/2021 – 06/2022	07/2022 – 06/2023	07/2020 – 06/2023
Stroke (CC 99 – 100)	6.3	8.4	8.6	7.8
Vascular or circulatory disease (CC 106 – 109)	51.8	59.0	59.9	56.9
Chronic obstructive pulmonary disease (COPD) (CC 111)	42.1	42.8	41.9	42.3
Fibrosis of lung or other chronic lung disorders (CC 112)	7.3	9.0	9.3	8.5
Asthma (CC 113)	9.6	11.3	11.7	10.8
Pneumonia (CC 114 – 116)	32.7	36.4	37.3	35.4
Dialysis status (CC 134)	6.3	6.0	5.9	6.1
Renal failure (CC 135 – 140)	70.6	71.1	70.9	70.9
Nephritis (CC 141)	1.5	1.8	1.7	1.7
Other urinary tract disorders (CC 145)	18.1	23.1	23.2	21.4
Decubitus ulcer or chronic skin ulcer (CC 157 – 161)	14.4	16.7	17.1	16.0

4.3.3 HF Model Parameters and Performance

Table 4.3.3.1 shows the parameter estimates and 95% CIs for the HF days in acute care model for the combined three-year dataset.

Table 4.3.3.1 — Median Parameter Estimates and CIs of Risk Variables from the Logit and Poisson Models for HF (July 2020 – June 2023)

Variable	Part 1: Logit Model		Part 2: Poisson Model	
	Median	CI	Median	CI
Years over 65 (continuous)	-0.001	(-0.001 – 0.000)	-0.007	(-0.007 – -0.007)
Male	0.003	(-0.006 – 0.012)	0.016	(0.013 – 0.020)
History of COVID-19	-0.004	(-0.018 – 0.009)	-0.032	(-0.037 – -0.027)
History of coronary artery bypass graft (CABG) surgery	0.030	(0.018 – 0.041)	-0.007	(-0.012 – -0.004)
Metastatic cancer and acute leukemia (CC 8)	0.201	(0.176 – 0.227)	0.027	(0.017 – 0.036)
Cancer (CC 9 – 14)	0.020	(0.009 – 0.031)	0.000	(-0.004 – 0.005)
Diabetes mellitus (DM) or DM complications (CC 17 – 19, 122 – 123)	0.074	(0.066 – 0.084)	0.032	(0.028 – 0.036)
Protein-calorie malnutrition (CC 21)	0.122	(0.108 – 0.136)	0.067	(0.063 – 0.072)
Other significant endocrine and metabolic disorders; disorders of fluid/electrolyte/acid-base balance (CC 23 – 24)	0.145	(0.135 – 0.154)	0.071	(0.067 – 0.075)
Liver or biliary disease (CC 27 – 32)	0.090	(0.078 – 0.102)	0.044	(0.040 – 0.048)
Peptic ulcer, hemorrhage, other specified gastrointestinal disorders (CC 36)	0.067	(0.054 – 0.078)	0.022	(0.017 – 0.027)
Other gastrointestinal disorders (CC 38)	0.094	(0.083 – 0.104)	-0.024	(-0.028 – -0.020)
Severe hematological disorders (CC 46)	0.236	(0.200 – 0.269)	0.072	(0.061 – 0.085)
Iron deficiency or other/unspecified anemias and blood disease (CC 49)	0.102	(0.091 – 0.112)	0.063	(0.058 – 0.067)
Dementia or other specified brain disorders (CC 51 – 53)	0.083	(0.071 – 0.095)	-0.003	(-0.008 – 0.001)

Variable	Part 1: Logit Model		Part 2: Poisson Model	
	Median	CI	Median	CI
Drug/alcohol abuse/dependence/psychosis (CC 54 – 56, 202 – 203)	0.111	(0.096 – 0.124)	-0.018	(-0.023 – -0.014)
Major psychiatric disorders (CC 57 – 59)	0.067	(0.052 – 0.079)	-0.003	(-0.009 – 0.002)
Depression (CC 61)	0.034	(0.023 – 0.046)	-0.021	(-0.026 – -0.017)
Other psychiatric disorders (CC 63)	0.104	(0.094 – 0.116)	-0.015	(-0.018 – -0.011)
Hemiplegia, paraplegia, paralysis, functional disability (CC 70 – 74, 103 – 104, 189 – 190)	0.067	(0.052 – 0.083)	0.011	(0.005 – 0.017)
Cardio-respiratory failure and shock (CC 84), plus ICD-10-CM codes R09.01 and R09.02	0.005	(-0.006 – 0.015)	0.065	(0.061 – 0.069)
Congestive heart failure (CC 85)	0.083	(0.071 – 0.097)	0.038	(0.033 – 0.044)
Acute coronary syndrome (CC 86 – 87)	0.102	(0.092 – 0.112)	0.017	(0.013 – 0.020)
Coronary atherosclerosis or angina (CC 88 – 89)	0.068	(0.057 – 0.078)	-0.010	(-0.013 – -0.006)
Valvular and rheumatic heart disease (CC 91)	0.054	(0.045 – 0.062)	0.031	(0.027 – 0.035)
Specified arrhythmias and other heart rhythm disorders (CC 96 – 97)	0.095	(0.085 – 0.107)	0.039	(0.035 – 0.043)
Other and unspecified heart disease (CC 98)	0.053	(0.043 – 0.064)	-0.010	(-0.014 – -0.006)
Stroke (CC 99 – 100)	0.046	(0.030 – 0.062)	-0.013	(-0.021 – -0.007)
Vascular or circulatory disease (CC 106 – 109)	0.080	(0.071 – 0.090)	0.025	(0.022 – 0.029)
Chronic obstructive pulmonary disease (COPD) (CC 111)	0.130	(0.121 – 0.140)	0.034	(0.030 – 0.037)
Fibrosis of lung or other chronic lung disorders (CC 112)	0.064	(0.051 – 0.081)	0.018	(0.013 – 0.025)
Asthma (CC 113)	0.026	(0.012 – 0.040)	-0.012	(-0.017 – -0.007)
Pneumonia (CC 114 – 116)	0.108	(0.098 – 0.117)	0.043	(0.040 – 0.046)
Dialysis status (CC 134)	0.256	(0.237 – 0.273)	-0.067	(-0.074 – -0.061)
Renal failure (CC 135 – 140)	0.191	(0.182 – 0.203)	0.126	(0.121 – 0.131)
Nephritis (CC 141)	0.035	(0.000 – 0.068)	0.040	(0.028 – 0.051)
Other urinary tract disorders (CC 145)	0.063	(0.052 – 0.074)	0.006	(0.002 – 0.009)
Decubitus ulcer or chronic skin ulcer (CC 157 – 161)	0.117	(0.106 – 0.130)	0.094	(0.090 – 0.099)

Table 4.3.3.2 shows the PPC results for the combined three-year dataset.

Table 4.3.3.2 — PPC Results for HF (July 2020 – June 2023)

Statistic	Observed Days in Acute Care	MCMC 95% CI for Predicted Days in Acute Care	P-Value
Variance	0.727	(0.285 – 0.363)	< 0.001
Median	1.360	(1.067 – 1.088)	< 0.001
IQR	0.604	(0.527 – 0.558)	< 0.001
Coefficient of variation	0.616	(0.489 – 0.547)	< 0.001

The c-statistic for the logistic part and the deviance R^2 for the truncated Poisson part are provided in Table 4.3.3.3.

Table 4.3.3.3 — HF Generalized Linear Regression Model Performance (July 2020 – June 2023)

Characteristic	07/2020 – 06/2023
C-statistic (Logic part)	0.59
Deviance R2 (Poisson part)	0.032

4.3.4 Distribution of Hospital Volumes and EDAC for HF

For the individual years, the mean hospital-level *observed* days in acute care per 100 discharges were as follows:

- July 1, 2020 – June 30, 2021: 138.07
- July 1, 2021 – June 30, 2022: 137.17
- July 1, 2022 – June 30, 2023: 138.40

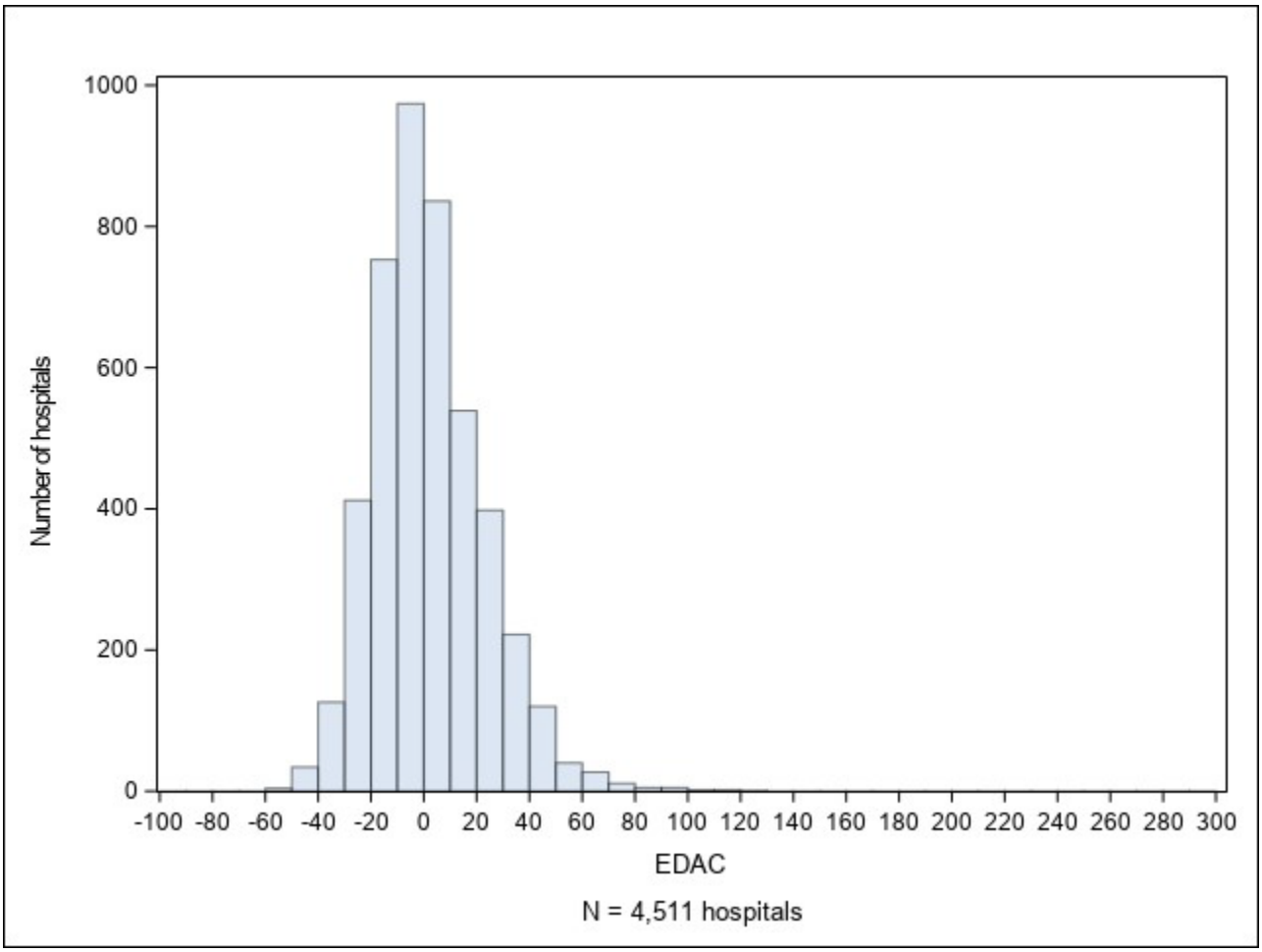
Table 4.3.4.1 shows both unadjusted (observed) days of post-discharge events per 100 discharges and EDAC per 100 discharges for HF.

