CBE ID

5565

Title

Excess Days in Acute Care (EDAC) After Isolated Coronary Artery Bypass Graft (CABG) Surgery

Project

Cost and Efficiency

Endorsement Status

New

Is Under Review

Yes

Next Maintenance Cycle

Spring 2026

Steward

Centers for Medicare & Medicaid Services

1.0 New or Maintenance

New

1.1 Measure Structure

Single Measure

1.3 Electronic Clinical Quality Measure (eCQM)

No

1.6 Measure Description

The Excess Days in Acute Care (EDAC) After Isolated Coronary Artery Bypass Graft (CABG) Surgery (hereafter “CABG EDAC") measure assesses days spent in acute care within 30 days of discharge from an inpatient hospitalization for an isolated CABG procedure. This measure is intended to capture the quality of care (during and after discharge) for patients undergoing CABG surgery by collectively measuring a set of adverse acute care outcomes that can occur post-discharge: emergency department (ED) visits, observation stays, and unplanned readmissions at any time during the 30 days post-discharge. To aggregate all three events, each event is measured in terms of days. The outcome is adjusted to account for age, sex, and comorbidities, and incorporates exposure time to account for survival times shorter than 30 days (for patients who die within 30 days of discharge). The measure cohort includes admissions for patients who are 65 years or older, are enrolled in Medicare Fee-For-Service (FFS) or Medicare Advantage (MA) and are hospitalized in non-federal short-term acute care hospitals. The final risk-adjusted measure score is based on two years of data and is calculated as the difference (“excess”) between a hospital’s “predicted days” and “expected days,” per 100 discharges.

1.7 Measure Type

Outcome

1.8 Level of Analysis

Facility

1.9 Care Setting

Hospital: Inpatient

1.10 Measure Rationale

The goal of the Excess Days in Acute Care (EDAC) After Isolated Coronary Artery Bypass Graft (CABG) Surgery (hereafter "CABG EDAC") measure is to improve patient outcomes by providing patients, physicians, hospitals, and policymakers with information about hospital-level, risk-standardized all-cause excess days in acute care after hospitalization for an isolated CABG procedure. The CABG EDAC measure captures excess days in acute care within 30 days of discharge from a hospitalization for an isolated CABG by accounting for the number of days a hospital's discharged patients spent in an unplanned inpatient readmission, in an observation stay, or in the emergency department (ED).

In the United States, approximately 400,000 CABG procedures are performed annually with highest usage among individuals aged 65-80 years and costs exceeding $6.5 billion per year (Alexander & Smith, 2016; Mori & Khera, 2020). First-year costs for CABG average $66,599 to $70,552 per patient, with the index hospitalization accounting for $30,800 to $33,474 of total episode payments (VA ROOBY Study Group et al., 2019). Approximately 12.9% to 15% of CABG patients are readmitted within 30 days (Khoury et al., 2019; Patel et al., 2024; Shawon et al., 2021). ED visits without readmission occur at rates similar to readmission rates (11.9% vs 15.0%), and monitoring both outcomes is essential to understanding the full scope of hospital-based acute care needs (Fox et al., 2013). The most common symptoms upon presentation relate to respiratory illness, infection, arrhythmia, heart failure and wound complications. The cost is reported as $13,400 per readmission according to one 2019 study (Shah et al., 2019); another study estimated annual costs to Medicare of more than $250 million related to readmissions after isolated CABG procedures (Khoury et al., 2019).

EDAC measures capture a complete picture of acute-care post-discharge utilization that informs patients and the public about care quality and incentivizes global improvement in transitional care. EDAC measures provide complementary information to CMS's readmission measures. The features of EDAC measures include: 1) capturing all acute-care, hospital-based post-discharge outcomes that matter to patients, such as having to return to the hospital, go to the ED, or spend time in the hospital under observation; 2) capturing utilization in days that can reflect variation in hospital quality; 3) capturing multiple events; for example, some patients have multiple visits in 30 days; and 4) addressing the impact of post-discharge mortality by accounting for time at risk of an event (that is, survival time) (Yale New Haven Health Services Corporation—Center for Outcomes Research and Evaluation, 2015). As such, EDAC measures provide a more comprehensive capture of post-discharge acute care (Wadhera et al., 2021).

The CABG EDAC measure was developed to identify hospitals whose performance is better or

worse than would be expected based on their patient case mix and therefore promote hospital quality improvement and better inform stakeholders about care quality. Measuring and reporting excess days in acute care provides transparency for consumers, and informs healthcare providers about opportunities to improve care, strengthen incentives for quality improvement, and ultimately improve the quality of care (including better inpatient/procedural management, better engagement of patients in the process of self-care, and better peri-discharge care quality) received by Medicare patients (see the CABG EDAC Logic Model in the Supplemental Attachment). As outlined in Section 6.2.1, there are evidence-based interventions that hospitals can implement, including early referral for cardiac rehabilitation (Ogawa et al., 2021) and ensuring early post-discharge clinic follow-up , that meaningfully reduce post-discharge hospital use (Chudgar et al., 2022) In addition, if the CABG EDAC measure is implemented, hospitals will be able to use their hospital-specific measure results to identify specific areas of improvement and implement or develop processes (supported by evidence) that are tailored to their own institution.

Testing for this measure included both Medicare Advantage (MA) and Fee-for-Service (FFS) beneficiaries. Including MA beneficiaries in CMS hospital outcome measures helps ensure that hospital quality is measured across all Medicare beneficiaries and not just the FFS population.

References

Alexander, J. H., & Smith, P. K. (2016). Coronary-artery bypass grafting. *The New England Journal of Medicine*, 374(20), 1954–1964. https://www.nejm.org/doi/10.1056/NEJMra1406944

Chudgar, N. P., Zhu, R., Gray, K. D., Chiu, R., Carrera, A. D., Lang, S. J., Avgerinos, D. V., & Mack, C. A. (2022). Implementing a high-value care discharge protocol in patients undergoing CABG reduces readmission. The Annals of Thoracic Surgery, 113(4), 1112–1118. https://doi.org/10.1016/j.athoracsur.2021.07.036

Fox, J. P., Suter, L. G., Wang, K., Wang, Y., Krumholz, H. M., & Ross, J. S. (2013). Hospital-based, acute care use among patients within 30 days of discharge after coronary artery bypass surgery. The Annals of Thoracic Surgery, 96(1), 96–104. https://doi.org/10.1016/j.athoracsur.2013.03.091

Khoury, H., Sanaiha, Y., Rudasill, S. E., Mardock, A. L., Sareh, S., & Benharash, P. (2019). Readmissions following isolated coronary artery bypass graft surgery in the United States (from the Nationwide Readmissions Database 2010 to 2014). The American Journal of Cardiology, 124(2), 205–210. https://doi.org/10.1016/j.amjcard.2019.04.018

Mori, M., & Khera, R. (2020). Pumping the brakes on health care costs of cardiac surgery by focusing on postacute care spending. Circulation: Cardiovascular Quality and Outcomes, 13(11), e007253. https://doi.org/10.1161/CIRCOUTCOMES.120.007253

Ogawa, M., Satomi-Kobayashi, S., Yoshida, N., Tsuboi, Y., Komaki, K., Wakida, K., Gotake, Y., Izawa, K. P., Sakai, Y., & Okada, K. (2021). Effects of acute-phase multidisciplinary rehabilitation on unplanned readmissions after cardiac surgery. The Journal of Thoracic and Cardiovascular Surgery, 161(5), 1853–1860.e2. https://doi.org/10.1016/j.jtcvs.2019.11.069

Patel, A., Khawaja, S., Dang, T., & Ranasinghe, I. (2024). Incidence, timing and variation in

unplanned readmissions within 30-days following isolated coronary artery bypass grafting. International Journal of Cardiology: Heart & Vasculature, 56, 101552. https://doi.org/10.1016/j.ijcha.2024.101552

Shah, R. M., Zhang, Q., Chatterjee, S., Cheema, F., Loor, G., Lemaire, S. A., Wall, M. J., Jr., Coselli, J. S., Rosengart, T. K., & Ghanta, R. K. (2019). Incidence, cost, and risk factors for readmission after coronary artery bypass grafting. The Annals of Thoracic Surgery, 107(6), 1782–1789. https://doi.org/10.1016/j.athoracsur.2018.10.077

Shawon, M. S. R., Odutola, M., Falster, M. O., & Jorm, L. R. (2021). Patient and hospital factors associated with 30-day readmissions after coronary artery bypass graft (CABG) surgery: A systematic review and meta-analysis. *Journal of Cardiothoracic Surgery, 16*(1), 172. https://doi.org/10.1186/s13019-021-01556-1

VA ROOBY Study Group, Wagner, T. H., Hattler, B., Bakaeen, F. G., Collins, J. F., Almassi, G. H., Quin, J. A., Grover, F. L., Bishawi, M., & Shroyer, A. L. W. (2019). Costs five years after off-pump or on-pump coronary artery bypass surgery. The Annals of Thoracic Surgery, 107(1), 99–105. https://doi.org/10.1016/j.athoracsur.2018.07.075

Wadhera, R. K., Joynt Maddox, K. E., Desai, N. R., Landon, B. E., Md, M. V., Gilstrap, L. G., Shen, C., & Yeh, R. W. (2021). Evaluation of Hospital Performance Using the Excess Days in Acute Care Measure in the Hospital Readmissions Reduction Program. Annals of internal medicine, 174(1), 86–92. https://doi.org/10.7326/M20-3486

Yale New Haven Health Services Corporation—Center for Outcomes Research and Evaluation. (2015). *Excess days in acute care after hospitalization for heart failure* (Version 1.0). https://qualitynet.cms.gov/files/5d0d393d764be766b01032b9?filename=EDAC_MrsMthdRpt_HF.pdf

1.13 Data Dictionary

Attached

1.13a Attach Data Dictionary

5565-1.13a-CABG-EDAC-Data-Dictionary-Spring2026.xlsx

1.14 Numerator

The outcome for the CABG EDAC measure is defined as the number of days a patient spends in acute care (ED treat-and-release visits, observation stays, and unplanned readmissions) for any cause, within 30 days after the date of discharge from an index admission where an isolated CABG procedure has been performed.

1.14a Numerator Details

The outcome for this measure (captured in days, for emergency department (ED) visits, observation stays, and unplanned readmissions) is defined specifically below; all outcomes are captured for 30 days after discharge from the index admission:

- **ED visits**: An ED visit is defined as a visit with revenue center codes '0450', '0451', '0452', '0456', '0459', or '0981'. See the Excel attachment, *CABG EDAC_Data Dictionary.xlsx*, for the code definitions. Each ED visit is counted as one day (1.0 day).
- **Observation stays**: An observation stay is defined as a visit with revenue center code '0762' and a Healthcare Common Procedure Coding System (HCPCS) code 'G0378' (in the hospital outpatient data files) or when a facility claim is not available, Current Procedural Terminology (CPT) codes '99217' to '99220' or '99234' to '99236' (in the professional data files). This broad definition captures all post-discharge observation stays in the facility and professional data files. See the Excel attachment, *CABG EDAC_Data Dictionary.xlsx*, for the code definitions. Observation stays are recorded in terms of hours and rounded up to the nearest integer of days.
- **Readmission**: A readmission is defined as any unplanned admission to an acute care hospital within 30 days of the discharge date for the index hospitalization. "Planned" readmissions, not included in the outcome, are those planned by providers for anticipated medical treatment or procedures that must be provided in the inpatient setting. To exclude planned readmissions, we use CMS's Planned Readmission Algorithm version 4.0 2024 (see additional information below and Figure 1 in the Supplemental Attachment). Readmissions are counted in days and are counted according to the length of stay, calculated as the discharge date minus the admission date, plus one day. Admissions that extend beyond the 30-day follow-up period are truncated on day 30. If a patient is readmitted to the same hospital on the same day of discharge for the same diagnosis as the index admission, the measure considers the patient to have had one single continuous admission. However, if the diagnosis of the readmission is different from the index admission, this is considered a readmission in the measure.
- **Overlapping outcomes**: When an ED visit, observation stay, or readmission overlaps with another event, we count only the most severe of the overlapping events. For example, in the case of an overlapping readmission and observation or ED visit, we count the readmission; if an observation stay and ED visit happen on the same day, we count the observation stay.
- **Multiple events**: We count all eligible outcomes occurring in the 30-day period, 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 day. Similarly, if a patient has two hospitalizations within 30 days, the days spent in each are counted. We take this approach in order to capture the full post-discharge utilization.
- **Transfers**: Admissions associated with transfers between acute care hospitals are included in the CABG EDAC measure. A transfer to another acute care facility after CABG surgery is most likely due to a complication of the CABG procedure or the perioperative care the patient received; and as such, the care provided by the hospital performing the CABG procedure likely dominates readmission risk, even among transferred patients. This is true also for patients that are transferred in from another hospital for their CABG surgery. Therefore, in a series of one or more transfers, the first admission where an eligible CABG procedure was done is included in the cohort, regardless of whether the patient is transferred in or transferred out. Furthermore, the measure assigns an unplanned readmission that occurs within 30 days of discharge to the hospital that performed the first ("index") CABG surgery, even if it is not the discharging hospital. For example, if a patient is admitted to Hospital A and undergoes CABG surgery, and then is transferred to Hospital B, the Hospital A admission would be included in the cohort, and an unplanned readmission within 30 days of discharge from the Hospital B admission would be captured in Hospital A's

readmission outcome.