Table 4.3.4.1 — Hospital-Level Unadjusted Distribution of Overall Acute Care, ED Visits, Observation Stays, and Readmissions per 100 HF Discharges, and Distribution of EDAC (July 2020 – June 2023)

Description	Mean (SD)	Median (Q1, Q3)	Range
Observed days in acute care	138.37 (85.28)	136.03 (104.02, 164.46)	1,800
Days of ED visits	22.11 (15.78)	18.31 (13.31, 27.78)	200
Days of observation stays	10.78 (14.19)	7.97 (3.32, 14.08)	333
Days of readmissions	113.82 (82.28)	111.84 (77.78, 140.00)	1,700
EDAC	2.11 (20.92)	-0.30 (-12.12, 14.11)	182.69
Days of predicted	136.93 (31.31)	135.41 (115.32, 156.10)	312.43
Days of expected	134.82 (21.28)	136.72 (123.93, 146.99)	282.40

Figure 4.3.4.1 shows the overall distribution of the hospital EDAC for the combined three-year dataset, which indicates that the hospital EDAC results are approximately normally distributed.

Figure 4.3.4.1 — Hospital-Level EDAC per 100 Discharges for HF for the July 2020 through June 2023 Dataset



4.3.5 Distribution of Hospitals by Performance Category in the Three-Year Dataset

Of 4,511 hospitals in the study cohort, 300 had "Fewer days than average," 2,482 were "Average," and 495 had "More days than average." 1,234 were classified as "Number of cases too small" (fewer than 25) to reliably conclude how the hospital is performing.

4.4. Pneumonia EDAC 2024 Model Results

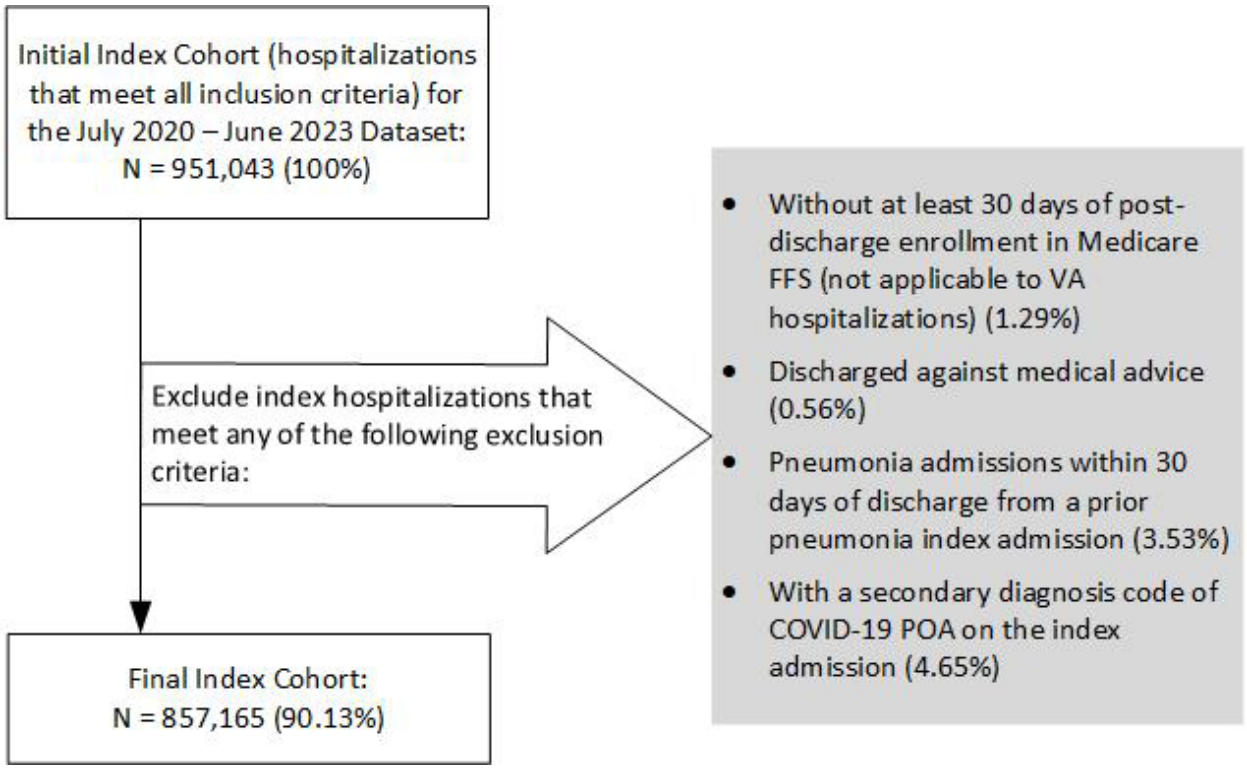
4.4.1 Index Cohort Exclusions

The exclusion criteria for this measure are presented in Section 2.2.1. The percentage of pneumonia admissions that met each exclusion criterion in the July 2020 – June 2023 dataset is presented in Figure 4.4.1.1.

Admissions may have been counted in more than one exclusion category because they are not mutually exclusive. The index cohort includes short-term acute care hospitalizations for patients:

- aged 65 or over;
- with one of the following:
  1. A principal discharge diagnosis of pneumonia; or
  2. a. A principal discharge diagnosis of sepsis (that is not severe); and
     b. A secondary diagnosis of pneumonia coded as POA; and
     c. No secondary diagnosis of sepsis that is both severe and coded as POA
- enrolled in Medicare FFS Part A and Part B for the 12 months prior to the date of admission and Part A during the index admission (not applicable to VA hospitalizations);
- who were not transferred to another acute care facility; and
- were alive at discharge.

Figure 4.4.1.1 — Pneumonia Cohort Exclusions in the July 2020 – June 2023 Dataset



4.4.2 Frequency of Pneumonia Model Variables

We examined the frequencies of clinical and demographic variables. Frequencies of model variables were relatively stable over the measurement period.

Refer to Table 4.4.2.1 for more detail.

Table 4.4.2.1 — Frequency of Pneumonia Model Variables over Different Time Periods

Variable (% unless otherwise indicated)	07/2020 – 06/2021	07/2021 – 06/2022	07/2022 – 06/2023	07/2020 – 06/2023
Total N	251,679	281,047	324,439	857,165
Mean age (SD), in years	79.5 (8.5)	79.8 (8.5)	79.9 (8.4)	79.7 (8.5)
Male	52.2	50.2	48.6	50.2
History of COVID-19	9.5	17.9	26.7	18.8
History of coronary artery bypass graft (CABG) surgery	9.3	9.2	8.6	9.0
Severe infection; other infectious diseases (CC 1, 3 – 7)	38.3	43.8	44.3	42.4
Septicemia, sepsis, systemic inflammatory response syndrome/shock (CC 2)	15.7	18.7	18.9	17.9
Metastatic cancer and acute leukemia (CC 8)	7.5	7.3	7.0	7.2
Lung and other severe cancers (CC 9)	9.6	9.6	9.5	9.6
Lymphoma; other cancers (CC 10 – 12)	16.9	18.9	19.2	18.4
Diabetes mellitus (DM) or DM complications (CC 17 – 19, 122 – 123)	42.3	43.4	43.1	43.0
Protein-calorie malnutrition (CC 21)	19.8	20.5	20.6	20.4
Other significant endocrine and metabolic disorders; disorders of fluid/electrolyte/acid-base balance (CC 23 – 24)	61.9	65.1	65.6	64.3
Other gastrointestinal disorders (CC 38)	64.6	69.8	69.4	68.1
Severe hematological disorders (CC 46)	1.9	2.0	1.9	2.0
Iron deficiency or other/unspecified anemias and blood disease (CC 49)	55.0	58.8	59.1	57.8
Dementia or other specified brain disorders (CC 51 – 53)	32.7	33.5	32.6	32.9
Drug/alcohol abuse/dependence/psychosis (CC 54 – 56, 202 – 203)	17.7	19.1	19.3	18.8
Major psychiatric disorders (CC 57 – 59)	14.9	16.9	17.4	16.5
Other psychiatric disorders (CC 63)	25.5	29.0	28.7	27.8
Hemiplegia, paraplegia, paralysis, functional disability (CC 70 – 74, 103 – 104, 189 – 190)	11.7	11.9	11.3	11.6
Respirator dependence/tracheostomy status (CC 82)	2.0	2.0	1.7	1.9
Respiratory arrest; cardio-respiratory failure and shock (CC 83 – 84), plus ICD-10-CM codes R09.01 and R09.02	60.7	66.9	69.7	66.1
Congestive heart failure (CC 85)	47.4	50.7	51.5	50.1
Acute coronary syndrome (CC 86 – 87)	15.0	17.7	18.4	17.1
Coronary atherosclerosis or angina (CC 88 – 89)	43.6	45.9	45.8	45.2
Valvular and rheumatic heart disease (CC 91)	22.7	28.8	30.1	27.5
Specified arrhythmias and other heart rhythm disorders (CC 96 – 97)	50.7	54.9	55.5	53.9

Variable (% unless otherwise indicated)	07/2020 – 06/2021	07/2021 – 06/2022	07/2022 – 06/2023	07/2020 – 06/2023
Stroke (CC 99 – 100)	8.6	10.2	9.8	9.6
Vascular or circulatory disease (CC 106 – 109)	45.1	51.6	51.8	49.8
Chronic obstructive pulmonary disease (COPD) (CC 111)	45.7	47.7	48.1	47.3
Fibrosis of lung or other chronic lung disorders (CC 112)	10.6	12.9	13.6	12.5
Asthma (CC 113)	9.3	11.9	13.1	11.6
Pneumonia (CC 114 – 116)	32.9	37.6	37.7	36.3
Pleural effusion/pneumothorax (CC 117)	20.2	22.7	23.1	22.1
Other respiratory disorders (CC 118)	39.3	46.3	49.6	45.5
Dialysis status (CC 134)	4.3	3.9	3.7	3.9
Renal failure (CC 135 – 140)	51.3	52.7	52.1	52.0
Urinary tract infection (CC 144)	32.3	34.9	34.1	33.8
Other urinary tract disorders (CC 145)	16.5	20.5	20.2	19.2
Decubitus ulcer or chronic skin ulcer (CC 157 – 161)	15.4	16.9	16.3	16.2
Vertebral fractures without spinal cord injury (CC 169)	4.6	6.0	6.0	5.6
Other injuries (CC 174)	29.2	37.7	38.2	35.4

4.4.3 Pneumonia Model Parameters and Performance

Table 4.4.3.1 shows the parameter estimates and 95% CIs for the pneumonia days in acute care model for the combined three-year dataset.

Table 4.4.3.1 — Median Parameter Estimates and CIs of Risk Variables from the Logit and Poisson Models for Pneumonia (July 2020 – June 2023)

Variable	Part 1: Logit Model		Part 2: Poisson Model	
	Median	CI	Median	CI
Years over 65 (continuous)	-0.003	(-0.004 – -0.002)	-0.006	(-0.006 – -0.006)
Male	0.058	(0.047 – 0.068)	0.041	(0.037 – 0.045)
History of COVID-19	-0.063	(-0.075 – -0.050)	-0.037	(-0.041 – -0.032)
History of coronary artery bypass graft (CABG) surgery	0.003	(-0.015 – 0.025)	-0.038	(-0.046 – -0.032)
Severe infection; other infectious diseases (CC 1, 3 – 7)	0.022	(0.012 – 0.032)	0.014	(0.009 – 0.018)
Septicemia, sepsis, systemic inflammatory response syndrome/shock (CC 2)	0.065	(0.049 – 0.078)	0.011	(0.006 – 0.017)
Metastatic cancer and acute leukemia (CC 8)	0.270	(0.247 – 0.293)	0.074	(0.065 – 0.083)
Lung and other severe cancers (CC 9)	0.136	(0.117 – 0.152)	0.029	(0.023 – 0.036)
Lymphoma; other cancers (CC 10 – 12)	0.035	(0.019 – 0.048)	0.002	(-0.003 – 0.007)
Diabetes mellitus (DM) or DM complications (CC 17 – 19, 122 – 123)	0.068	(0.058 – 0.079)	0.028	(0.024 – 0.032)
Protein-calorie malnutrition (CC 21)	0.185	(0.173 – 0.199)	0.110	(0.105 – 0.115)
Other significant endocrine and metabolic disorders; disorders of fluid/electrolyte/acid-base balance (CC 23 – 24)	0.102	(0.091 – 0.115)	0.057	(0.052 – 0.062)

Variable	Part 1: Logit Model		Part 2: Poisson Model	
	Median	CI	Median	CI
Other gastrointestinal disorders (CC 38)	0.090	(0.078 – 0.100)	-0.025	(-0.030 – -0.020)
Severe hematological disorders (CC 46)	0.274	(0.238 – 0.308)	0.083	(0.072 – 0.094)
Iron deficiency or other/unspecified anemias and blood disease (CC 49)	0.136	(0.125 – 0.147)	0.067	(0.063 – 0.072)
Dementia or other specified brain disorders (CC 51 – 53)	0.081	(0.067 – 0.094)	-0.003	(-0.007 – 0.002)
Drug/alcohol abuse/dependence/psychosis (CC 54 – 56, 202 – 203)	0.096	(0.082 – 0.108)	-0.034	(-0.038 – -0.028)
Major psychiatric disorders (CC 57 – 59)	0.053	(0.037 – 0.067)	-0.013	(-0.018 – -0.007)
Other psychiatric disorders (CC 63)	0.100	(0.088 – 0.112)	-0.012	(-0.017 – -0.008)
Hemiplegia, paraplegia, paralysis, functional disability (CC 70 – 74, 103 – 104, 189 – 190)	0.100	(0.082 – 0.116)	0.044	(0.037 – 0.049)
Respirator dependence/tracheostomy status (CC 82)	0.175	(0.141 – 0.213)	0.088	(0.079 – 0.099)
Respiratory arrest; cardio-respiratory failure and shock (CC 83 – 84), plus ICD-10-CM codes R09.01 and R09.02	0.004	(-0.008 – 0.017)	0.071	(0.067 – 0.075)
Congestive heart failure (CC 85)	0.145	(0.135 – 0.159)	0.059	(0.054 – 0.064)
Acute coronary syndrome (CC 86 – 87)	0.071	(0.057 – 0.083)	0.036	(0.031 – 0.041)
Coronary atherosclerosis or angina (CC 88 – 89)	0.035	(0.025 – 0.045)	-0.019	(-0.024 – -0.014)
Valvular and rheumatic heart disease (CC 91)	0.041	(0.027 – 0.053)	0.007	(0.003 – 0.012)
Specified arrhythmias and other heart rhythm disorders (CC 96 – 97)	0.101	(0.092 – 0.113)	0.023	(0.019 – 0.028)
Stroke (CC 99 – 100)	0.054	(0.038 – 0.071)	-0.001	(-0.007 – 0.005)
Vascular or circulatory disease (CC 106 – 109)	0.059	(0.048 – 0.070)	0.000	(-0.004 – 0.005)
Chronic obstructive pulmonary disease (COPD) (CC 111)	0.094	(0.083 – 0.106)	0.019	(0.015 – 0.024)
Fibrosis of lung or other chronic lung disorders (CC 112)	0.068	(0.053 – 0.083)	0.043	(0.037 – 0.049)
Asthma (CC 113)	0.006	(-0.010 – 0.021)	-0.028	(-0.034 – -0.022)
Pneumonia (CC 114 – 116)	0.111	(0.098 – 0.123)	0.005	(0.000 – 0.009)
Pleural effusion/pneumothorax (CC 117)	0.153	(0.138 – 0.165)	0.085	(0.080 – 0.090)
Other respiratory disorders (CC 118)	0.018	(0.008 – 0.029)	-0.008	(-0.012 – -0.004)
Dialysis status (CC 134)	0.326	(0.304 – 0.351)	-0.026	(-0.034 – -0.018)
Renal failure (CC 135 – 140)	0.098	(0.088 – 0.108)	0.066	(0.062 – 0.070)
Urinary tract infection (CC 144)	0.083	(0.071 – 0.094)	0.003	(-0.002 – 0.007)
Other urinary tract disorders (CC 145)	0.052	(0.039 – 0.065)	-0.002	(-0.007 – 0.002)
Decubitus ulcer or chronic skin ulcer (CC 157 – 161)	0.112	(0.097 – 0.126)	0.101	(0.096 – 0.106)
Vertebral fractures without spinal cord injury (CC 169)	0.048	(0.026 – 0.070)	0.019	(0.010 – 0.028)
Other injuries (CC 174)	0.091	(0.079 – 0.103)	-0.039	(-0.044 – -0.036)

Table 4.4.3.2 shows the PPC results for the combined 29-month dataset.

Table 4.4.3.2 — PPC Results for Pneumonia (July 2020 – June 2023)

Statistic	Observed Days in Acute Care	MCMC 95% CI for Predicted Days in Acute Care	P-Value
Variance	0.470	(0.209 – 0.276)	< 0.001
Median	1.114	(0.854 – 0.872)	< 0.001
IQR	0.566	(0.491 – 0.521)	< 0.001
Coefficient of variation	0.604	(0.511 – 0.583)	0.009

The c-statistic for the logistic part and the deviance R^2 for the truncated Poisson part are provided in Table 4.4.3.3.