Planned Readmission Algorithm (Version 4.0)

The planned readmission algorithm (see Figure 1. Planned Readmission Algorithm Version 4.0 2024 Flowchart in the Supplemental Attachment) is a set of criteria for classifying readmissions as planned using Medicare claims and encounters. The algorithm identifies admissions that are typically planned and may occur within 30 days of discharge from the hospital.

The planned readmission algorithm has three fundamental principles:

1. A few specific, limited types of care are always considered planned (transplant surgery, maintenance chemotherapy/ immunotherapy, rehabilitation);
2. Otherwise, a planned readmission is defined as a non-acute readmission for a scheduled procedure; and,
3. Admissions for acute illness or complications of care are never planned.

The algorithm was developed in 2011 as part of the Hospital-Wide Readmission measure. In 2013, CMS applied the algorithm to its other readmission measures.

Please see *CABG EDAC Risk Variable Complications of Care* tab in the Excel file entitled *CABG EDAC_Data Dictionary.xlsx* for the list of potential complications referred to in Step 3 of the planned readmission algorithm.

1.15 Denominator

The target population for the CABG EDAC cohort is defined as patients aged 65 years or older undergoing a qualifying isolated CABG surgery,* who were enrolled in Medicare Fee-for-Service (FFS) or Medicare Advantage (MA) for the 12 months prior to and during the index admission, discharged alive from a non-federal short-term acute care hospital, and not transferred to another acute care facility.*A qualifying isolated CABG procedure is defined as CABG procedures performed without the following concomitant valve or other major cardiac, vascular, or thoracic procedures: valve procedures; atrial and/or ventricular septal defects; congenital anomalies; other open cardiac procedures; heart transplants; aorta or other non-cardiac arterial bypass procedures; head, neck, or intracranial vascular procedures; other chest and thoracic procedures

1.15a Denominator Details

The CABG EDAC measure includes index admissions for patients who meet all the following criteria:

- **Having a qualifying isolated CABG procedure during the index admission**
  - *Rationale*: Isolated CABG surgery is the procedure targeted for measurement. Isolated CABG procedures are defined as those procedures performed without concomitant valve or other major cardiac, vascular, or thoracic procedures, because they represent a population of patients with higher risk. These procedure groups include:
    - valve procedures;
    - atrial and/or ventricular septal defects;

        - congenital anomalies;
        - other open cardiac procedures;
        - heart transplants;
        - aorta or other non-cardiac arterial bypass procedures;
        - head, neck, or intracranial vascular procedures; and
        - other chest and thoracic procedures.
- **Enrolled in Medicare (FFS or MA) for the 12 months prior to the date of admission and during the index admission**
    - *Rationale*: The 12-month 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.
- **Aged 65 or over**
    - *Rationale*: Patients younger than 65 are not included in the measure because they are considered clinically distinct from patients 65 or over.
- **Discharged alive from a non-federal short-term acute care hospital**
    - *Rationale*: It is only possible for patients to experience the outcome if they are discharged alive.

Figure 2 (in the Supplemental Attachment) shows the final CABG cohort with the inclusions and exclusions applied.

1.15b Denominator Exclusions

This measure excludes index admissions for patients who meet any of the following criteria:

- Without at least 30 days of post-discharge enrollment in Medicare FFS or MA
- Discharged against medical advice (AMA)
- Admissions for subsequent qualifying CABG procedures during the measurement period

1.15c Denominator Exclusions Details

This measure excludes index admissions for patients who meet any of the following exclusion criteria:

- **Without at least 30 days of post-discharge enrollment in Medicare FFS or MA**
    - *Rationale*: 30-day outcomes cannot be assessed in this group since claims/encounter data are used to determine whether a patient experienced post-discharge acute care.
- **Discharged against medical advice (AMA)**
    - *Rationale*: Providers did not have the opportunity to deliver full care and prepare the patient for discharge.
- **Admissions for subsequent qualifying CABG procedures during the measurement period**
    - *Rationale*: CABG procedures are expected to last for several years without the need for revision or repeat revascularization. A repeat CABG procedure during the measurement period likely represents a complication of the original CABG procedure

and is a clinically more complex and higher risk surgery. Therefore, we select the first CABG surgery admission for inclusion in the measure and exclude subsequent CABG surgery admissions from the cohort.

1.15d Age Group

Older Adults (65 years and older)

1.16 Type of Score

Rate/proportion

1.17 Measure Score Interpretation

Better performance = Lower score

1.18 Calculation of Measure Score

The steps in measure calculation are as follows:

- **Define the cohort** (the index admissions that will be counted in the measure)
  - **Apply inclusion criteria (see Section 1.15a for details)**
  - **Apply exclusion criteria (see Section 1.15b and 1.15c for details)**
- **Apply the predictive model** and calculate the "predicted" and "expected" values for each hospital.
  - **Apply planned readmission algorithm (see Section 1.14a for details).**
  - **Sum the predicted days for each patient at each hospital**

    Using the predictive model including the model's risk variables (see excel attachment *CABG EDAC_Data Dictionary.xlsx*), sum the predicted days in acute care within 30-days after discharge for each admission at the hospital level.

    The risk-adjustment model is a hierarchical generalized linear model. This consists of a binomial model specified for days in acute care as a proportion of the number of exposure days (alive days up to 30 days post-discharge) and includes random effects for hospitals. This accounts for the within-hospital correlation of the observed outcome and accommodates the assumption that underlying differences in quality across hospitals lead to systematic differences in outcomes. Please see the Measure Score Calculation EDAC Attachment for details.

  - **Calculate the expected days for an average-performing hospital with the same case mix.**

    Expected days is the sum across all patients of the model-predicted number of days that would have been expected if the patients were discharged from an average-performing hospital, after adjusting for patient case mix.

- **Calculate the hospital measure score ("excess" days per 100 discharges)**

For each hospital, subtract the summed expected days from the predicted days. Then to make the results comparable across hospitals, divide by the total number of qualifying admissions (the cohort) for that hospital, and multiply by 100 (to ease in interpretability). A negative score indicates fewer days in acute care than expected (better performance), while a positive score indicates more days in acute care than expected.

1.18a Attach measure score calculation diagram

5565-1.18a-CABG-Measure-Score-Calculation-EDAC-Spring2026.pdf

1.19 Measure Stratification Details

This measure is not stratified.

1.20 Types of Data Sources

Administrative Data, Claims Data

1.21a Data Collection Tool URL(s)

http://example.com

1.25 Data Source Details

Medicare Fee-for-Service (FFS) claims and Medicare Advantage (MA) encounters, in addition to Medicare administrative data, are used to derive all components of the measure.

MA claims data quality has improved, and it is increasingly being used for quality measurement. Its addition to quality measures captures a broader group of patients, increases the precision of measurement, and increases the number of hospitals that can be included in measurement (Kyanko et al., 2024). MA data has recently been included within three quality measures related to the CABG EDAC measures that were recently newly endorsed or re-endorsed by the Consensus-Based Entity (CBE) Cost & Efficiency Recommendation Group, after considering the addition of MA admissions. Those measures include: hybrid Hospital-Wide Readmission [hHWR] (CBE 2879e) re-endorsed in Fall 2024, AMI EDAC (CBE 2881) re-endorsed in Spring 2025, and Sepsis Readmission (CBE 5275) newly endorsed in Fall 2025. The details of how MA claims are identified for this measure are described in more detail below.

The hospital inpatient claims, outpatient claims, professional claims, and durable medical equipment (DME) claims can be identified using the claim types in the table below. Notably, most MA beneficiary inpatient admissions have two claim submission sources: hospital-submitted claims and Medicare Advantage Organization (MAO)-submitted encounter claims. Both types of claims are information-only (i.e., not billing) that include items and services provided. CMS requires MAOs and hospitals that receive disproportionate-share hospital or medical education payments from Medicare to submit information-only claims for inpatient stays for MA beneficiaries. We use both sources for cohort and outcome derivation.

Medicare FFS and Advantage Claim Type Codes

Type of Claim	FFS	Hospital-submitted MA	MAO-submitted (Encounter) MA
Inpatient	60	62, 63, 64	4011, 4041
Outpatient Facility	40	-	4012 – 4014, 4022, 4023, 4034, 4043, 4071 – 4077, 4079, 4083, 4085, 4089
Professional	71, 72	-	4700
DME	81, 82	-	4800

There are benefits to using both inpatient claims sources for MA beneficiaries for the broadest and most timely capture of MA claims. First, not all hospitals are required to submit claims for MA beneficiaries (i.e., hospitals that do not receive disproportionate-share hospital or medical education payments from Medicare), and using only hospital-submitted data would miss capture of these claims. All hospitals submit inpatient claims for MA beneficiaries to MAO, and therefore MAO-submitted claims capture these additional admissions not found in the hospital-submitted claims. However, relying solely on MAO-submitted claims poses three challenges: 1) MAO-submitted claims are not as timely as hospital-submitted claims, which is disadvantageous for reporting deadlines for CMS hospital outcome measures; 2) in measure testing, a small proportion of MA admissions were only found in the hospital-submitted claims; and 3) MAO-submitted claims identify hospitals using a National Provider Identifier (NPI), whereas hospital-submitted claims are already associated with a CMS Certification Number (CCN) used to identify hospitals in the CMS outcome measures.

As a result, if an MA admission was found in both datasets, we used the claim found in the hospital-submitted data. For the small portion of MA admissions with only MAO-submitted claims, we obtained the CCN with Integrated Data Repository provider history data, using the NPI, claim discharge date, provider history begin (effective) date, and provider history end (obsolete) date.

Because it is expected that this CABG EDAC measure would be implemented by CMS for public reporting in the Hospital Inpatient Quality Reporting (IQR) program, which is limited to short-term acute care hospitals and critical access hospitals, we used the CCN taxonomy to further restrict the claims to those filed by acute care hospitals (3rd and 4th digit as ‘01’) and critical access hospitals (3rd and 4th digit as ‘13’).

References

Kyanko, K., Sahay, K. M., Wang, Y., Li, S. X., Schreiber, M., Hager, M., Myers, R., Johnson, W., Zhang, J., Krumholz, H., Suter, L. G., & Triche, E. W. (2024). Incorporating Medicare Advantage admissions into the CMS hospital-wide readmission measure. *JAMA Network Open, 7*(6), e2414431.

1.26 Minimum Sample Size

The measure does not have a minimum sample size.

2.1 Attach Logic Model

5565-SupplementalAttachment-Spring2026.pdf

2.2 Evidence of Measure Importance

Coronary artery bypass grafting (CABG) surgery is a major intervention for individuals with complex coronary artery disease, and while it is often lifesaving, the post-discharge period is associated with substantial risk of complications and acute care use. After CABG surgery individuals are at risk of infection, arrhythmia, adverse drug reactions, and heart failure flare-ups (Shawon, 2021), which might lead to unscheduled readmissions, ED visits, or observation stays. There is considerable variation in CABG readmission rates suggesting that there is room for quality improvement; notably, a study of thirty-day readmission rates among Medicare patients discharged after CABG hospitalization showed a range of 12.6% to 23.6% across hospitals, with a median rate of 16.8%. (Shahian, 2014). ED visits also are shown to occur at a high rate post CABG with rates up to 14% reported within 30 days (Fox et al., 2013). Prior studies have shown that 30-day readmission following CABG is substantially correlated with both hospital-level and patient-level characteristics, according to a systematic review and meta-analysis by Shawon et al. (2021). Many of these causes were found to be preventable with better discharge planning and follow-up care. These acute care encounters put a significant strain on the healthcare system in addition to interfering with recovery.

By capturing the entire range of acute care utilization within 30 days following discharge, including ED visits and observation stays in addition to readmissions, the CABG EDAC measure overcomes the limitations of traditional readmission metrics. In this way, the CABG EDAC measure bridges the measurement gap of not accounting for all post-discharge inpatient utilization. In addition to supporting more focused quality improvement initiatives, this broad, risk-adjusted outcome offers a more thorough view of hospital performance during the post-discharge phase. By accounting for patient attributes including age, sex, comorbidities, and exposure duration, this measure supports equitable comparisons between populations and hospitals. Importantly, the CABG EDAC measure reflects the frequency and severity of acute care after discharge, providing data to inform more general objectives of increasing continuity of care, reducing fragmentation, and strengthening value-based care.

Guidelines for best practice provide direction for hospitals that can lower the number of acute care days after CABG by implementing specific structural and procedural changes. For coronary artery revascularization, the 2021 American College of Cardiology (ACC)/American Heart Association (AHA)/Society for Cardiovascular Angiography and Interventions (SCAI) guidelines highlight the value of patient-centered care, which includes multidisciplinary team coordination, post-discharge care planning, and shared decision-making (Lawton et al., 2022). To avoid difficulties during recovery, the 2024 European Association for Cardio-Thoracic Surgery (EACTS) guidelines also suggest early outpatient care and consistent perioperative drug regimens (Jeppsson et al., 2024). Furthermore, early referral for cardiac rehabilitation (Ogawa et al., 2021) and ensuring early post-discharge clinic follow-up, meaningfully reduce post-discharge hospital use (Chudgar et al., 2022). Hospitals that put these recommendations into practice will be in a better position to cut down on unnecessary acute care days, especially if they have specialized cardiac care teams, case management systems, and easy interaction with outpatient doctors. Please see section 6.2.1 for additional details about the evidence base on interventions to improve outcomes.

Studies have underscored the role of remote monitoring and digital follow-up platforms in

reducing post-CABG acute care use. Patients who were discharged following surgery and who received virtual care and remote automated monitoring had lower rates of acute hospital utilization than those who received standard care, as well as better detection of medication errors and earlier intervention, according to the PVC-RAM-1 randomized controlled trial (McGillion et al., 2021). Similar to this, Lobdell et al. (2023) detailed a paradigm change in post-cardiac surgery treatment through remote monitoring, which enhanced adherence to care regimens and allowed for earlier detection of complications amenable to ambulatory care such as arrhythmia, surgical site pain, and superficial infections, as well as clinical deterioration. These results provide credence to the inclusion of telehealth platforms and mobile health tools connected to multidisciplinary structures of care equipped to respond to these tools in discharge procedures, particularly for high-risk patients who have little access to in-person treatment.

Contextually informed education and patient engagement are equally important. Mobile health applications combining education and patient engagement greatly enhanced medication adherence and clinical outcomes for patients with coronary heart disease, including those recovering from CABG, according to a systematic study by Zhu et al. (2024). More treatment adherence and fewer complications have been associated with structured discharge education on wound care, medication use, and symptom awareness, as well as explicit directions for follow-up consultations (Akbari & Celik, 2015). According to Rahpeima et al. (2022), interdisciplinary discharge planning greatly decreased readmissions after cardiac procedures and enhanced patient adherence. Additionally, it has been demonstrated that pharmacist-led medication reconciliation at discharge lowers medication mistakes, which are a significant cause of problems following CABG (Pereira et al., 2017).

Hospitals that engage in ongoing data review and root cause analysis are better equipped to identify care gaps and refine interventions. Hospitals can prioritize providing enhanced transitional care to patients who are most at risk for post-discharge problems by using proven tools from the Society of Thoracic Surgeons (STS) risk models (Shahian et al., 2018). This type of risk stratification allows hospitals to tailor programs and surveillance intensity to the risk attributed to individuals. Joining the STS Adult Cardiac Surgery Database also makes it easier to obtain information for quality improvement and benchmark performance. Mejia et al. (2024) showed in a statewide intervention that data-driven coaching and staff training enhanced clinician involvement in QI procedures and standardized treatment protocols, thereby improving CABG outcomes. In cardiac surgery, these initiatives are in line with larger initiatives to foster accountability and lessen variability in care transitions.

The cumulative effect of these interventions is reflected in improved care coordination, reduced acute care utilization, and better patient outcomes. According to Becker et al. (2021), communication-focused discharge treatments increased patient satisfaction and decreased readmission rates. Reduced ED visits and observation stays have been associated with improved outpatient follow-up, especially when accompanied by telehealth and remote monitoring (McGillion et al., 2021; Lobdell et al., 2023). Better integration between hospital and outpatient care, longer-lasting decreases in acute care utilization, and enhanced performance on publicly available quality metrics like the Hospital Readmissions Reduction Program (HRRP) are all results of enhanced discharge procedures and patient engagement strategies.

In addition to clinical gains, the CABG EDAC measure supports health system-level impacts. According to cost-effectiveness studies, CABG prevents expensive complications and recurrent

hospitalizations related to symptomatic coronary artery disease and heart failure, which results in positive returns on investment when combined with evidence-based post-discharge therapies (Chew et al., 2022). In order to enable a thorough assessment of hospital performance and ensure the benefits of CABG procedures to both patients and hospitals, quality assessment approaches for CABG have emphasized the significance of adding outcome indicators such as EDAC (Li et al., 2022). Studies show that when recovery is easy and supported, patients' health-related quality of life and satisfaction with care improve (Hämäläinen et al., 2023; Lie et al., 2012). The clinical and experiential aspects of care transitions must be addressed by hospitals, according to these studies. There is substantial evidence supporting the CABG EDAC measure, showing that extra days spent in acute care are a significant, controllable, and actionable consequence. This measure is essential for enhancing the safety, effectiveness, and person-centeredness of post-CABG care because of variation in hospital performance, the accessibility of evidence-based treatments, and the alignment with national policy aims.

The measure's importance is underscored by the outcome window, which assesses eligible outcomes within a 30-day period from the date of discharge from an index hospitalization. We considered 30 days as a clinically reasonable timeframe because (1) within a 30-day timeframe, ED visits, observation stays, and readmissions are more likely attributable to the care received during the index admission and during hospital discharge than outcomes occurring later post-discharge, and (2) the 30-day timeframe is consistent with CMS's existing, publicly reported, Consensus-Based Entity-endorsed 30-day readmission measures. Empirical evidence from this measure submission supports attributing the 30-day outcome to the discharging hospital, both in terms of the timing and volume of post-discharge acute care use relative to the index admission, and the clinical relatedness of the readmission, as the most common principal discharge diagnoses are clinically associated with the index hospitalization.

There is both a quality gap and a measurement gap for post-discharge outcomes for patients hospitalized for CABG. The quality gap is illustrated by variation at the hospital level in risk-standardized post-discharge acute care utilization for patients hospitalized for a CABG procedure (see section 2.4, Performance Gap); a hospital at the 10th percentile (better performance) has -34.3 excess days in acute care per 100 discharges, whereas a hospital at the 90th percentile (worse performance) has 47.8 excess days in acute care per 100 discharges. In terms of a measurement gap, while there is a CABG readmission measure in CMS's HRRP, there are no outcome measures in any federal programs that comprehensively address all post-discharge utilization for patients hospitalized for CABG (that is, include the outcomes of ED visits and observation stays, in addition to inpatient admissions). Therefore, this CABG EDAC measure provides information and transparency to consumers, policy makers, and hospitals, to allow them to better understand and care for this population of Medicare beneficiaries.

The evidence above, including the burden of CABG post-discharge care, variation in hospital performance, and the existence of effective interventions demonstrate the importance and value of the hospital-level quality measure for post-discharge acute care. Hospitals taking these steps, while using the CABG EDAC measure outcome, can provide safer, more efficient, and patient-centered care by incorporating evidence-based structural and procedural improvements into a validated outcome measure.

References

Akbari, M., & Celik, S. S. (2015). The effects of discharge training and counseling on post-discharge problems in patients undergoing coronary artery bypass graft surgery. *Iranian Journal of Nursing and Midwifery Research, 20*(4), 442–449. https://doi.org/10.4103/1735-9066.161007

Becker, C., Zumbrunn, S., Beck, K., Vincent, A., Loretz, N., Müller, J., Amacher, S. A., Schaefert, R., & Hunziker, S. (2021). Interventions to improve communication at hospital discharge and rates of readmission: A systematic review and meta-analysis. *JAMA Network Open, 4*(8), e2119346. https://doi.org/10.1001/jamanetworkopen.2021.19346

Chew, D. S., Cowper, P. A., Al-Khalidi, H., Anstrom, K. J., Daniels, M. R., Davidson-Ray, L., Li, Y., Michler, R. E., Panza, J. A., Piña, I. L., Rouleau, J. L., Velazquez, E. J., & Mark, D. B. (2022). Cost-effectiveness of coronary artery bypass surgery versus medicine in ischemic cardiomyopathy: The STICH randomized clinical trial. *Circulation, 145*(11), 819–828. https://doi.org/10.1161/CIRCULATIONAHA.121.056276

Chudgar, N. P., Zhu, R., Gray, K. D., Chiu, R., Carrera, A. D., Lang, S. J., Avgerinos, D. V., & Mack, C. A. (2022). Implementing a high-value care discharge protocol in patients undergoing CABG reduces readmission. *The Annals of Thoracic Surgery*, 113(4), 1112–1118. https://doi.org/10.1016/j.athoracsur.2021.07.036

Fox, J. P., Suter, L. G., Wang, K., Wang, Y., Krumholz, H. M., & Ross, J. S. (2013). Hospital-based, acute care use among patients within 30 days of discharge after coronary artery bypass surgery. *The Annals of Thoracic Surgery, 96*(1), 96–104. https://doi.org/10.1016/j.athoracsur.2013.03.091

Hämäläinen, L., Kohonen, M., & Laurikka, J. (2023). Health-related quality of life is improved after coronary artery bypass graft surgery: A 1-year follow-up study. *Scandinavian Cardiovascular Journal, 57*(1), 2284083. https://doi.org/10.1080/14017431.2023.2284083

Jeppsson, A., Rocca, B., Hansson, E. C., Gudbjartsson, T., James, S., Kaski, J. K., Landmesser, U., Landoni, G., Magro, P., Pan, E., Ravn, H. B., Sandner, S., Sandoval, E., Sousa Uva, M., Milojevic, M., & EACTS Scientific Document Group. (2024). 2024 EACTS guidelines on perioperative medication in adult cardiac surgery. *European Journal of Cardio-Thoracic Surgery*. https://doi.org/10.1093/ejcts/ezae355

Lawton, J. S., Tamis-Holland, J. E., Bangalore, S., Bates, E. R., Beckie, T. M., Bischoff, J. M., Bittl, J. A., Cohen, M. G., DiMaio, J. M., Don, C. W., Fremes, S. E., Gaudino, M. F., Goldberger, Z. D., Grant, M. C., Jaswal, J. B., Kurlansky, P. A., Mehran, R., Metkus, T. S., Nnacheta, L. C., … Zwischenberger, B. A. (2022). 2021 ACC/AHA/SCAI guideline for coronary artery revascularization: A report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. Journal of the American College of Cardiology, 79(2), e21–e129. https://doi.org/10.1016/j.jacc.2021.09.006

Li, Z., Shirakawa, N., Chen, A., Ji, F. H., & Liu, H. (2022). Methodology in coronary artery bypass surgery quality assessment. *Journal of Geriatric Cardiology, 19*(11), 867–875. https://doi.org/10.11909/j.issn.1671-5411.2022.11.006

Lie, I., Bunch, E. H., Smeby, N. A., Arnesen, H., & Hamilton, G. (2012). Patients' experiences with symptoms and needs in the early rehabilitation phase after coronary artery bypass grafting. *European Journal of Cardiovascular Nursing, 11*(1), 14–24. https://doi.org/10.1016/j.ejcnurse.2010.09.004

Lobdell, K. W., Crotwell, S., Watts, L. T., LeNoir, B., Frederick, J., Skipper, E. R., Russell, G. B., Habib, R., Maxey, T., & Rose, G. A. (2023). Remote monitoring following adult cardiac surgery: A paradigm shift? *JTCVS Open, 15*, 300–310. https://doi.org/10.1016/j.xjon.2023.07.003

McGillion, M. H., Parlow, J., Borges, F. K., Marcucci, M., Jacka, M., Adili, A., & Sessler, D. I. (2021). Post-discharge after surgery virtual care with remote automated monitoring-1 (PVC-RAM-1) technology versus standard care: Randomised controlled trial. *BMJ, 374*, n2209. https://doi.org/10.1136/bmj.n2209

Mejia, O. A. V., Borgomoni, G. B., de Freitas, F. L., Furlán, L. S., Orlandi, B. M. M., Tiveron, M. G., Silva, P. G. M. B. E., Nakazone, M. A., Oliveira, M. A. P., Campagnucci, V. P., Normand, S. L., Dias, R. D., Jatene, F. B., & REPLICCAR Study Group. (2024). Data-driven coaching to improve statewide outcomes in CABG: Before and after interventional study. International Journal of Surgery, 110(5), 2535–2544. https://doi.org/10.1097/JS9.0000000000001153