Table 4.4.3.3 — Pneumonia Generalized Linear Regression Model Performance (July 2020 – June 2023)

Characteristic	07/2020 – 06/2023
C-statistic (Logit part)	0.62
Deviance R^2 (Poisson part)	0.041

4.4.4 Distribution of Hospital Volumes and EDAC for Pneumonia

For the individual years, the mean hospital-level *observed* days in acute care per 100 discharges were as follows:

- July 1, 2020 – June 30, 2021: 120.22
- July 1, 2021 – June 30, 2022: 113.46
- July 1, 2022 – June 30, 2023: 107.54

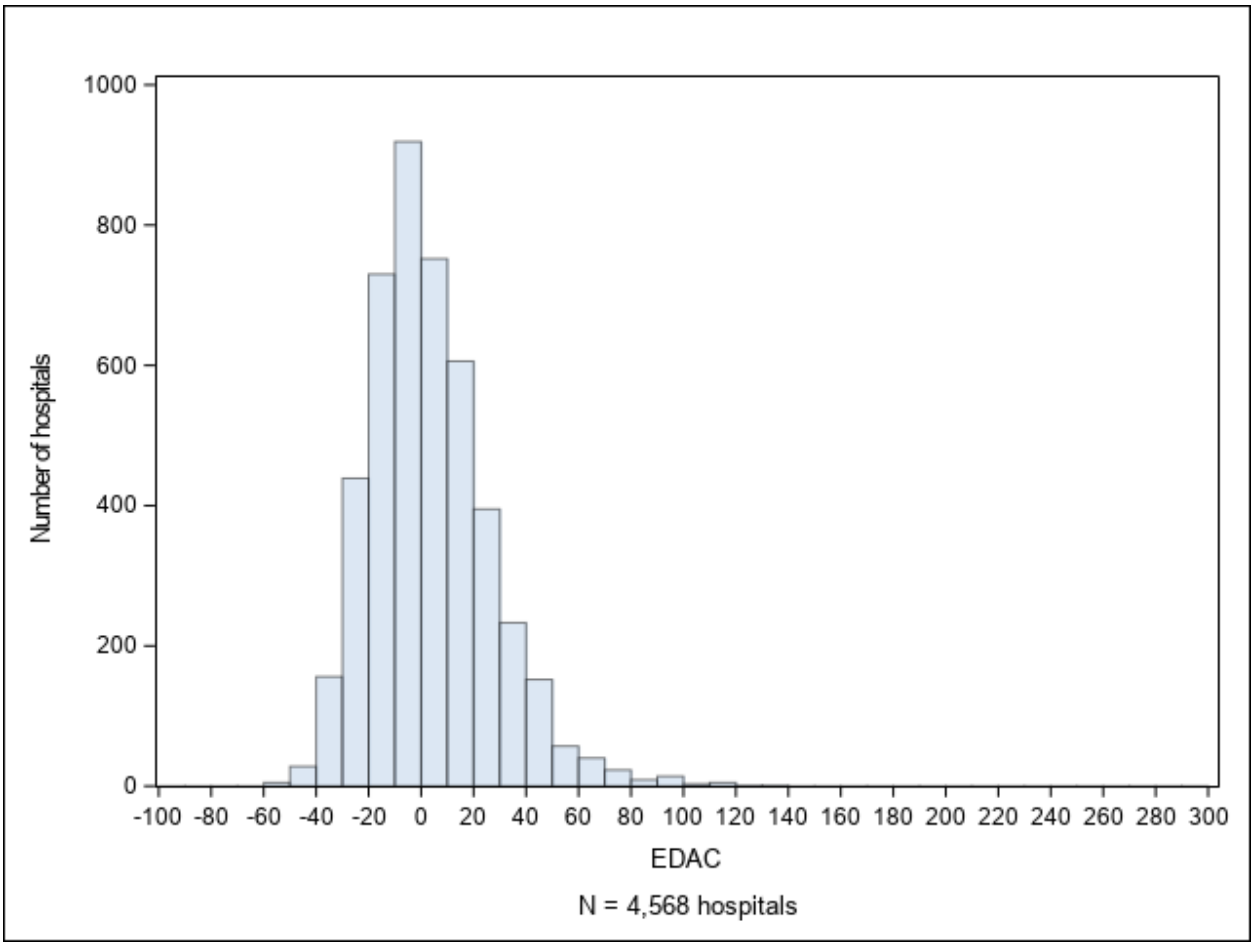
Table 4.4.4.1 shows both unadjusted (observed) days of post-discharge events per 100 discharges and EDAC per 100 discharges for pneumonia.

Table 4.4.4.1 — Hospital-Level Unadjusted Distribution of Overall Acute Care, ED Visits, Observation Stays, and Readmissions per 100 Pneumonia Discharges, and Distribution of EDAC (July 2020 – June 2023)

Description	Mean (SD)	Median (Q1, Q3)	Range
Observed days in acute care	113.42 (68.56)	111.38 (81.78, 138.42)	2,000
Days of ED visits	18.48 (11.70)	15.99 (11.67, 23.14)	150
Days of observation stays	8.10 (12.15)	5.83 (2.44, 10.23)	400
Days of readmissions	93.07 (67.13)	90.85 (60.00, 118.66)	2,000
EDAC	3.34 (23.03)	0.06 (-12.57, 16.08)	189.24
Days of predicted	115.41 (32.49)	111.74 (91.84, 133.98)	343.66
Days of expected	112.07 (18.70)	112.48 (100.95, 122.44)	249.09

Figure 4.4.4.1 shows the overall distribution of the hospital EDAC for the combined three-year dataset, which indicates that the hospital EDAC results are approximately normally distributed.

Figure 4.4.4.1 — Hospital-Level EDAC per 100 Discharges for Pneumonia for the July 2020 through June 2023 Dataset



4.4.5 Distribution of Hospitals by Performance Category in the Three-Year Dataset

Of 4,568 hospitals in the study cohort, 393 had “Fewer days than average,” 2,650 were “Average,” and 700 had “More days than average.” 825 were classified as “Number of cases too small” (fewer than 25) to reliably conclude how the hospital is performing.

5. GLOSSARY

Acute care hospital: A hospital that provides inpatient medical care for surgery and acute medical conditions or injuries. Short-term acute care hospitals provide care for short-term illnesses and conditions. In contrast, long-term acute care hospitals generally treat medically complex patients who require long-stay hospital-level care, which is generally defined as an inpatient length of stay more than 25 days.

C-statistic: An indicator of the model's discriminant ability or ability to correctly classify those patients who have and have not had a qualifying event within 30 days. Potential values range from 0.5, meaning no better than chance, to 1.0, an indication of perfect prediction. Perfect prediction implies that patients' outcomes can be predicted completely by their risk factors, and physicians and hospitals play no role in their patients' outcomes.

Case mix: The particular illness severity, age, and, for some measures, gender characteristics of patients with index admissions at a given hospital.

Clinical Classification Software (CCS): Software maintained by the AHRQ HCUP that groups thousands of individual procedure and diagnosis codes into clinically coherent, mutually exclusive procedure and diagnosis categories. AHRQ CCS categories are used to determine if a readmission is planned. AHRQ CCS procedure categories are used to define planned and potentially planned procedures. AHRQ CCS diagnosis categories are used to define acute diagnoses and complications of care that are considered unplanned, as well as a few specific types of care that are always considered planned (for example, maintenance chemotherapy). Mappings which show the assignment of ICD-10 codes to the AHRQ CCS diagnosis and procedure categories for 2024 public reporting are posted here on *QualityNet*.

Cohort: The index admissions used to calculate the measure after inclusion and exclusion criteria have been applied.

Comorbidities: Medical conditions the patient had in addition to their primary reason for admission to the hospital.

Complications: Medical conditions that may have occurred as a consequence of care rendered during hospitalization.

Condition Categories (CCs): Groupings of ICD-10-CM diagnosis codes into clinically relevant categories, from the HCC system.[14, 15] CMS uses modified groupings, but not the hierarchical logic of the system, to create risk factor variables. Mappings which show the assignment of ICD-10 codes to the CCs are available here on *QualityNet*.

Credible interval (CI): Analogous to a confidence interval, under a Bayesian framework. Like a confidence interval, a CI is a range of values that describes the uncertainty surrounding an estimate. However, unlike a confidence interval, the 95% CI is selected from the posterior probability distribution, which takes into account the prior distribution and new evidence learned.

Deviance R^2: A statistical tool used to evaluate the goodness-of-fit of logistic models.

Expected days: The average number of risk-adjusted days in acute care that a hospital's patients would have been expected to spend if discharged from an average-performing hospital with the same case mix.

Index admission: Any admission included in the measure calculation as the initial admission for an episode of AMI, HF, or pneumonia care and evaluated for the outcome.

Log-likelihood: The logarithm of a likelihood function, which is defined as a function of the parameters of a statistical model given data.

Medicare Fee-For-Service (FFS): Original Medicare plan in which providers receive a fee or payment directly from Medicare for each individual service provided. Patients in managed care (Medicare Advantage) are excluded from the measures.

Outcome: The result of a broad set of healthcare activities that affect patients' well-being. For the EDAC measures, the outcome is the number of days the patient spends in acute care in the 30 days after discharge.

Planned readmissions: A readmission within 30 days of discharge from a short-term acute care hospital that is a scheduled part of the patient's plan of care. Planned readmissions are not captured in the outcomes of these measures.

Posterior predictive checking (PPC): To evaluate whether the model fits the data well, observations from the fitted model are simulated, followed by a comparison of the distribution of the simulation data to the observed data (that is, the real data). The aim is to investigate whether there is any discrepancy between the real data and the model-based simulated data.

Predicted days: The average number of risk-adjusted days a hospital's patients spent in acute care.

Risk-adjustment variables: Patient demographics and comorbidities used to standardize rates for differences in case mix across hospitals.

Truncated Poisson model (or Truncated Poisson distribution): Similar to the usual Poisson distribution, the zero-truncated Poisson (ZTP) distribution is a discrete probability distribution that only takes positive integers.

Unplanned readmissions: Acute clinical events a patient experienced that require urgent rehospitalization. Unplanned readmissions are captured in the outcomes of these measures.

VA beneficiary: For the purposes of our measures, a "VA beneficiary" is a patient who has VA healthcare benefits (according to VA administrative data). They may or may not be dually enrolled in Medicare FFS.

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7. APPENDICES

Appendix A. Statistical Approach for AMI, HF, and Pneumonia Measures

We estimate the hospital-specific EDAC using a random effects hurdle model. This model consists of the two-part logit/truncated Poisson model specifications for days in acute care and includes two random effects for hospitals — one for the logit part and one for the truncated Poisson part — with a non-zero covariance between the two random effects. This strategy accounts for within-hospital correlation of the observed outcome and accommodates the assumption that underlying differences in quality across hospitals lead to systematic differences in outcomes.