Ogawa, M., Satomi-Kobayashi, S., Yoshida, N., Tsuboi, Y., Komaki, K., Wakida, K., Gotake, Y., Izawa, K. P., Sakai, Y., & Okada, K. (2021). Effects of acute-phase multidisciplinary rehabilitation on unplanned readmissions after cardiac surgery. The Journal of Thoracic and Cardiovascular Surgery, 161(5), 1853–1860.e2. https://doi.org/10.1016/j.jtcvs.2019.11.069

Pereira, P., Kapoor, A., Sinha, A., Agarwal, S. K., Pande, S., Khanna, R., Srivastava, N., Kumar, S., Garg, N., Tewari, S., & Goel, P. (2017). Do practice gaps exist in evidence-based medication prescription at hospital discharge in patients undergoing coronary artery bypass surgery & coronary angioplasty? *Indian Journal of Medical Research, 146*(6), 722–729. https://doi.org/10.4103/ijmr.IJMR_1905_15

Rahpeima, E., Bijani, M., Karimi, S., Alkamel, A., & Dehghan, A. (2022). Effect of the implementation of interdisciplinary discharge planning on treatment adherence and readmission in patients undergoing coronary artery angioplasty. *Investigación y Educación en Enfermería, 40*(2), e08. https://doi.org/10.17533/udea.iee.v40n2e08

Shahian, D. M., He, X., O'Brien, S. M., Grover, F. L., Jacobs, J. P., Edwards, F. H., Welke, K. F., Suter, L. G., Drye, E., Shewan, C. M., Han, L., & Peterson, E. (2014). Development of a clinical registry-based 30-day readmission measure for coronary artery bypass grafting surgery. *Circulation*, *130*(5), 399–409. https://doi.org/10.1161/CIRCULATIONAHA.113.007541

Shahian, D. M., Jacobs, J. P., Badhwar, V., D'Agostino, R. S., Bavaria, J. E., Prager, R. L., Kurlansky, P. A., Furnary, A. P., Rankin, J. S., Filardo, G., & Edwards, F. H. (2018). The Society of Thoracic Surgeons 2018 adult cardiac surgery risk models: Part 1—Background, design considerations, and model development. *The Annals of Thoracic Surgery, 105*(5), 1411–1418. https://doi.org/10.1016/j.athoracsur.2018.03.002

Shawon, M. S. R., Odutola, M., Falster, M. O., & Jorm, L. R. (2021). Patient and hospital factors

associated with 30-day readmissions after coronary artery bypass graft (CABG) surgery: A systematic review and meta-analysis. *Journal of Cardiothoracic Surgery, 16*(1), 172. https://doi.org/10.1186/s13019-021-01556-1

Zhu, Y., Zhao, Y., & Wu, Y. (2024). Effectiveness of mobile health applications on clinical outcomes and health behaviors in patients with coronary heart disease: A systematic review and meta-analysis. *International Journal of Nursing Sciences, 11*(2), 258–275. https://doi.org/10.1016/j.ijnss.2024.03.012

2.3 Anticipated Impact

As noted above in Section 2.2, CABG is a common and costly procedure, associated with high healthcare utilization, including post-procedural acute care. Because there are existing evidence-based standards of care designed for patients undergoing a CABG procedure, and because there is variation in care and outcomes, we anticipate that a CABG EDAC measure will support hospital efforts to optimize the quality of care for patients undergoing isolated CABG, with a concomitant reduction in post-discharge, hospital-based acute care (please see the CABG EDAC Logic Model in the Supplemental Attachment). Because this measure identifies a comprehensive picture of post-discharge acute care (including unplanned readmission, ED visits, and observation stays), and if implemented, supplementary reports will provide hospitals with patient-level details including the reason (principal discharge diagnosis) for the hospital visit, this measure can help hospitals identify areas of focus for their quality improvement efforts. The measure will also provide information to consumers about hospital-level variation in a more comprehensive capture of post-discharge acute care utilization. Please see the CABG EDAC Logic Model in the Supplemental Attachment for details on activities, outputs, outcomes, and impact expected as a result of the implementation of the CABG EDAC quality measure.

As described in the logic model, anticipated short- and long-term outcomes impacted by this measure include improvements in clinical, patient-experience-related, and economic outcomes. For example, early referral to cardiac rehabilitation results in better functional status post-discharge. This, in turn, leads to increased adherence to follow-up and engagement with care teams, all of which improve long-term quality of life and cardiovascular outcomes.

For hospitals, there is no associated cost for reporting the measure, because it is calculated by CMS directly from claims. The costs of interventions to improve outcomes will vary by hospital based on their existing infrastructure, and the specific structure/process gaps that underlie their performance on the CABG EDAC measure. Implementing an evidence-based quality improvement effort has many benefits, including short and long-term clinical benefits (that may have spill-over effects to other conditions), direct and indirect impact on patients (impacting physical and mental health, finances, employment, and larger impacts on the family), as well as short- and long-term financial impacts on the hospital itself.

While a formal economic analysis is outside the scope of a developer's resources, we estimate that if all patients hospitalized for a CABG procedure in the cohort were seen at a hospital that performed at the mean of the best performing (1st) decile of performance on the CABG EDAC measure (see Table 1), this would avoid about 64,000 days in acute care. Taking into account an estimated average cost of post-discharge hospital stay per day of roughly $3,000 (Kaiser Family

Foundation, 2024), and an estimated average intervention cost of about $500 per admission (Hirschman et al. 2015; Transitional Care Model, 2018), we estimate that across all admissions there would be substantial net economic direct short-term savings (approximately $118 million per performance period). While this cost savings scenario assumes that all hospitals could meet measure performance at the mean for hospitals in the best-performing (1st) decile, and is based on rough cost estimates, the magnitude of potential savings suggests a true net economic benefit even if a smaller proportion of hospitals can shift to a better-performing decile (reduce post-discharge acute care utilization). In addition, this estimate does not include any long-term or indirect costs, nor does it reflect post-discharge short- and long-term clinical benefits of improved care spill-over effects to other patients, and economic benefits to the patients themselves (see the CABG EDAC Logic Model in the Supplemental Attachment for more details). It also, however, does not account for the likely shifting of services to the outpatient setting (which is the desired outcome).

No actual unintended consequences have been identified because this measure has not yet been implemented. Potential unintended consequences are discussed in Section 6.2.5a.

References

Transitional Care Model. (2018). EvidenceBasedPrograms.org. https://evidencebasedprograms.org/programs/transitional-care-model/

Hirschman, K. B., Shaid, E., McCauley, K., Pauly, M. V., & Naylor, M. D. (2015). Continuity of care: The transitional care model. *Online Journal of Issues in Nursing, 20*(3), 1.

Kaiser Family Foundation. (2024). *Hospital adjusted expenses per inpatient day.*https://www.kff.org/health-costs/state-indicator/expenses-per-inpatient-day/

2.4 Performance Gap

Table 1 and Figure 3 (in the Supplemental Attachment) show that there is meaningful variation in the distribution of measure scores (Excess Days in Acute Care per 100 discharges) using the most recent testing data (January 1, 2022 - December 31, 2023).

Because the measure score (see Section 1.18) is calculated as the difference between the predicted days (sum, across all admissions at any one hospital) and expected days (what would be expected for the average hospital with the same patient case mix), a hospital performing better than expected will have a negative measure score, a hospital performing as expected will have a measure score of zero, and a hospital performing worse than expected will have a positive measure score.

Table 1. Performance Scores by Decile

	Overall	Min	Decile 1	Decile 2	Decile 3	Decile 4	Decile 5	Decile 6	Decile 7	Decile 8	Decile 9	Decile 10	Max
Mean Performance Score	**6.5**	**-132.8**	**-49.6**	**-28.0**	**-19.0**	**-11.3**	**-4.4**	**2.6**	**11.9**	**22.6**	**37.4**	**102.7**	**921.0**
N of Entities	**1,114**	**1**	**111**	**111**	**112**	**111**	**112**	**111**	**112**	**111**	**112**	**111**	**1**
N of Persons / Encounters / Episodes	**148,701**	**1**	**9,545**	**16,856**	**17,024**	**13,938**	**18,748**	**18,705**	**18,791**	**15,435**	**12,149**	**7,510**	**1**

As shown in Table 1a, CABG EDAC measure scores (excess days per 100 discharges) range from -132.8 to 921.0; the median is -1.3; the 10th percentile is -34.3 and the 90th percentile is 47.8. A hospital at the 10th percentile has about 82 fewer excess days per 100 discharges compared with a hospital performing at the 90th percentile.

Table 1a. CABG EDAC: Hospital Distribution of Risk-Adjusted Measure Scores per 100 Discharges, January 1, 2022 – December 31, 2023 (N=1,114)

Category	Value
Number of Hospitals	1,114
Mean (SD)	6.5 (52.4)
Range (min. to max.)	-132.8 to 921.0
10th Percentile	-34.3
25th Percentile	-19.2
50th Percentile	-1.3
75th Percentile	22.2
90th Percentile	47.8

2.5 Health Care Quality Landscape

The CABG EDAC measure joins a group of EDAC measures that address specific conditions and procedures. The CABG EDAC measure is unique in the following aspects:

- The CABG EDAC measure addresses a target population that is not captured by other implemented or new EDAC measures. This measure captures the full spectrum of post-discharge utilization (readmission/ED visit/observation stay) for this specific population of people hospitalized for a CABG procedure.
- While overlapping in cohort and part of the outcome with the existing CABG readmission measure, and overlapping with part of the cohort and part of the outcome for the hybrid Hospital Wide Readmission (hHWR) measure, the CABG EDAC measure:
    - Has a more comprehensive outcome (it includes ED visits and observation stays, in addition to readmission) and accounts for the total length of stay

- Accounts for post-discharge time at risk for the outcome
- Allows for assessment of risk-adjusted post-discharge hospital visits specifically for isolated CABG.

By capturing a range of utilization outcomes that are important to patients, this measure can produce a complete picture of post-discharge outcomes that inform the public about care quality and incentivize global improvement in transitional care.

2.6 Meaningfulness to Target Population

Acute care utilization after discharge (that is, return to the ED, observation stay, and readmission) for any reason, is disruptive to patients and caregivers, costly to the healthcare system, and puts patients at additional risk of hospital-acquired infections and complications. Although some hospital returns are unavoidable, others may result from poor quality of care or inadequate transitional care.

When CORE interviewed patients and caregivers for an EDAC Technical Expert Panel (TEP), patients and caregivers shared their stories of frustration, confusion, and suffering, as they or their loved ones faced unexpected returns to the hospital after discharge. In our interviews, they shared experiences such as return to the hospital following exacerbation of a condition caused by changes in medication after discharge, returns to the hospital due to infection after an inpatient procedure, and other signs of poor coordination of care including insufficient communication from providers and hospital staff. As part of assessing face validity (discussed further in sections 5.3.3 and 5.3.4), four patient and caregiver TEP members participated in the face validity vote on the CABG EDAC measure, with all agreeing that the measure as specified is meaningful and produces information that is valuable in making care decisions. The strong agreement among members indicates that the measure is meaningful and valued.

3.1 Contributions Towards Closing Care Gaps

This domain is optional for the Spring 2026 cycle.

4.1a Data Structure and Availability

This is a claims-based measure, and all data elements are in structured fields that are available in electronic sources.

CMS monitors feedback from the public and measured entities and there have been no concerns about feasibility or burden related to the currently implemented related measures and hence, we expect no new concerns regarding this new measure.

We did not perform an analysis of missing data for the measure because it is based on a 100% sample of paid, final action claims submitted by facilities for payment.

4.1b Implementation Costs and Burden

If implemented, there will be no costs or other burdens for this measure (for any component, including the calculation of the score) because the measure score would be calculated (by CMS) automatically from claims data which are routinely generated during the delivery of care.

Because the measure's data are automatically generated during patient care, and because CMS would calculate and report the data, there is no impact on clinician workflow (e.g., modifications), diagnostic thought processes, or patient-physician interaction. There are no barriers to implementing measure specifications, including data collection and measure calculation, and no barriers to performance reporting.

4.1c Confidentiality

There are no concerns about patient confidentiality because the measure is based on claims data submitted by facilities to CMS, and CMS uses that data for both reimbursement and calculation of the measure score.

4.3 Feasibility Informed Final Measure

Because this is a claims-based measure, there is no burden on the facility or its clinicians and no feasibility concerns; rates are automatically calculated by CMS based on claims data submitted by facilities for payment.

4.4 Proprietary Information

Not a proprietary measure and no proprietary components

5.1.1 Data Used for Testing

For most of the testing in this submission, we used two years of national Medicare [Fee-for-Service (FFS)] and Medicare Advantage (MA)) claims and administrative data (January 1, 2022-December 31, 2023). Descriptions of the data used for testing are outlined in the table below.

CABG EDAC: Dataset Descriptions

Dataset	Applicable Testing	Description of Dataset

CY2022/CY2023: 2-year Medicare FFS and Medicare Advantage dataset (January 1, 2022-December 31, 2023)	Reliability testing Empirical validity Measure score distribution Risk variable frequencies and odds ratios Model performance testing (discrimination and calibration) Social risk factor testing	Dates of Data: January 1, 2022-December 31, 2023 Total number of hospitals (with at least 1 admission): 1,114 Total number of admissions: 148,701 Male (n=110,632), 74.4% Female (n=38,069), 25.6% Dual eligible (DE) (n=10,746), 7.2% Total number of hospitals with at least 25 admissions: 966 (86.7% of total) Number of admissions within facilities with at least 25 admissions: 147,631 (99.3% of total)
CY2022: 1-year Medicare FFS and Medicare Advantage Dataset (January 1, 2022-December 30, 2022)	Cohort definition Risk variable selection Model performance testing (discrimination and calibration) Face validity	Dates of Data: January 1, 2022-December 30, 2022 Total number of hospitals (with at least 1 admission): 1,070 Total number of admissions: 72,183

5.1.1a Dates of Testing Data

January 1, 2022-December 31, 2023

5.1.2 Differences in Data

Please see Section 5.1.4 for details. Differences in data used for testing are outlined in the table in Section 5.1.1.

5.1.3 Characteristics of Measured Entities

Characteristics of measured entities differ depending on the dataset. Please see the table in Section 5.1.1.

5.1.4 Characteristics of Units of the Eligible Population

The datasets, dates, number of measured hospitals, and number of admissions used in each type of testing are in the table in Section 5.1.1. For most measure testing, we used two years of Medicare data from January 1, 2022, to December 31, 2023. These datasets also include claims data on each patient for the 12 months prior to the index admission and contain facility inpatient

and Medicare Enrollment Database (EDB) data.

5.2.1 Level(s) of Reliability Testing Conducted

Person or encounter level (i.e., data element) (e.g., inter–abstractor reliability), Accountable entity level (i.e., measure score) (e.g., signal-to-noise analysis)

5.2.2 Method(s) of Reliability Testing

Data Element Reliability

For data element reliability, we provide information from literature, related measures that use the same ICD-10 code list, and from CMS coding guidance.

Entity-Level Reliability (Signal-to-Noise)

The EDAC statistical model uses hierarchical logistic regression to estimate the predicted and expected proportions of acute care days post discharge (please see the attachment in Section 1.18a). The rationale for calculating signal-to-noise reliability is stated in CBE guidance materials (PQM 2025, p.14) cited below:

“Logistic regression is a commonly used method for estimating reliability, especially for risk-adjusted measures with binomial data. In this approach, a hierarchical (multi-level) logistic regression model is fit, with the entity (e.g., hospital, provider) included as a random effect. This allows for estimation of both between-entity variance (signal) and within-entity variance (noise). The reliability estimate is then calculated as the ratio of between-entity variance to total variance, similar to the IUR.”

Specifically, we tested facility-level measure score reliability with the above-mentioned variant of the signal-to-noise method, using the formula presented in Figure 4 in the Supplemental Attachment (Adams et al., 2010; Yu et al., 2013). Specifically, for each facility, we calculate reliability using the hospital intercept estimated through the random intercept of the hierarchical logistic regression model, which is the quality signal, as follows:

Reliability=(σ_(facility-to-facility)^2)/(σ_(facility-to-facility)^2+ (σ_(facility error variance)^2)/n)

Where facility-to-facility variance is estimated from the hierarchical logistic regression model, n is equal to each facility’s observed case size, and the facility error variance is estimated using the variance of the logistic distribution (pi^2/3).

If implemented in a national quality program, public reporting will be limited to hospitals with a minimum index admission volume of at least 25. The volume restriction will mitigate concerns related to the “shrinkage” effect.

References

Adams, J. L., Mehrotra, A., Thomas, J. W., & McGlynn, E. A. (2010). Physician cost profiling--reliability and risk of misclassification. *The New England Journal of Medicine*, *362*(11), 1014–1021. https://doi.org/10.1056/NEJMsa0906323

Partnership for Quality Measurement. (2025). *National consensus development and strategic planning for health care quality measurement: Reliability guidance for the endorsement and maintenance (E&M) of clinical quality measures*. Battelle. https://p4qm.org/document/5201

Yu, H., Mehrotra, A., & Adams, J. (2013). Reliability of utilization measures for primary care physician profiling. *Healthcare (Amsterdam, Netherlands)*, *1*(1-2), 22–29. https://doi.org/10.1016/j.hjdsi.2013.04.002

5.2.3 Reliability Testing Results

Data Element Reliability

CMS claims data, used for reimbursement, are routinely used for quality measurement, and represent electronic data from structured fields; according to Battelle guidance, reliability is assumed for electronic data from structured fields (PQM, 2026).

CMS has in place multiple hospital auditing programs used to assess and improve claims coding reliability and validity, to ensure appropriate billing, and for overpayment recoupment (for example, CMS's Comprehensive Error Rate Testing Program and Fee-for-Service Recovery Audit Program) (Centers for Medicare & Medicaid Services, n.d.-a; Centers for Medicare & Medicaid Services, n.d.-b). CMS routinely conducts data analysis to identify potential problem areas and detect fraud, and audits important data fields used in our measures, including diagnosis and procedure codes as well as other elements that are consequential to reimbursement. In addition, CMS codes are updated annually effectively on October 1st of every year. Updates are jointly managed by CMS and the National Center for Health Statistics (NCHS) (Centers for Medicare & Medicaid Services, 2026).

The data elements used to capture the procedural cohort (ICD-10 procedural codes) are identical to those used in the CBE endorsed (endorsed by extension) CABG mortality and readmission measures (CBE 2558 and CBE 2515, respectively). Finally, the developer annually tracks the volume of admissions for each of the ICD-10 codes used to define the cohort and has not detected large code-level changes or coding anomalies.

Other elements of the measure that are not specific to the CABG cohort (for example, those that are used to define the outcome) are currently in use in other valid and recently CBE-endorsed measures (e.g. the AMI EDAC measure [CBE 2881].)

Entity-Level Reliability (Signal-to-Noise)

Table 2a provides the Battelle-required table of reliability within deciles of entity volume. Table 2b provides the distribution of entity-level signal-to-noise reliability.

As shown in Table 2b, for hospitals with at least 25 admissions, median signal-to-noise reliability was 0.857. Signal-to-noise reliability ranged from a minimum of 0.555 to a maximum of 0.981; the 25th and 75th percentiles were 0.777 and 0.908, respectively.

Using two years of data (the performance period) and a minimum public reporting threshold of 25, reliability meets Battelle's threshold (at least 70% of entities >=0.6).

References

Centers for Medicare & Medicaid Services (CMS). (n.d.-a). Comprehensive Error Rate Testing (CERT) Program. U.S. Department of Health and Human Services, https://www.cms.gov/data-research/monitoring-programs/improper-payment-measurement-programs/comprehensive-error-rate-testing-cert. Accessed on April 3, 2026.

Centers for Medicare & Medicaid Services (CMS). (n.d.-b). Medicare Fee-for-Service Recovery Audit Program. U.S. Department of Health and Human Services, https://www.cms.gov/data-research/monitoring-programs/medicare-fee-service-compliance-programs/medicare-fee-service-recovery-audit-program. Accessed on April 3, 2026.

Centers for Medicare & Medicaid Services. (2026). *ICD-10 codes*. U.S. Centers for Medicare & Medicaid Services. https://www.cms.gov/medicare/coding-billing/icd-10-codes. Accessed on April 16, 2026.

Partnership for Quality Measurement (PQM). (2026, March). *Endorsement and maintenance (E&M) Guidebook*. March 2026. https://p4qm.org/EM#EM-guidebook

5.2.3a Attach Additional Reliability Testing Results

5565-SupplementalAttachment-Spring2026.pdf

5.2.4 Interpretation of Reliability Results

Data Element Reliability

Because the fields used for all aspects of this measure are derived from electronic data from structured claims, and because data elements from Medicare claims that are used for reimbursement are collected using standardized coding and billing procedures and are routinely audited, they are considered sufficiently reliable. Data from literature further supports their reliability.

Entity-Level Reliability (Signal-to-Noise)

Using two years of data (the performance period) and a minimum public reporting threshold of 25 index admissions, reliability meets Battelle's threshold (at least 70% of entities >=0.6).

Table 2a. Accountable Entity Level Reliability Testing Results by Denominator, Target Population Size

	Overall	Min	Decile 1	Decile 2	Decile 3	Decile 4	Decile 5	Decile 6	Decile 7	Decile 8	Decile 9	Decile 10	Max
Reliability	0.835	0.555	0.633	0.733	0.777	0.814	0.845	0.869	0.890	0.907	0.926	0.952	0.981
Mean Performance Score	4.10	14.71	24.49	6.70	4.93	0.84	0.30	4.77	2.09	2.34	-2.76	-2.83	-1.18
Number of Entities	966	4	97	93	101	94	98	96	97	99	94	97	1

Number of Persons / Encounters / Episodes	14,7631	100	3,422	5,141	7,090	8,273	10,767	12,802	15,776	19,534	23,624	41,202	1,058

Table 2b. Accountable Entity Level Reliability Testing Results by Reliability Score

Minimum Case Volume	Number of Hospitals (%)	Mean (SD)	Min-Max	25th Percentile	Median	75th Percentile
>=1	1,114 (100)	0.752 (0.238)	0.048-0.981	0.726	0.837	0.900
>=25	966 (87)	0.835 (0.095)	0.555-0.981	0.777	0.857	0.908

5.3.1 Level(s) of Validity Testing Conducted

Person or encounter level (i.e., data element) (e.g., sensitivity and specificity), Accountable entity level (i.e., measure score) (e.g., criterion validity)

5.3.2 Type of Accountable Entity Level Validity Testing Conducted

Empirical validity testing at the accountable entity-level (e.g., criterion validity, construct validity, known groups analysis), Systematic assessment of face validity of the measure's performance score as an indicator of quality or resource use

5.3.3 Method(s) of Validity Testing

Data Element Validity

For data element validity we provide evidence from literature, and related measures.

Face Validity

During measure development, we obtained expert and stakeholder input by convening a technical expert panel (TEP) of clinicians, patients, patient advocates, and other stakeholders (see Table 3 for a complete list). Collectively, TEP members brought expertise in clinical content, performance measurement, coding, informatics, quality improvement, hospital administration, and patient and caregiver experience. In 2023 and 2024, we held two TEP meetings, where TEP members provided input on the cohort definition and specifications, risk variable selection, and risk model assessment, and reviewed model testing results, measure score reliability and validity, and testing variables related to economic disadvantage. Following completion of measure development, we systematically assessed the face validity of the measure score as an indicator of quality by soliciting the agreement from the TEP members via a survey, with the following question: "Do you think that the CABG EDAC measure as specified, can distinguish between better and/or worse performance across hospitals?" We measured agreement using a six-point scale (strongly agree, agree, somewhat agree, somewhat disagree, disagree, strongly disagree).