Hospital Performance Reporting

Explicitly, let Y_{ij} denote the number of days in acute care experienced by the *i*-th patient discharged from the *j*-th hospital, and ω_{ij} is the patient's exposure time (the number of days alive up to 30). At the first stage, whether a patient has non-zero days in acute care (that is, a binary outcome of $Y_{ij} > 0$ versus $Y_{ij} = 0$) is modeled via a logistic regression model. At the second stage, if a patient utilizes acute care within 30 days after discharge ($Y_{ij} > 0$), Y_{ij} is made a variable of counts and is assumed to follow a ZTP distribution. Thus, we have the following "hurdle" model:

$$\begin{cases} \text{logit}(\pi_{ij}) = \log(\omega_{ij}) + X_{ij}C + v_j \text{ where } \pi_{ij} = \Pr\{Y_{ij} > 0\} \\ \log(\mu_{ij}) = \log(\omega_{ij}) + X_{ij}B + u_j \text{ where } Y_{ij} \mid Y_{ij} > 0 \sim \text{Truncated Poisson}(\mu_{ij}) \end{cases} \quad (1)$$

Note that $E(Y_{ij} \mid Y_{ij} > 0) = \mu_{ij}/(1 - \exp(-\mu_{ij}))$ and $E(Y_{ij}) = \pi_{ij}\mu_{ij}/(1 - \exp(-\mu_{ij}))$. $(v_j, u_j) \sim MVN(M, \Sigma)$, where v_j and u_j are random effects across hospitals with means $M = [C_0, B_0]$ and variance-covariance matrix Σ. The X_{ij} is a vector of patient risk factors, and B and C are vectors of covariate coefficients.

We estimated the model and used the coefficient vectors B and C and the random effects v_j and $u_j$to calculate the predicted (P_{ij}) and expected (E_{ij}) days in acute care for each index admission, respectively. Specifically, we calculate:

Predicted $$P_{ij} = \text{logit}^{-1}(\log(\omega_{ij}) + X_{ij}C + v_j) * \frac{\exp(\log(\omega_{ij}) + X_{ij}B + u_j)}{1 - \exp(-\exp(\log(\omega_{ij}) + X_{ij}B + u_j))} \quad (2)$$

Expected $$E_{ij} = \text{logit}^{-1}(\log(\omega_{ij}) + X_{ij}C + C_0) * \frac{\exp(\log(\omega_{ij}) + X_{ij}B + B_0)}{1 - \exp(-\exp(\log(\omega_{ij}) + X_{ij}B + B_0))} \quad (3)$$

where C_0 and B_0 are means of the random effects v_j and u_j.

We then calculated the EDAC for the hospital *j* as:

$$EDAC_j = 100 * \sum(P_{ij} - E_{ij})/m_j \quad (4)$$

where the sum is over all patients at hospital *j*, and m_j is the number of index admissions at hospital *j*. To be consistent with the reporting of the CMS 30-day AMI, HF, and pneumonia readmission measures, we have multiplied the final measure by 100 so that EDAC represents EDAC per 100 discharges.

Creating Credible Intervals (CIs)

We use Markov Chain Monte Carlo (MCMC) estimation approach to derive a CI.[16] MCMC estimation allows us to generate a large number of simulated values of P_{ij}, E_{ij}, v_j and u_j, from their posterior distribution (determined by both prior assumption for those quantities and the actual data), to base inferences; using these simulated values of P_{ij}, E_{ij}, v_j and u_j, we can also obtain the posterior distribution of $EDAC_j$ for each hospital (since $EDAC_j$ is a function of those values). The median value of the posterior distribution of $EDAC_j$ is taken as the hospital point estimate, with the 2.5th and 97.5th percentile order statistics taken as the endpoints of a 95% CI.

Appendix B. Data QA

This production year required updates to all SAS packs to account for updates in ICD-10 codes and associated mappings of clinical groupers.

This section represents QA for the subset of the work YNHHSC/CORE conducted to maintain and report these EDAC measures. It does not describe the QA for processing data and creating the input files, nor does it include the QA for the final processing of production data for public reporting, because another contractor conducts that work.

To assure the quality of measure output, we utilized a multi-phase approach to QA of the EDAC measures.

Phase I

As the first step in the QA process, we review changes in the cohort and outcomes definitions as determined by the measure-specific code set files that were updated to account for changes in ICD-10 coding. This includes updates to the AHRQ HCUP CCS and the HCC clinical category maps.

In general, we use both manual scan and descriptive analyses to conduct data validity checks, including cross-checking EDAC information, distributions of ICD-10 codes, and frequencies of key variables.

Phase II

We update the existing SAS packs to accommodate the new codes and updates to the measures. To ensure accuracy in SAS pack coding, two analysts independently write SAS code for any major changes made in calculating the EDAC measures: data preparation, sample selection, hierarchical modeling, and calculation of EDAC. This process highlights any programming errors in syntax or logic. Once the parallel programming process is complete, the analysts cross-check their codes by analyzing datasets in parallel, checking for consistency of output, and reconciling any discrepancies.

Phase III

A third analyst reviews the finalized SAS code and recommends changes to the coding and readability of the SAS packs, where appropriate. The primary analyst receives the suggested changes for possible re-coding or program documentation when needed.

During this phase, we also compare prior years' risk-adjustment parameter estimates and variable frequencies to enable us to check for potential inconsistencies in the data and the impact of any changes to the SAS packs. Anything that seems outside of normal coding fluctuation is reviewed in more detail.

Appendix C. Annual Updates

Prior annual updates for the measures can be found in the annual updates and specifications reports available here on *QualityNet*. For convenience, we have listed all updates under the reporting year and corresponding report. In 2013, CMS began assigning version numbers to its measures. The measure specifications in the original methodology reports are considered Version 1.0 for each measure. The measure specifications in the updated AMI and HF EDAC methodology reports are considered Version 1.1. The measures receive a new version number for each subsequent year of public reporting.

2024

2024 Measures Updates and Specifications Report (Version 9.0 — AMI and HF) (Version 8.0 — Pneumonia)

- Updated the ICD-10 code-based specifications used in the measures — Specifically, we:
  - incorporated the code changes that occurred in the ICD-10-CM/PCS code set releases since 2023 public reporting (namely, October 1, 2022 [FY 2023] and April 1, 2023) into the cohort definitions and risk models;
  - applied a YNHHSC/CORE-modified v4.0 of the AHRQ HCUP's beta version 2019.1 CCS for ICD-10-CM/PCS to the planned readmission algorithm;
  - applied a modified version of the FY 2023 V24 CMS-HCC crosswalk that is maintained by RTI International to the risk models; and
  - made additional code specification changes prompted by the activities described in Section 3.1.
    - Rationale: Revisions to the measure specifications were warranted to accommodate updated versions of the ICD-10-CM/PCS and CMS-HCC crosswalk as well as the workgroup review activities.
- Expanded the measurement period for 2024 public reporting to three years (the typical measurement period prior to the COVID-19 PHE)
  - Rationale: The rates for the measures are calculated using rolling data. Each year, the rates are updated by dropping the data representing the oldest year and adding data for the newest available year. As a result, the 2024 measurement period begins with July 2020 discharges (incremented one year from the start of the 2023 public reporting period of July 2019).
- Updated the CPT® code-based specifications used to identify observation stays in the EDAC outcome
  - Rationale: Revisions to the measure specifications were warranted to accommodate changes in the calendar year 2023 CPT® code set.
- Revised the methodology used to weight ED visits and observation stays in calculating EDAC outcome — Specifically, we:
  - increased the weight of each ED visit to one whole day; and
  - changed how we round observation stay hours, from half-days to whole days.
    - Rationale: Modifying the weight of ED and observation stay days helps with the production, implementation, and ongoing reevaluation of the EDAC measures and improves the performance of the statistical model. Additionally, feedback from stakeholders suggests that although the average ED treat and discharge stay is about four hours, patients often spend an entire day from the time it takes to get to the ED, the wait time in the ED for treatment, treatment in the ED, and any trips for medication or supplies after their ED visit.

2023

2023 Measures Updates and Specifications Report (Version 8.0 — AMI and HF) (Version 7.0 — Pneumonia)

- Updated the ICD-10 code-based specifications used in the measures — Specifically, we:
  - incorporated the code changes that occurred in the ICD-10-CM/PCS code set releases since 2022 public reporting (namely, October 1, 2021 [FY 2022] and April 1, 2022) into the cohort definitions and risk models;
  - applied a YNHHSC/CORE-modified v3.0 of the AHRQ HCUP's beta version 2019.1 CCS for ICD-10-CM/PCS to the planned readmission algorithm;
  - applied a modified version of the FY 2022 V24 CMS-HCC crosswalk that is maintained by RTI International to the risk models; and
  - made additional code specification changes prompted by other workgroup activities, including code frequency monitoring, review of select pre-existing ICD-10 code specifications, and neighboring code searches.
    - Rationale: Revisions to the measure specifications were warranted to accommodate updated versions of the ICD-10-CM/PCS and CMS-HCC crosswalk as well as the workgroup review activities.
- Increased the reporting threshold for the AMI EDAC measure from a minimum case count of 25 or more to a minimum case count of 50 or more, as finalized in the FY 2023 IPPS Final Rule
  - Rationale: The minimum case volume was raised to increase the reliability of the measure.