Table 3. CABG EDAC: Technical Expert Panel (TEP)

Name and Credentials	Organization (if applicable) and Role	Location
Rosie Bartel, MA	PFAnetwork, PFCCpartners; Person Family Engagement Partner	Chilton, WI
Ann Borzecki, MD, MPH	VA Bedford Healthcare; Physician-Investigator	Bedford, MA
Jean Boyer	Person Family Engagement Partner	Picayune, MS
Sophia Brasil, MPH	Stratis Health; Senior Data Analyst	Boise, ID
Matt Cheung, PhD, RPh	University of the Pacific, Thomas J Long School of Pharmacy (part-time); Adjunct Professor of Pharmacy Practice, Independent Consultant (Medical Reviewer, Patient/Stakeholder Research Partner)	Gatos, CA
Steven Coffee, MA, EM CQSL	Headquarters U.S. Cyber Command, Patients for Patient Safety, U.S., Head2HeartConnections, LLC; Colonel, USAF Director, Military Personnel, Patient Advocate/Caregiver	Dumfries, VA
Craig Davies	Person Family Engagement Partner	New Orleans, LA
Michael Duan, MS	Premier, Inc.; Principal Data Scientist	Charlotte, NC
Ryan Merkow, MD, MS	University of Chicago Medicine Comprehensive Cancer Center and Cancer Service Line, Department of Surgery; Director for Surgical Cancer Quality, Associate Director of Health Services Research, Director Hepatic Artery Infusion Pump Program	Chicago, IL
Sachin Shah, MD, MPH	Massachusetts General Hospital, Harvard University; Physician; Clinical Researcher	Boston, MA
Donté Smith	Legacy Community Health; Person Family Engagement Partner, Caregiver/Patient Navigator	Houston, TX
Brian Stein, MD, MS	Rush University Medical Center; Physician and Chief Quality Officer	Chicago, IL
Mary Vaughan-Sarrazin, PhD	University of Iowa Department of Internal Medicine, VA Medical Center; Associate Professor, Department of Internal Medicine	Iowa City, IA
Bonnie Weiner, MD, MSEC, MBA, MSCAI, FACC, FAHA, DNBPAS	Saint Vincent Hospital, Worcester Medical Center, Accreditation for Cardiovascular Excellence; Physician and Director – Interventional Cardiology; Associate Program Director of Cardiovascular Medicine Fellowship; Chief Medical Officer at Accreditation for Cardiovascular Excellence Inc.	Harvard, MA

Empiric (Construct) Validity

We also explored validation through meaningful comparisons of CABG EDAC measure scores with those from existing quality metrics where we hypothesized we would see an empiric relationship.

To identify candidate measures for construct validity testing, we reviewed the logic model (see the CABG EDAC Logic Model in Supplemental Attachment) to identify quality measures that fell within the same causal pathway. From that candidate list of measures, we determined which

measures had data available publicly, at the hospital level. We then assessed the relationship between those measures and CABG EDAC measure scores, as described below.

We examined correlations between CABG EDAC measure scores and components of the Overall Hospital Star Rating, including the Readmission Group Score (with and without the related Hospital-Wide Readmission measure), the Summary Score (with and without the entire Readmission Group), the Patient Experience Group score, and Medicare Spending Per Beneficiary (MSPB). Because the CABG EDAC measure score is on a lower-is-better scale, and the Star Rating measures are on a higher-is-better scale, we hypothesized that the CABG EDAC measure would be negatively correlated (weakly to moderately) with Star Rating-related measures, and positively (weakly) associated with MSPB. We expect, however, to see different effect sizes, based on the specific comparator construct. For example, for comparisons that compare associations with and without readmission measures, we expect to see the largest effect size for the comparisons with readmission components, and we expect to see weaker associations when they are removed. For example, we expect the association between the Star Ratings Summary Score with the Readmission Group to be stronger compared with the Summary Score without the Readmission Group.

We calculated Pearson's correlation coefficients for the association between the CABG EDAC measure and these existing quality/cost measures on the same measured entities. For these analyses, we used calendar year (CY) 2022/2023 data for CABG EDAC measure scores, and April 2025 Star Rating preview data with measure dates of data ranging from 07/2020 - 06/2023. The full methodology for the Overall Hospital Quality Star Rating can be found at: https://qualitynet.cms.gov/files/603966dda413b400224ddf50?filename=Star_Rtngs_CompMthdlgy_v4.1.pdf

The full methodology of the MSPB measure can be found at: https://qualitynet.cms.gov/inpatient/measures/hiqr-mspb/methodology

Validity of the Outcome

To assess the validity of the outcome, we examined the time in days until the first post-discharge hospital visit (unplanned inpatient readmission, ED visit, or observation stay) for patients in the CABG cohort, using the two-year dataset (CY2022/2023). Additionally, we further validated the outcome by analyzing the reasons (principal discharge diagnoses) for post-discharge hospitalizations within 30 days. To assess the clinical reason (principal discharge diagnoses) for post-discharge hospitalization within 30 days we mapped each principal discharge diagnosis to its associated Agency for Healthcare Research and Quality (AHRQ) Clinical Classifications Software (CCS) category; AHRQ CCS categorizes ICD-10 diagnosis codes into a smaller number of clinically meaningful groups (AHRQ, 2019). We then identified the most frequently occurring AHRQ CCS categories associated with readmission in the CABG cohort (Table 6).

References

Agency for Healthcare Research and Quality. (2019, November). *Clinical Classifications Software (CCS) for ICD-10-PCS (beta version)*. Healthcare Cost and Utilization Project (HCUP). Agency for Healthcare Research and Quality. https://www.hcup-us.ahrq.gov/toolssoftware/ccs10/ccs10.jsp

5.3.4 Validity Testing Results

Data Element Validity

The data elements used to calculate the CABG EDAC measures are currently used in other validated quality measures. For example, the cohort is defined by ICD-10 procedural codes that are identical to the CBE endorsed CABG mortality and readmission measures (CBE 2558 and CBE 2515, respectively). The outcome is defined by clinical events that are captured by multiple data fields and used for reimbursement; it is highly unlikely that the occurrence of an emergency department visit, observation stay or readmission is captured in error. A 2016 study found perfect agreement between ICD-10 procedure codes for CABG and registry data ($\kappa = 1.00$). Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were between 99.2% and 100.0% (Youngson et al., 2016).

In addition, as discussed in the "Data element reliability" section, CMS has several audit programs in place to assess the accuracy of codes used for reimbursement.

Face Validity

Table 4 shows the results of the TEP face validity vote, where TEP members indicated their agreement with the following question*: "Do you think that the CABG EDAC measure as specified, can distinguish between better and/or worse performance across hospitals?"* Twelve TEP members responded to the TEP survey; 11 out of 12 (92%) agreed (strongly agreed, agreed, or somewhat agreed) with the face validity of the measure, indicating support for the validity of the CABG EDAC measure. In responding to questions about the measure, one member who disagreed stated that they did not think that the outcome could be captured in claims data, nor did they think that the outcome reflects the quality of care that a patient received.

Table 4. CABG EDAC: Technical Expert Panel (TEP) Face Validity Voting Results

Response Category	Number	Frequency
Strongly Agree	6	50.0%
Moderately Agree	3	25.0%
Somewhat Agree	2	16.8%
Somewhat Disagree	1	8.3%
Moderately Disagree	0	0.0%
Strongly Disagree	0	0.0%

Empiric Validity

Selection of Comparator Measures

Below we describe the measures that were selected as comparator measures for construct validity testing.

In our evaluation of the logic model, we identified the following comparator measures for construct validity testing:

- **Star Rating Summary Score**: The Star Rating Summary score is calculated using a weighted average of Group Scores derived from quality measures assigned to five domains: Mortality (7 measures), Readmission (11), Safety of Care (8), Patient Experience (8) and Timely and Effective Care (14). Because the Summary Score contains the Readmission and Patient Experience Group Scores (see below), we hypothesized that the Summary Score would be weakly, negatively associated with the CABG EDAC measure score. Furthermore, we hypothesized that if we removed the Readmission Group from the Summary Score, that there would be a weaker, yet significant remaining association due to the presence of the Patient Experience score.
- **Star Rating Readmission Group Score:** The Readmission Group Score is calculated as the simple average of measures within the Readmission Group, which includes hospital-level (inpatient) readmission and EDAC measures and hospital visit measures following outpatient procedures (Centers for Medicaid & Medicare Services, 2025). Therefore, these measures overlap in their outcome, and because there is evidence of effectiveness of broad-based interventions to reduce unplanned readmissions (Kripalani et al., 2014), we hypothesized that hospitals with lower (better) CABG EDAC measure scores would also perform better on the composite Readmission Group Score. We note that all of the claims-based comparator measures include only Medicare Fee-For-Service (FFS) admissions and therefore we hypothesized a weak to moderate association between the CABG EDAC measure scores and the Readmission Group Score. We further hypothesized that removing the HWR measure (whose cohort overlaps with the CABG EDAC measure) from the Readmission Group Score, would result in a weaker association.
- **Patient Experience Group Score:** The Patient Experience Group Score is calculated from eight components (Centers for Medicaid & Medicare Services, 2025) of the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey (Centers for Medicaid & Medicare Services, 2024), including important components of care coordination both during and after hospitalization, and for this reason it was selected as a comparator measure. For example, components of HCAHPS in the Patient Experience Group Score include patients' assessments of doctor and nurse communication, and if patients understood their care when they left the hospital. The Patient Experience Group Score also includes patient reports of receiving discharge instructions, and reports of staff explaining patients' medications. Therefore, the Patient Experience Group Score is on the same causal pathway as the CABG EDAC measure. HCAHPS is calculated for a sample of patients aged 18 and over, and only some of the patient experience subdomains overlap with EDAC (for example, questions about cleanliness and quiet do not); we therefore expect a weak negative association (and a smaller effect size compared with the Readmission Group Score) between the Patient Experience Group Score and CABG EDAC.
- **Medicare Spending per Beneficiary (MSPB):** MSPB shows whether Medicare spends more, less, or about the same for an episode of care at a specific hospital compared to all hospitals nationally. An MSPB episode includes Medicare Part A and Part B payments for services provided by hospitals and other healthcare providers the 3 days prior to, during, and 30 days following a patient's inpatient stay. This measure evaluates hospitals' costs compared to the costs of the national median hospital and is adjusted for patient age, comorbidities, and geographic payment differences. MSPB was selected as a comparator measure as in our logic model, we hypothesize that quality improvement to lower EDAC would result in lower costs. MSPB is calculated only for Medicare FFS patients and covers all episodes of care, therefore we hypothesize a weak, positive correlation between MSPB

and CABG EDAC measure scores.

Analysis of Construct Validity

Table 5 provides Pearson correlation coefficients that show the relationship between the CABG EDAC measure score and related measures. Pearson correlation coefficients between the CABG EDAC measure and the comparator measures (Readmission Group Score, Readmission Group Score excluding HWR, and the Patient Experience Group Score) were -0.214 (p<.0001), -0.211 (p<.0001), and -0.045 (p=0.1681). Pearson correlation coefficients between the CABG EDAC measure and the Summary Score, with and without the Readmission Group, were-0.147 (p<.0001) and -0.066 (p=0.0406). The Pearson correlation coefficients between the CABG EDAC measure scores and MSPB were 0.012, p=.7184. These results show a significant association with the expected strength and in the expected direction with measures in the same causal pathway, which supports the validity of the CABG EDAC measure.

Table 5. CABG EDAC: Association (Pearson Correlation Coefficients) between Measure Scores and Comparator Measures for Hospitals with >=25 eligible admissions (CABG EDAC dates: January 1, 2022-December 31, 2023)

Comparison Measure	Number of Hospitals	Pearson Correlation Coefficient	p-value
Star Rating Standardized Readmission Group Scores	**955**	**-0.214**	**<.0001**
Star Rating Standardized Readmission Group Scores Excluding Hospital-Wide Readmission	**953**	**-0.211**	**<.0001**
Star Rating Standardized Summary Scores	**955**	**-0.147**	**<.0001**
Star Rating Standardized Summary Scores Excluding Readmission Group Score	**955**	**-0.066**	**.0406**
Star Ratings Standardized Patient Experience Group Score	**953**	**-0.045**	**.1681**
Medicare Spending Per Beneficiary	**941**	**0.012**	**.7184**

Star Rating preview data from the April 2025 release on Hospital Care Compare with measure dates of data ranging from 07/2020 - 06/2023

Empiric Validity: Validity of the Outcome

Time to post-discharge event

The EDAC measures use a 30-day time frame that captures a clinically vulnerable post-discharge period, which is particularly relevant for older adult patients (Dharmarajan et al., 2015). 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 patients and their communities to reduce acute care events (see Section 2.1, Logic Model, and Sections 2.2 and 6.2.1).

Furthermore, the 30-day, all-cause outcome is supported by empiric evidence showing the time

course of post-discharge acute care visits. We illustrate this in Figure 5 (in the Supplemental Attachment), for the CABG EDAC cohort, where it is evident that post-discharge hospital visits continue beyond 30 days, and do not reach baseline until about 60 days.

Principal diagnoses associated with post-discharge hospital visits

In Table 6, we show that the most frequent reasons (principal discharge diagnoses) associated with unplanned readmission within 30 days are commonly recognized and potentially preventable complications after a CABG procedure.

Table 6. CABG EDAC: Top 25 (Most Frequent) CCS Categories Associated with Unplanned Readmission (January 1, 2022 – December 31, 2023)

Rank	CCS	CCS Description	Count	Percent	Cumulative	Cumulative Percent
1	99	Hypertension with complications and secondary hypertension	2,648	16.7%	2,648	16.7%
2	238	Complications of surgical procedures or medical care	2,324	14.7%	4,972	31.4%
3	2	Septicemia (except in labor)	1,233	7.8%	6,205	39.1%
4	106	Cardiac dysrhythmias	1,005	6.3%	7,210	45.5%
5	130	Pleurisy; pneumothorax; pulmonary collapse	685	4.3%	7,895	49.8%
6	153	Gastrointestinal hemorrhage	599	3.8%	8,494	53.6%
7	103	Pulmonary heart disease	546	3.4%	9,040	57.0%
8	122	Pneumonia (except that caused by tuberculosis or sexually transmitted disease)	468	3.0%	9,508	60.0%
9	100	Acute myocardial infarction	419	2.6%	9,927	62.6%
10	237	Complication of device; implant or graft	401	2.5%	10,328	65.1%
11	157	Acute and unspecified renal failure	393	2.5%	10,721	67.6%
12	109	Acute cerebrovascular disease	302	1.9%	11,023	69.5%
13	55	Fluid and electrolyte disorders	278	1.8%	11,301	71.3%
14	999	COVID-19	260	1.6%	11,561	72.9%
15	131	Respiratory failure; insufficiency; arrest (adult)	249	1.6%	11,810	74.5%

Rank	CCS	CCS Description	Count	Percent	Cumulative	Cumulative Percent
16	97	Peri-; endo-; and myocarditis; cardiomyopathy (except that caused by tuberculosis or sexually transmitted disease)	248	1.6%	12,058	76.1%
17	117	Other lower respiratory disease	236	1.5%	12,294	77.5%
18	50	Diabetes mellitus with complications	212	1.3%	12,506	78.9%
19	101	Coronary atherosclerosis and other heart disease	194	1.2%	12,700	80.1%
20	159	Urinary tract infections	190	1.2%	12,890	81.3%
21	102	Nonspecific chest pain	173	1.1%	13,063	82.4%
22	149	Biliary tract disease	142	0.9%	13,205	83.3%
23	197	Skin and subcutaneous tissue infections	142	0.9%	13,347	84.2%
24	118	Other upper respiratory disease	141	0.9%	13,488	85.1%
25	108	Congestive heart failure; nonhypertensive	113	0.7%	13,601	85.8%

References

Agency for Healthcare Research and Quality. (2019, November). Clinical Classifications Software (CCS) for ICD-10-PCS (beta version). Healthcare Cost and Utilization Project (HCUP). Agency for Healthcare Research and Quality. https://www.hcup-us.ahrq.gov/toolssoftware/ccs10/ccs10.jsp

Centers for Medicare & Medicaid Services. (2025). *Overall hospital quality star rating*. https://data.cms.gov/provider-data/topics/hospitals/overall-hospital-quality-star-rating/#measure-included-by-categories

Centers for Medicare & Medicaid Services. (2024). *HCAHPS: Patients' perspectives of care survey*. https://www.cms.gov/medicare/quality/initiatives/hospital-quality-initiative/hcahps-patients-perspectives-care-survey/

Dharmarajan, K., Hsieh, A. F., Kulkarni, V. T., Lin, Z., Ross, J. S., Horwitz, L. I., Kim, N., Suter, L. G., Lin, H., Normand, S.-L. T., & Krumholz, H. M. (2015). Trajectories of risk after hospitalization for heart failure, acute myocardial infarction, or pneumonia: Retrospective cohort study. BMJ, 350, h411. https://doi.org/10.1136/bmj.h411

Kripalani, S., Theobald, C. N., Anctil, B., & Vasilevskis, E. E. (2014). Reducing hospital readmission rates: current strategies and future directions. *Annual review of medicine*, *65*, 471–485. https://doi.org/10.1146/annurev-med-022613-090415

Youngson E, Welsh RC, Kaul P, McAlister F, Quan H, Bakal J. Defining and validating comorbidities and procedures in ICD-10 health data in ST-elevation myocardial infarction patients. *Medicine (Baltimore)*. 2016;95(32):e4554. doi:10.1097/MD.0000000000004554

5.3.4a Attach Additional Validity Testing Results

5565-SupplementalAttachment-Spring2026_0.pdf

5.3.5 Interpretation of Validity Results

Data element validity is supported by evidence from the literature and long-term use of these specific claims-based data elements for other CABG quality measures in CMS reporting.

Both strong face validity and empiric validity testing results support the validity of the CABG EDAC measure. Ninety-two percent of TEP members voted in support of the face validity of the measure. Our empiric validity analysis shows a statistically significant association with the expected strength and in the expected direction with four of the six measures in the same causal pathway, which supports the construct validity of the CABG EDAC measure. Lastly, validity of the outcome results show that the most frequent reasons (principal discharge diagnoses) associated with readmission for those in the CABG EDAC cohort are associated with the initial index admission for a CABG procedure. In addition, we provide evidence for the validity of the 30-day outcome. The interpretation of these results is discussed below.

Face validity

The validity of the CABG EDAC measure is supported by strong face validity results, as measured by systematic feedback from the TEP.

Construct Validity Testing

The validity of the CABG EDAC measure is further supported by the empiric construct validity results that demonstrate a correlation (in the expected strength and direction) between the CABG EDAC measure and other quality/cost measures in the causal pathway (see CABG EDAC Logic Model in the Supplemental Attachment), such as the Star Rating readmission group score (without the HWR measures) and the Summary Score, with and without the Readmission Group.

As expected, the magnitude of the associations (effect sizes) account for only a portion of the CABG EDAC construct, for the following reasons:

- Star Ratings Summary Score:
  - The Summary Score is a broad measure of quality that includes five domains with many quality measures, some of which are not in the same causal pathway (including outpatient measures).
  - None of the measures capture the MA population.
  - Some measures within the Summary Score capture a broader population (all adults, for example).
  - The timeframes of the measures overlap but are not perfectly aligned.
- Star Ratings Readmission Group Score:

    - There are measures in this group that have outcomes that conceptually overlap (post-discharge acute hospitalization use), but largely focus on other target populations
    - Measures in this group include only FFS admissions, compared with the CABG EDAC measure, that includes both FFS and MA admissions.
    - There are outpatient measures in the Readmission Group whereas the CABG EDAC measure cohort includes admissions discharged from an inpatient stay only.
    - The CABG EDAC measure overlaps with a small proportion of the HWR measure, and for that small proportion the HWR measure includes only the outcome of readmission.
    - The timeframe of the measures overlaps but is not perfectly aligned.
- Star Ratings Patient Experience Group Score
    - Patient Experience captures a cohort that includes all adults; CABG EDAC is only adults over age 65 with a qualifying index hospitalization procedure code for an isolated CABG.
    - Patient Experience is patient-reported; CABG EDAC is claims-based.
    - CABG EDAC has a smaller cohort and fewer acute care events compared with the condition-related Diabetes and COPD EDAC measures, submitted in this same CBE cycle. We therefore expect to see a weaker association with Patient Experience compared with those measures.
- MSPB:
    - MSPB includes only FFS beneficiaries.
    - CABG hospitalizations are only a fraction of the cohort size captured by MSPB.
    - Cost and quality are not always aligned (higher cost can be associated with better, and worse quality). For example, improving post-discharge quality and reducing EDAC may result in appropriate shifting of services and related costs to the outpatient setting, or alternatively, improving inpatient care may result in reducing short- and long-term complications and reducing a proportion of costs.
    - The timing of long-term cost savings may not align with performance periods.

However, because we know that (1) there are effective strategies that hospitals can implement to reduce post-discharge hospital use, and (2) hospitals have implemented quality improvement programs to improve readmission rates, which can be broad-based, we conclude with moderate certainty that the relationships we see between the Readmission Group and the CABG EDAC performance are directly related.

Finally, when considering the three types of measures we analyzed, our results support the notion of convergent validity. Each of the measures examines a different quality domain (readmission, patient experience, and cost), with different data sources (patient experience vs. claims) and measure calculation approaches. Yet our results show a pattern consistent with most of our hypothesis with correlations in the expected direction and strength across all three domains.

Validity of the Outcome (30-day, all-cause)

The validity of the 30-day, all-cause outcome is supported by several pieces of empirical evidence. First, as shown by the time course of post-discharge hospital visits, the daily post-discharge utilization rate does not return to baseline after 30 days after the index admission and is therefore temporally associated with the index admission (Figure 5). This provides evidence in support of a causal relationship (rather than random hospital visits for unrelated reasons). Second, we show that most of the reasons identified for readmissions within 30-days post-discharge (principal

discharge diagnoses) are clinically related to the index admission (Table 6). We note however, that seemingly unrelated diagnoses (such as a fall resulting in fracture, dehydration, delirium, or an exacerbation of another chronic condition) may also be caused by poor care coordination (e.g., lack of medication management) (Liang & Alper, 2018). In addition, through the literature, we show that there is a relationship between specific care processes and the outcome of post-discharge facility-based acute care utilization. As discussed in the evidence of measure importance (Section 2.2), interventions during and after a hospitalization can be effective in reducing utilization rates in geriatric populations and, particularly, for older patients undergoing a CABG procedure. Lastly, there is also increasing evidence that hospitals have been able to reduce readmission rates through quality improvement initiatives (see Section 6.2.1 for details).

References

Liang, K., & Alper, E. (2018). *Patient safety during hospital discharge*. PSNet. Agency for Healthcare Research and Quality.

5.4.1 Methods Used to Address Risk Factors

Statistical risk adjustment model with risk factors

5.4.2 Conceptual Model Rationale

The goal of risk adjustment is to adjust for case-mix differences across the hospitals. Risk adjustment supports fair and accurate comparison of outcomes across measured entities by including an adjustment for factors such as patient age, comorbid diseases, and indicators of patient frailty, which are clinically relevant and have relationships with the outcome. In pursuing a risk adjustment approach that best leverages the data, we used a framework based largely on individual ICD-10 codes for risk adjustment. The main advantage of leveraging ICD-10 codes in place of alternative methods that employ an ICD-10 grouper (such as CMS's Condition Categories, or CCs) is the ability to address the clinical heterogeneity found in the broadly defined CCs. Our previous research indicates that the model performance of the mortality measures is significantly improved by using individual codes instead of CCs (Krumholz et al., 2019). The CABG EDAC measure adjusts for case-mix differences between hospitals based on the clinical status of the patient at the time of the index admission (CABG procedure). Accordingly, only comorbidities that convey information about the patient at that time or in the 12 months prior, and not complications that arise related to the CABG procedure and during the index hospitalization, are included in the risk adjustment.

The process for determining patient comorbidities present at the time of the index admission from the index admission claim/encounter data uses a present-on-admission (POA) algorithm. The POA algorithm applies only in the case of secondary diagnosis codes on the index admission used in the risk adjustment of a measure. In brief, an 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/encounter 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. Please see Tab *CABG EDAC Risk Variable Complications of Care* in the Excel file entitled "*CABG EDAC_Data Dictionary.xlsx*" for the list of potential complications referred to in Step 3 of the algorithm.

This measure does 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 this measure to adjust for patient demographic and clinical characteristics while illuminating important quality differences.

The measure does not adjust for patients' admission source or their discharge disposition (for example, skilled nursing facility) because these factors are associated with the structure of the healthcare system, not solely with patients' clinical comorbidities.

Selection of Clinical Risk Variables

Risk variables were originally selected for the complementary CABG readmission measure, as described below. Risk variables were selected using a data-driven, empiric approach, followed by minor adjustments for face validity. For candidate risk variables, we used a 70% randomly selected sample of data from the CY2022 dataset and included all secondary ICD-10 codes documented as POA during the index admission (except for the palliative care code of Z51.5, which, effective October 1, 2021, was considered POA-exempt), and both principal and secondary ICD-10 codes in the 12 months prior to admission from any inpatient, outpatient, and professional provider claims. We also considered age, frailty, and an indicator for whether the admission was Medicare Advantage (MA) vs. Fee-for-Service (FFS). The variable selection of individual ICD-10 codes mainly relied on data-driven methodologies involving three key steps: 1) identifying candidate risk variables for testing in the risk model, 2) evaluating the bivariate association with outcome, and 3) consideration of associations between other non-individual-ICD-10 code variables, including frailty, with the outcome. In the first step, we screened and included ICD-10 codes identified at the index admission (index codes) and those captured in the 12 months prior to admission (pre-index codes) if their prevalence exceeded 0.5% and 2.5%, respectively. Further, co-occurring index and pre-index codes (at the admission level) with Pearson correlation coefficients greater than 0.8 were combined into one risk variable. Finally, pairs of identical index and pre-index ICD-10 codes with similar odds ratios that acted in the same direction (where the difference in association with the outcome, measured by odds ratio (OR), was less than 0.2) were merged. We note that frequencies were based on a 100% sample, but that all subsequent steps were based on a 70% sample. In the second step, we included the remaining candidate variables (including age) in a multivariable logistic regression model that underwent variable selection through 1,000 iterations of bootstrapping. We selected variables that were statistically significantly associated with the outcome ($p<0.05$) in at least 80% of the bootstrapped samples. We determined if additional variables should be added to the multivariate model by examining if there was a resulting increase in the model c-statistic (using a threshold of at least 0.0005 increase in c-statistic for each additional variable, or an increase of at least 0.005 for including additional variables within the next 5% of bootstrapped samples [variables that were statistically significantly associated with the outcomes in at least 75% of the bootstrapped samples]); however, increases in the c-statistic did not meet these thresholds when additional variables were

evaluated. In addition, based on evidence from the literature, expert input, guidance from the consensus-based entity for measure endorsement, the Assistant Secretary for Planning and Evaluation, input from other stakeholders, and prior testing results, we included a claims-based indicator of frailty in the final model. This indicator was developed for CMS's Multiple Chronic Conditions (MCC) measure. We adjusted for sex because it is associated with differences in baseline clinical risk, anatomy related to surgical procedure, comorbidity burden, presentation, and post-discharge outcomes after CABG, so adjustment helps ensure that hospitals are compared more fairly based on performance rather than differences in patient case mix.