2022

2022 Measures Updates and Specifications Report (Version 7.0 — AMI and HF) (Version 6.0 — Pneumonia)

- Updated the ICD-10 code-based specifications used in the measures — Specifically, we:
  - incorporated the code changes that occurred in the ICD-10-CM/PCS code set releases since 2021 public reporting (namely, April 1, 2020; August 1, 2020; October 1, 2020 [FY 2021]; and January 1, 2021) into the cohort definitions and risk models;
  - applied a YNHHSC/CORE-modified v2.0 of the AHRQ HCUP's beta version 2019.1 CCS for ICD-10-CM/PCS to the planned readmission algorithm;
  - applied a modified version of the FY 2021 V24 CMS-HCC crosswalk that is maintained by RTI International to the risk models; and
  - made additional code specification changes prompted by other workgroup activities, including code frequency monitoring, review of select pre-existing ICD-10 code specifications, and neighboring code searches.
    - Rationale: Revisions to the measure specifications were warranted to accommodate updated versions of the ICD-10-CM/PCS and CMS-HCC crosswalk as well as the workgroup review activities.
- Adjusted the specifications and methodologies for the measures in response to the COVID-19 PHE — Specifically, we:
  - removed COVID-19 index admissions from the cohorts;
  - rendered COVID-19 ED visits, observation stays, and readmissions ineligible for the EDAC outcome and excluded them;
  - added a new 'History of COVID-19' risk variable to the risk-adjustment models;
  - shortened the measurement period for 2022 public reporting to approximately 29 months (from the typical three-year measurement period), similar to 2021 public reporting; and

- reduced the look-back period for use of claims/VA data in risk adjustment to less than 12 months (from the typical 12 months) for those patients whose 12-month period included any portion of the January 1, 2020 through June 30, 2020 claims exclusion time frame. This reduced look-back period also applies to the identification of patients with a procedure code for LVAD implantation or heart transplantation prior to the index admission (an exclusion for the HF EDAC measure cohort).
    - Rationale: The COVID-19 PHE continues to have significant and enduring effects on the provision of medical care in the country and around the world. Adjustments to measure specifications and methodologies for 2022 help to ensure the intent of the measures is maintained. The measurement period and look-back period reductions (in certain cases) are in response to CMS's decision to exclude claims data for January 1, 2020 through June 30, 2020 (Q1 and Q2 of 2020) under its ECE policy.
- Added a POA algorithm to the risk-adjustment methodology used to pull CC-defined risk-adjustment variables from the index admission claim/VA data
    - Rationale: POA coding is a logical reflection of comorbidities. POA indicators more accurately distinguish complications of care from conditions already present at admission, in comparison to the previous methodology that utilized only the potential complications list.[17] Additionally, use of POA indicators helps particularly in cases where a patient has not been hospitalized or had provider visits in the last year or where a comorbid condition present at the time of admission is relatively new.

2021

2021 Measures Updates and Specifications Report (Version 6.0 — AMI and HF) (Version 5.0 — Pneumonia)

- Updated the ICD-10 code-based specifications used in the measures — Specifically, we:
    - incorporated the code changes that occurred in the FY 2020 version of the ICD-10-CM/PCS (effective with October 1, 2019+ discharges) into the cohort definitions and risk models;
    - applied a YNHHSC/CORE-modified version of the AHRQ HCUP's beta version 2019.1 CCS for ICD-10-CM/PCS to the planned readmission algorithm;
    - applied a modified version of the FY 2020 V24 CMS-HCC crosswalk that is maintained by RTI International to the risk models; and
    - made additional code specification changes prompted by other workgroup activities, including code frequency monitoring, review of select pre-existing ICD-10 code specifications, and neighboring code searches.
        - Rationale: Revisions to the measure specifications were warranted to accommodate updated versions of the ICD-10-CM/PCS and CMS-HCC crosswalk as well as the workgroup review activities.
- Shortened the measurement period for 2021 public reporting to approximately 29 months (from the typical three-year measurement period)
    - Rationale: The measurement period reduction is in response to the COVID-19 PHE and CMS's decision to exclude claims data for January 1, 2020 through June 30, 2020 (Q1 and Q2 of 2020) under its ECE policy.
- Removed the International Classification of Diseases, Ninth Revision (ICD-9) code-based specifications from the measures and SAS packs
    - Rationale: The Medicare claims and VA administrative data for the measurement period of July 1, 2017 through December 1, 2019 are completely ICD-10 code-based. 2020 public reporting was the last year that warranted any ICD-9 code specifications.

- Added the revenue center code 0456 (Emergency room-urgent care) to the revenue center code list used to identify ED visits
    - Rationale: Revenue center code 0456 is an appropriate code for identifying an ED encounter in non-VA hospital claims.

2020

2020 Measures Updates and Specifications Report (Version 5.0 — AMI and HF) (Version 4.0 — Pneumonia)

- Updated the ICD-10 code-based specifications used in the measures — Specifically, we:
    - incorporated the code changes that occurred in the FY 2019 version of the ICD-10-CM/PCS (effective with October 1, 2018+ discharges) into the cohort definitions and risk models;
    - applied version 2019.1 (beta version) of the AHRQ HCUP CCS for ICD-10-CM/PCS to the planned readmission algorithm;
    - applied a modified version of the FY 2019 V22 CMS-HCC crosswalk that is maintained by RTI International to the risk models; and
    - made additional code specification changes prompted by other workgroup activities, including code frequency monitoring, review of select pre-existing ICD-10 code specifications, and neighboring code searches.
        - Rationale: Revisions to the measure specifications were warranted to accommodate updated versions of the ICD-10-CM/PCS, AHRQ HCUP CCS, and CMS-HCC crosswalk as well as the workgroup review activities.
- Added admission data from VA hospitals to the measures
    - Rationale: Creates a more inclusive perspective of the relative quality of U.S. hospitals
- Added the revenue center codes 0138 (Semi-private 3 and 4 beds-rehabilitation) and 0158 (Room & Board ward (medical or general)-rehabilitation) to the revenue center code list used to identify transfers to rehabilitation units, to ensure these transfers are not captured as readmissions for any hospital (Refer to the 2018 updates below)
    - Rationale: Revenue center codes 0138 and 0158 are appropriate codes for identifying rehabilitation stays in non-VA hospital claims.

2019

2019 Measures Updates and Specifications Report (Version 4.0 — AMI and HF) (Version 3.0 — Pneumonia)

- Updated the ICD-10 code-based specifications used in the measures — Specifically, we:
    - incorporated the code changes that occurred in the FY 2018 version of the ICD-10-CM/PCS (effective with October 1, 2017+ discharges) into the cohort definitions, planned readmission algorithm, and risk models;
    - applied version 2018.1 of the AHRQ HCUP CCS for ICD-10-CM/PCS to the planned readmission algorithm;
    - applied a modified version of the FY 2018 V22 CMS-HCC crosswalk that is maintained by RTI International to the risk models; and
    - made additional code specification changes prompted by other workgroup activities, including code frequency monitoring, review of select pre-existing ICD-10 code specifications, and neighboring code searches. For example, ICD-10-CM code I21.9, Acute myocardial infarction, unspecified, was identified through a “neighboring code search” (found near existing code I21.4, Non-ST elevation (N-STEMI) myocardial infarction) and determined through clinical review to be a code which meets measure intent. As a result, it was added to the AMI cohort inclusion list.

        - Rationale: Revisions to the measure specifications were warranted to accommodate updated versions of the ICD-10-CM/PCS, AHRQ HCUP CCS, and CMS-HCC crosswalk as well as the workgroup review activities.
- Revised the methodology used to count the number of observation stay days in the EDAC outcome. The use of both physician and facility claims (and use of the claim with the longer duration when both claims are present) was changed to use of physician claims only in cases when a facility claim is not available.
    - Rationale: Done in response to stakeholder feedback. This change has minimal impact on the measure results.

2018

2018 Measures Updates and Specifications Report (Version 3.0 — AMI and HF) (Version 2.0 — Pneumonia)

- Updated the ICD-10 code-based specifications used in the measures — Specifically, we:
    - incorporated the code changes that occurred in the FY 2017 version of the ICD-10-CM/PCS into the planned readmission algorithm and risk models;
    - applied the 2017.1 and 2017.2 versions of the AHRQ HCUP CCS to the planned readmission algorithm for diagnoses and procedures, respectively;
    - applied the FY 2017 version of the V22 CMS-HCC crosswalk maintained by RTI International to the risk models; and
    - monitored code frequencies to identify any code specification changes warranted due to possible changes in coding practices and patterns. Additionally, our clinical and measure experts reviewed the pre-existing ICD-10 code-based specifications to confirm the appropriateness of the specifications unaffected by the updates.
        - Rationale: Updated versions of the ICD-10-CM/PCS, AHRQ HCUP CCS, and CMS-HCC crosswalk were released. Revisions to the measure specifications were warranted to accommodate these updates.
- Updated the methodology used in analytic input file production to identify transfers to rehabilitation units, to further ensure these transfers are not captured as readmissions for any hospital. In addition to the previous methods described in the 2017 update below, use of revenue center codes has been implemented, to help identify these cases in both ICD-9 and ICD-10 code-based claims. Specifically:
    - 0024: Inpatient Rehabilitation Facility services paid under PPS submitted as TOB 11X
    - 0118: Private medical or general-rehabilitation
    - 0128: Semi-private 2 bed (medical or general)-rehabilitation
    - 0148: Private (deluxe)-rehabilitation
        - Rationale: The inability to use principal discharge diagnosis codes to identify rehabilitation stays (due to ICD-10 coding guidance) has led to an under-counting of these transfers primarily for Maryland hospitals and CAHs, hospitals that are not part of the IPPS. Utilization of revenue center codes augments our ability to identify and exclude admissions to rehabilitation beds in these hospitals that are not identified through discharge disposition codes alone. Of note, rehabilitation units are most often identified by CMS certification number (CCN).
- Removed the obstetric AHRQ CCS procedure and diagnosis categories from the planned readmission algorithm. Specifically, AHRQ CCS procedure categories 134 and 135 and AHRQ CCS diagnosis categories 194 and 196 were deleted from the always planned procedure and diagnosis lists, respectively. They remain in the SAS packs but are commented out.

- Rationale: The obstetric codes were incorporated into the initial planned readmission algorithm specifications during development. They were provided for all-payer settings but are not applicable to the CMS EDAC measures that include only those patients aged 65 or over.

- Re-specified the pneumonia risk model, updating the CC-based risk variables previously defined using the HCC version 12 map (in the pneumonia measure methodology report posted here on *QualityNet*) to the HCC version 22 map
  - Rationale: The measurement period for 2018 public reporting required data from claims that include ICD-10 codes in addition to data from claims that include ICD-9 codes. Thus, updating the CC-based risk variables to the ICD-10-compatible HCC system version 22 was warranted.

2017

2017 Measures Updates and Specifications Report (Version 2.0 — AMI and HF)

- Revised the measure specifications to accommodate the implementation of ICD-10 coding — Specifically, we:
  - identified the ICD-10 codes used to define each of the measure cohorts for discharges on or after October 1, 2015;
  - updated the planned readmission algorithm, by using the most recent (2016) version of the ICD-10-based AHRQ HCUP CCS and ICD-10 codes for certain "potentially planned procedures" and "acute diagnoses" to the algorithm specifications, for discharges on or after October 1, 2015; and
  - re-specified the risk models, updating the CC-based risk variables to the ICD-10-compatible HCC system version 22 and applying ICD-10 codes for certain risk variables (for example, 'History of percutaneous transluminal coronary angioplasty (PTCA)') to the models.
    - Rationale: The ICD-9 code sets used to report medical diagnoses and inpatient procedures were replaced by ICD-10 code sets on October 1, 2015. The U.S. Department of Health and Human Services mandated that ICD-10 codes be used for medical coding, effective with October 1, 2015 discharges. The measurement period for 2017 public reporting required data from claims that include ICD-10 codes in addition to data from claims that include ICD-9 codes. Thus, re-specification was warranted to accommodate ICD-10 coding.

- Psychiatric and rehabilitation units within short-term acute care hospitals in Maryland have the same type of provider ID number (or CCN) as the acute care hospital in which they are housed. Transfers to these units can therefore look like readmissions. To accurately assess readmissions in Maryland and allow for public reporting of Maryland readmission rates, methodologies to identify these cases were needed, to ensure these transfers are not captured as readmissions for any hospital — Specifically:
  - Identification of psychiatric admissions before and after October 1, 2015:
    (1) the admission being evaluated as a potential readmission has a psychiatric principal discharge diagnosis code (ICD-9-CM codes beginning with "29," "30," or "31," for discharges prior to October 1, 2015, or ICD-10-CM codes beginning with "F," for discharges on or after October 1, 2015);
    (2) the index admission has a discharge disposition code to a psychiatric hospital or psychiatric unit from the index admission; and

(3) the admission being evaluated as a potential readmission occurred during the same day as or the day following the index discharge.

- Identification of rehabilitation admissions prior to October 1, 2015:
  (1) The admission being evaluated as a potential readmission has an ICD-9-CM principal discharge diagnosis code beginning with "V57."
- Identification of rehabilitation admissions on or after October 1, 2015:
  (1) the index admission has a discharge disposition code to a rehabilitation hospital or rehabilitation unit from the index admission; and
  (2) the admission being evaluated as a potential readmission occurred on the same day as or the day following the index discharge.
- Psychiatric/rehabilitation admissions identified as described above are not captured as readmissions. Note that we do not expect to see rehabilitation claims in hospital data from states other than Maryland.
  - Rationale: With the implementation of ICD-10 coding effective with discharges on or after October 1, 2015, the criteria for Maryland hospitals had to be specified for both ICD-10 and ICD-9 code-based claims. For psychiatric admissions, defining "psychiatric diagnosis" with ICD-10-CM codes for discharges on or after October 1, 2015 was a simple solution, as mental health diagnosis codes all reside under the Category "F" (Mental, Behavioral and Neurodevelopmental disorders). However, for rehabilitation admissions, rehabilitation diagnosis codes are no longer coded consistently. Thus, defining the V57.0 ICD-9-CM code criterion with ICD-10-CM codes was not a viable option, and a different strategy was warranted.

Appendix D. Measure Specifications

Appendix D.1 Hospital-Level 30-Day EDAC following AMI (CBE #2881)

Cohort

Inclusion Criteria for AMI Measure

- **Principal discharge diagnosis of AMI**
  - Rationale: AMI is the condition targeted for measurement.
- **Enrolled in Medicare FFS Part A and Part B for the 12 months prior to the date of admission and Part A during the index admission (not applicable to VA hospitalizations)**
  - Rationale: For patients who are not VA beneficiaries, the 12-month Part A and Part B prior enrollment criterion ensures that the comorbidity data used in risk adjustment can be captured from inpatient, outpatient, and physician claims data for up to 12 months prior to the index admission, to augment the index admission claim itself. Medicare Part A during the index admission is required to ensure Medicare FFS enrollment at the time of admission.
- **Aged 65 or over**
  - Rationale: Patients younger than 65 are not included in the measure because they are considered to be too clinically distinct from patients 65 or over.
- **Discharged alive from a non-federal short-term acute care hospital or VA hospital**
  - Rationale: It is only possible for patients to be eligible for an ED visit, observation stay, or readmission if they are discharged alive.
- **Not transferred to another acute care facility**
  - Rationale: Hospitalizations that result in a transfer to another acute care facility are not included in the measure because the measure's focus is on admissions that result in discharge to a non-acute care setting (for example, to home or a skilled nursing facility).

Exclusion Criteria for AMI Measure

- **Without at least 30 days of post-discharge enrollment in Medicare FFS (not applicable to VA hospitalizations)**
  - Rationale: The 30-day outcome cannot be assessed in this group since claims data are used to determine whether a patient visited the ED, was placed under observation, or was readmitted.
- **Discharged against medical advice**
  - Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge.
- **Same-day discharges**
  - Rationale: Patients admitted and then discharged on the same day are not included as an index admission because it is unlikely that these admissions are for clinically significant AMIs.
- **AMI admissions within 30 days of discharge from a prior AMI index admission**
  - Rationale: Additional AMI admissions within 30 days are excluded as index admissions because they are part of determination of the outcome. CMS does not want to potentially count the additional admission as both an index admission and an unplanned readmission outcome for the first admission.

- **With a principal diagnosis code of COVID-19 or with a secondary diagnosis code of COVID-19 coded as POA on the index admission claim**
    - Rationale: COVID-19 patients are removed from the AMI cohort in response to the COVID-19 PHE.

The ICD-10-CM codes used to define the AMI cohort are outlined in the 2024 AMI EDAC Measure Code Specifications supplemental file posted here on *QualityNet*.

Outcome

Outcome Criteria for AMI Measure

- **All-cause days in acute care within 30 days from the date of discharge from an index admission**
    - Rationale: Days in acute care are defined as days spent in an ED, admitted to observation status, or admitted as an unplanned readmission for any cause within 30 days from the date of discharge from the index AMI hospitalization. From a patient's perspective, days in acute care from any cause is an adverse event. Multiple events are counted in order to capture the full patient experience in the post-discharge period. Outcomes occurring within 30 days of discharge can be influenced by hospital care. The 30-day time frame is a clinically meaningful period for hospitals to collaborate with their communities to reduce days in acute care.
- **ED visits, observation stays, and readmissions with a principal diagnosis code of COVID-19 on the claim or with a secondary diagnosis code of COVID-19 on the claim (and coded as POA, in the case of readmissions) are not eligible and are excluded**
    - Rationale: COVID-19 ED visits, observation stays, and readmissions are not eligible for the EDAC outcome in response to the COVID-19 PHE.

Appendix D.2 Hospital-Level 30-Day EDAC following HF (CBE #2880)

Cohort

Inclusion Criteria for HF Measure

- **Principal discharge diagnosis of HF**
  - Rationale: HF is the condition targeted for measurement.
- **Enrolled in Medicare FFS Part A and Part B for the 12 months prior to the date of admission and Part A during the index admission (not applicable to VA hospitalizations)**
  - Rationale: For patients who are not VA beneficiaries, the 12-month Part A and Part B prior enrollment criterion ensures that the comorbidity data used in risk adjustment can be captured from inpatient, outpatient, and physician claims data for up to 12 months prior to the index admission, to augment the index admission claim itself. Medicare Part A during the index admission is required to ensure Medicare FFS enrollment at the time of admission.
- **Aged 65 or over**
  - Rationale: Patients younger than 65 are not included in the measure because they are considered to be too clinically distinct from patients 65 or over.
- **Discharged alive from a non-federal short-term acute care hospital or VA hospital**
  - Rationale: It is only possible for patients to be eligible for an ED visit, observation stay, or readmission if they are discharged alive.
- **Not transferred to another acute care facility**
  - Rationale: Hospitalizations that result in a transfer to another acute care facility are not included in the measure because the measure's focus is on admissions that result in discharge to a non-acute care setting (for example, to home or a skilled nursing facility).

Exclusion Criteria for HF Measure

- **Without at least 30 days of post-discharge enrollment in Medicare FFS (not applicable to VA hospitalizations)**
  - Rationale: The 30-day outcome cannot be assessed in this group since claims data are used to determine whether a patient visited the ED, was placed under observation, or was readmitted.
- **Discharged against medical advice**
  - Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge.
- **HF admissions within 30 days of discharge from a prior HF index admission**
  - Rationale: Additional HF admissions within 30 days are excluded as index admissions because they are part of determination of the outcome. CMS does not want to potentially count the additional admission as both an index admission and an unplanned readmission outcome for the first admission.
- **With an ICD-10 code indicating LVAD implantation or heart transplantation either during the index admission or up to 12 months prior to the index admission**
  - Rationale: These patients represent a clinically distinct group.
- **With a principal diagnosis code of COVID-19 or with a secondary diagnosis code of COVID-19 coded as POA on the index admission claim**
  - Rationale: COVID-19 patients are removed from the HF cohort in response to the COVID-19 PHE.

The ICD-10 codes used to define HF cohort inclusions and exclusions are outlined in the 2024 HF EDAC Measure Code Specifications supplemental file posted here on *QualityNet*.

Outcome

Outcome Criteria for HF Measure

- **All-cause days in acute care within 30 days from the date of discharge from an index admission**
  - Rationale: Days in acute care are defined as days spent in an ED, admitted to observation status, or admitted as an unplanned readmission for any cause within 30 days from the date of discharge from the index HF hospitalization. From a patient's perspective, days in acute care from any cause is an adverse event. Multiple events are counted in order to capture the full patient experience in the post-discharge period. Outcomes occurring within 30 days of discharge can be influenced by hospital care. The 30-day time frame is a clinically meaningful period for hospitals to collaborate with their communities to reduce days in acute care.
- **ED visits, observation stays, and readmissions with a principal diagnosis code of COVID-19 on the claim or with a secondary diagnosis code of COVID-19 on the claim (and coded as POA, in the case of readmissions) are not eligible and are excluded**
  - Rationale: COVID-19 ED visits, observation stays, and readmissions are not eligible for the EDAC outcome in response to the COVID-19 PHE.

Appendix D.3 Hospital-Level 30-Day EDAC following Pneumonia (CBE #2882)

Cohort

Inclusion Criteria for Pneumonia Measure

- **Diagnosis coding that met one of the two following requirements:**
  1. **Principal discharge diagnosis of pneumonia; or**
  2. **a. Principal discharge diagnosis of sepsis (that is not severe); and**
     b. A secondary diagnosis of pneumonia coded as POA; and
     c. No secondary diagnosis of sepsis that is both severe and coded as POA.
  - Rationale: Pneumonia is the condition targeted for measurement. Sepsis admissions with a secondary diagnosis of pneumonia, as described above, are also included in order for the measure to more fully reflect the population of patients being treated for pneumonia.
- **Enrolled in Medicare FFS Part A and Part B for the 12 months prior to the date of admission and Part A during the index admission (not applicable to VA hospitalizations)**
  - Rationale: For patients who are not VA beneficiaries, the 12-month Part A and Part B prior enrollment criterion ensures that the comorbidity data used in risk adjustment can be captured from inpatient, outpatient, and physician claims data for up to 12 months prior to the index admission, to augment the index admission claim itself. Medicare Part A during the index admission is required to ensure Medicare FFS enrollment at the time of admission.
- **Aged 65 or over**
  - Rationale: Patients younger than 65 are not included in the measure because they are considered to be too clinically distinct from patients 65 or over.
- **Discharged alive from a non-federal short-term acute care hospital or VA hospital**
  - Rationale: It is only possible for patients to be eligible for an ED visit, observation stay, or readmission if they are discharged alive.
- **Not transferred to another acute care facility**
  - Rationale: Hospitalizations that result in a transfer to another acute care facility are not included in the measure because the measure's focus is on admissions that result in discharge to a non-acute care setting (for example, to home or a skilled nursing facility).

Exclusion Criteria for Pneumonia Measure

- **Without at least 30 days of post-discharge enrollment in Medicare FFS (not applicable to VA hospitalizations)**
  - Rationale: The 30-day outcome cannot be assessed in this group since claims data are used to determine whether a patient visited the ED, was placed under observation, or was readmitted.
- **Discharged against medical advice**
  - Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge.
- **Pneumonia admissions within 30 days of discharge from a prior pneumonia index admission**
  - Rationale: Additional pneumonia admissions within 30 days are excluded as index admissions because they are part of determination of the outcome. CMS does not want to potentially count the additional admission as both an index admission and an unplanned readmission outcome for the first admission.

- **With a principal diagnosis code of COVID-19 or with a secondary diagnosis code of COVID-19 coded as POA on the index admission claim**
    - Rationale: COVID-19 patients are removed from the pneumonia cohort in response to the COVID-19 PHE.

The ICD-10-CM codes used to define the pneumonia cohort are outlined in the 2024 Pneumonia EDAC Measure Code Specifications supplemental file posted here on *QualityNet*.

Outcome

Outcome Criteria for Pneumonia Measure

- **All-cause days in acute care within 30 days from the date of discharge from an index admission**
    - Rationale: Days in acute care are defined as days spent in an ED, admitted to observation status, or admitted as an unplanned readmission for any cause within 30 days from the date of discharge from the index pneumonia hospitalization. From a patient's perspective, days in acute care from any cause is an adverse event. Multiple events are counted in order to capture the full patient experience in the post-discharge period. Outcomes occurring within 30 days of discharge can be influenced by hospital care. The 30-day time frame is a clinically meaningful period for hospitals to collaborate with their communities to reduce days in acute care.
- **ED visits, observation stays, and readmissions with a principal diagnosis code of COVID-19 on the claim or with a secondary diagnosis code of COVID-19 on the claim (and coded as POA, in the case of readmissions) are not eligible and are excluded**
    - Rationale: COVID-19 ED visits, observation stays, and readmissions are not eligible for the EDAC outcome in response to the COVID-19 PHE.

Appendix D.4 Definition of ED Visits and Observation Stays

Table D.4.1 — Codes Used to Define ED Visits and Observation Stays

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Code (Code Type)	Description	Additional Details
ED Definition		
0450 (Revenue Center Code)	Emergency room-general classification	-
0451 (Revenue Center Code)	Emergency room-EMTALA emergency medical screening services	-
0452 (Revenue Center Code)	Emergency room-ER beyond EMTALA screening	-
0456 (Revenue Center Code)	Emergency room-urgent care	-
0459 (Revenue Center Code)	Emergency room-other	-
0981 (Revenue Center Code)	Professional fees-emergency room	-
Observation Stay Definition		
0762 (Revenue Center Code)	Treatment or observation room-observation room	-
G0378 (HCPCS Code)	Hospital observation service, per hour	-
99217 (CPT® Code)	Hospital observation care on day of discharge	Retired effective 1/1/2023; keep in list until 2027 public reporting
99218 (CPT® Code)	Initial hospital observation care per day, typically 30 minutes	Retired effective 1/1/2023; keep in list until 2027 public reporting
99219 (CPT® Code)	Initial hospital observation care per day, typically 50 minutes	Retired effective 1/1/2023; keep in list until 2027 public reporting
99220 (CPT® Code)	Initial hospital observation care per day, typically 70 minutes	Retired effective 1/1/2023; keep in list until 2027 public reporting
99234 (CPT® Code)	Hospital inpatient or observation care, for the evaluation and management of a patient including admission and discharge on the same date, which requires a medically appropriate history and/or examination and straightforward or low level of medical decision making	-
99235 (CPT® Code)	Hospital inpatient or observation care, for the evaluation and management of a patient including admission and discharge on the same date, which requires a medically appropriate history and/or examination and moderate level of medical decision making	-

Code (Code Type)	Description	Additional Details
99236 (CPT® Code)	Hospital inpatient or observation care, for the evaluation and management of a patient including admission and discharge on the same date, which requires a medically appropriate history and/or examination and high level of medical decision making	-

Appendix E. Planned Readmission Algorithm
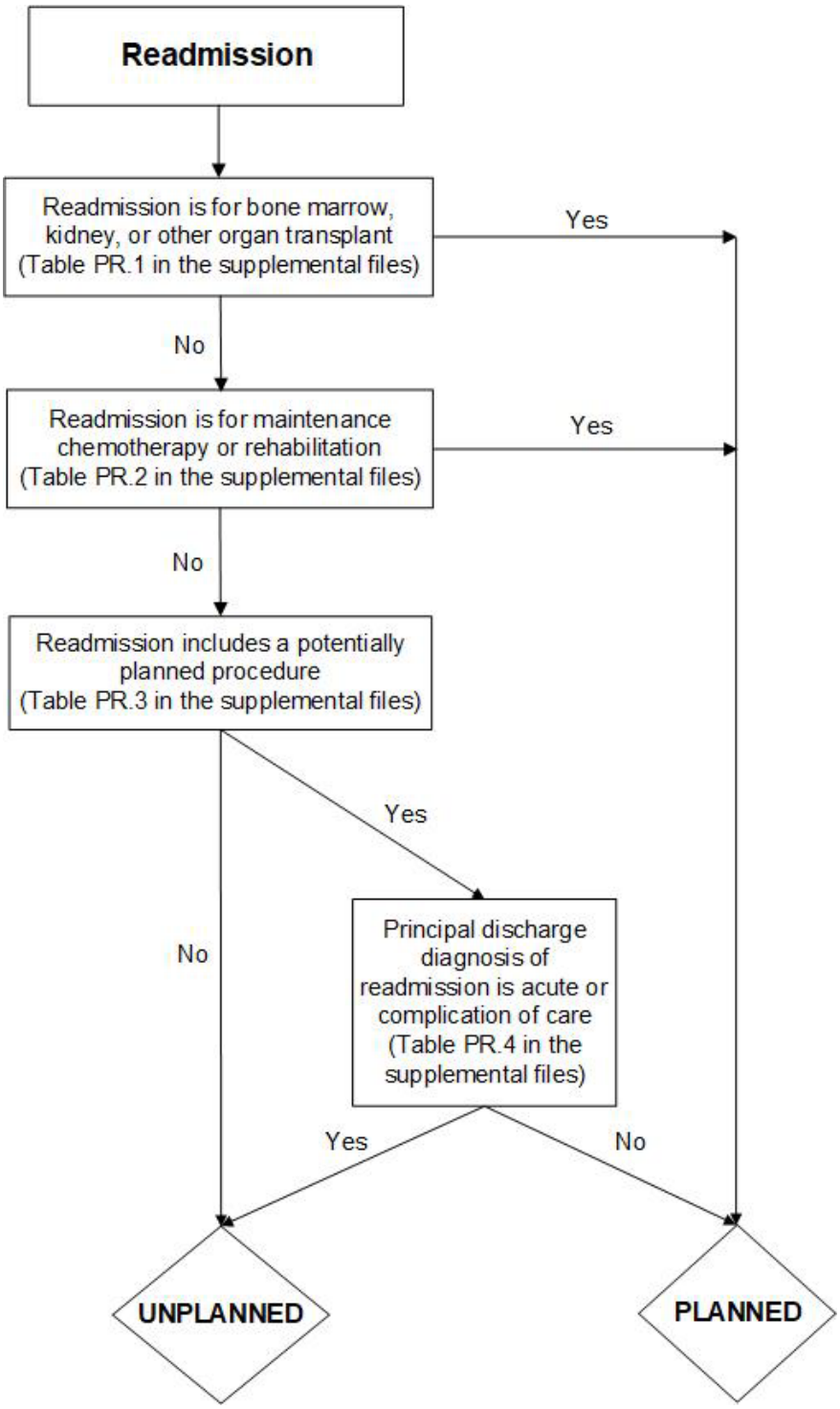
Figure E.1 — Planned Readmission Algorithm Version 4.0 2024 Flowchart