For the combined MA and FFS cohort, the risk-adjustment model was updated to include an MA indicator (versus FFS) as a main effect. This was to adjust for the generally higher prevalence of comorbidities in the MA cohort, especially among the pre-index variables that were derived from services in the outpatient setting (e.g., physician visits).

Economic Disadvantage

Because our risk variable selection process was based on an empirical approach using individual ICD-10 codes related to a patient's clinical status at admission and in the 12 months prior to admission, we separately considered variables related to economic disadvantage and their overlap with clinical risk factors. Although some recent literature has evaluated the relationship between these variables and the EDAC outcome, few studies directly address specific causal pathways or examine the role of the hospital in these pathways (see, for example: Hamadi et al., 2019; Kaiser Permanente Washington Health Research Institute, 2022; Rogstad et al., 2022; Joynt Maddox et al., 2019). Our conceptual model described below (and in the Supplemental Attachment) builds on published literature as well as our empirical analyses and identifies several overlapping pathways whereby patients may experience worse outcomes.

Conceptual Model for Clinical Factors and Factors Related to Economic Disadvantage

Our conceptual model described below builds on published literature as well as our empirical analyses and identifies several overlapping pathways whereby patients may experience worse outcomes. These pathways are not mutually exclusive.

- **Comorbidities and economic disadvantage:** Economically disadvantaged patients may have worse health at the time of hospital admission and patient comorbidities are known risk factors for post discharge acute care use in patients hospitalized for a CABG procedure (Shawon et al., 2021). Patients who have lower income/education/literacy or unstable housing may have a worse general health status and may present for their hospitalization/procedure with a greater severity of underlying illness (Owens et al., 2022). These factors, which are characterized by patient-level or neighborhood-/community-level (as proxy for patient-level) variables, may contribute to worse health status at admission due to competing priorities (restrictions based on job, lack of childcare, etc.), lack of access to care (geographic, cultural, or financial), or lack of health insurance. Given that these risk factors all lead to worse general health status, this causal pathway should be largely accounted for by current clinical risk adjustment. We note that patient comorbidities and economic disadvantage variables overlap in their contribution to a higher risk of the outcome, as shown by our empirical evidence (see Section 5.3).
- **Differential care:** A second pathway by which economic disadvantage may contribute to

post discharge acute care risk is that patients may not receive equivalent care within a facility (Lloren at el., 2019). It has been shown that for other conditions (acute myocardial infarction, pneumonia, and heart failures), that across almost all hospitals (>98% of hospitals with sufficient data for assessment), dually eligible patients have higher rates of post discharge hospital based care (readmission) when compared with patients who are not dually eligible patients in the same hospital (within hospital disparities), after accounting for comorbidities, and area level variables (Silvestri et al., 2022). For CABG specifically, a 2024 study of Medicare beneficiaries found that patients with dual eligibility were less likely to receive post-procedural home health care compared with patients who were not dual eligible, and home health care use was associated with lower risk of readmission and ED visits (Thompson et al., 2024). The authors also found that home health care use was primarily driven by the discharging hospital.

- **Low-quality hospitals:** Economically disadvantaged patients may receive care at lower quality hospitals. Patients of lower income, lower education, or unstable housing may not have the same access to high quality facilities, in part, because such facilities may be less likely to be found in geographic areas with large populations of patients with these factors (Fahrenbach et. al., 2020). Thus, patients with low income may be more likely to be treated in lower quality hospitals, which can contribute to an increased risk of readmission. In addition, or alternatively, low quality hospitals may not implement evidence-based interventions to reduce the risk of readmission, such as post-discharge follow-up; economically disadvantaged patients are known to have lower rates of follow-up after discharge and higher rates of post-discharge acute care (Anderson et al., 2022).
- **Residual risk:** Economically disadvantaged patients may experience worse health outcomes only partially under the control of the healthcare system. Some economic factors, such as income or wealth, may affect the likelihood of readmission without directly affecting health status at admission or the quality of care received during the hospital stay. For instance, while a hospital may make appropriate care decisions and provide tailored care and education, a lower-income patient may still have a worse outcome post-discharge due to competing economic priorities or a lack of access to care outside of the hospital (Chatterjee et al., 2022).

These proposed pathways overlap and are complex to distinguish analytically. They also have different implications on the decision to risk adjust, or not, depending on the degree to which hospitals can mitigate the increased risk. Furthermore, the ongoing consolidation of the healthcare market puts more control, resources, and accountability on hospitals (that are now increasingly part of large multi-hospital systems) to invest in mitigating these risks (Levinson et al., 2024). However, in some markets, hospital systems choose to close facilities or limit access to care, based on financial decisions, rather than assessments of resource needs (Levins, 2023), including assessment of, and investment in, programs that mitigate such needs.

Economic Variables Used in Testing

Based on the available literature and given the limited availability of valid and reliable variables that can be tested in claims data, we selected dual eligibility as a variable for testing.

Dual eligibility for Medicare and Medicaid is available at the patient level in the Medicare Master Beneficiary Summary File. The eligibility threshold for aged 65 or older Medicare patients

considers both income and assets. There is also a body of literature demonstrating differential health care and health outcomes among dually eligible beneficiaries (ASPE, 2020).

References

Anderson, A., Mills, C. W., Willits, J., Lisk, C., Maksut, J. L., Khau, M. T., & Scholle, S. H. (2022). Follow-up post-discharge and readmission disparities among Medicare fee-for-service beneficiaries, 2018. *Journal of General Internal Medicine, 37*(12), 3020–3028. https://doi.org/10.1007/s11606-022-07488-3

Centers for Medicare & Medicaid Services. *2024 All-Cause Unplanned Admissions for Multiple Chronic Conditions Measure*. Published December 20, 2023. Updated December 21, 2023. https://qpp.cms.gov/resources/document/750f3c88-e16c-46a5-a7f6-e8235aefd574. Accessed March 25, 2026.

Chatterjee, P., Liao, J. M., Wang, E., & Navathe, A. S. (2022). Characteristics, utilization, and concentration of outpatient care for dual-eligible Medicare beneficiaries. The American Journal of Managed Care, 28(10), e370–e377. https://doi.org/10.37765/ajmc.2022.89189

Fahrenbach, J., Chin, M. H., Huang, E. S., Springman, M. K., Weber, S. G., & Tung, E. L. (2020). Neighborhood disadvantage and hospital quality ratings in the Medicare Hospital Compare Program. *Medical Care, 58*(4), 376–383. https://doi.org/10.1097/MLR.0000000000001283

Hamadi, H., Moody, L., Apatu, E., Vossos, H., Tafili, A., & Spaulding, A. (2019). Impact of hospitals' referral region racial and ethnic diversity on 30-day readmission rates of older adults. Journal of Community Hospital Internal Medicine Perspectives, 9(3), 181–188. https://doi.org/10.1080/20009666.2019.1613882

Joynt Maddox, K. E., Reidhead, M., Hu, J., Kind, A. J. H., Zaslavsky, A. M., Nagasako, E. M., & Nerenz, D. R. (2019). Adjusting for social risk factors impacts performance and penalties in the hospital readmissions reduction program. *Health Services Research, 54*(2), 327–336. https://doi.org/10.1111/1475-6773.13133 ;

Kaiser Permanente Washington Health Research Institute. (2022). *Association of social risk factors with emergency department and inpatient hospital utilization.* Social Needs Network for Evaluation and Translation (SONNET). https://kpwashingtonresearch.org/application/files/4016/7639/1403/SONNET_Report_Social-Risk-Health-Care-Utilization_FINAL.pdf

Krumholz, H. M., Coppi, A. C., Warner, F., Triche, E. W., Li, S.-X., Mahajan, S., Li, Y., Bernheim, S. M., Grady, J., Dorsey, K., Lin, Z., & Normand, S.-L. T. (2019). Comparative Effectiveness of New Approaches to Improve Mortality Risk Models From Medicare Claims Data. *JAMA Network Open*, *2*(7), e197314–e197314. https://doi.org/10.1001/jamanetworkopen.2019.7314

Levins, H. (2023, January 19). Hospital consolidation continues to boost costs, narrow access, and impact care quality. *Leonard Davis Institute of Health Economics, University of Pennsylvania*. https://ldi.upenn.edu/our-work/research-updates/hospital-consolidation-continues-to-boost-costs-narrow-access-and-impact-care-quality/

Levinson, Z., Godwin, J., Hulver, S., & Neuman, T. (2024, April 19). Ten things to know about consolidation in health care provider markets. *KFF*. https://www.kff.org/health-costs/issue-brief/ten-things-to-know-about-consolidation-in-health-care-provider-markets/

Lloren, A., Liu, S., Herrin, J., Lin, Z., Zhou, G., Wang, Y., Kuang, M., Zhou, S., Farietta, T., McCole, K., Charania, S., Dorsey Sheares, K., & Bernheim, S. (2019). Measuring hospital-specific disparities by dual eligibility and race to reduce health inequities. Health services research, 54 Suppl 1(Suppl 1), 243–254. https://doi.org/10.1111/1475-6773.13108

Office of the Assistant Secretary for Planning and Evaluation. (2020). Second report to Congress on social risk factors and performance in Medicare's value-based purchasing programs. U.S. Department of Health and Human Services. https://aspe.hhs.gov/reports/second-report-congress-social-risk-medicares-value-based-purchasing-programs

Owens, P. L., Liang, L., Barrett, M. L., & Fingar, K. R. (2022). Comorbidities associated with adult inpatient stays, 2019. *Agency for Healthcare Research and Quality, Healthcare Utilization Project Statistical Brief #303*. https://hcupus.ahrq.gov/reports/statbriefs/sb303-Comorbidities-Adult-Hospitalizations-2019.jsp

Rogstad, T. L., Gupta, S., Connolly, J., Shrank, W. H., & Roberts, E. T. (2022). Social risk adjustment in the Hospital Readmissions Reduction Program: A systematic review and implications for policy. *Health Affairs, 41*(9), 1266–1274. https://doi.org/10.1377/hlthaff.2022.00614

Shawon, M. S. R., Odutola, M., Falster, M. O., & Jorm, L. R. (2021). Patient and hospital factors associated with 30-day readmissions after coronary artery bypass graft (CABG) surgery: A systematic review and meta-analysis. *Journal of Cardiothoracic Surgery, 16*(1), 172. https://doi.org/10.1186/s13019-021-01556-1

Silvestri, D., Goutos, D., Lloren, A., Zhou, S., Zhou, G., Farietta, T., Charania, S., Herrin, J., Peltz, A., Lin, Z., & Bernheim, S. (2022). Factors associated with disparities in hospital readmission rates among US adults dually eligible for Medicare and Medicaid. *JAMA Health Forum, 3*(1), e214611. https://doi.org/10.1001/jamahealthforum.2021.4611

Thompson, M. P., Hou, H., Likosky, D. S., Pagani, F. D., Falvey, J. R., Bowles, K. H., Wadhera, R. K., & Sterling, M. R. (2024). Home health care use and outcomes after coronary artery bypass grafting among Medicare beneficiaries. *Circulation: Cardiovascular Quality and Outcomes, 17*(7), e010459. https://doi.org/10.1161/CIRCOUTCOMES.123.010459

5.4.2a Attach Conceptual Model

5565-SupplementalAttachment-Spring2026_0.pdf

5.4.3 Variable Distribution Across Measured Entities

Table 7 shows the risk variable frequencies and odds ratios for the final risk variables selected by the process described in Section 5.4.2. Risk variables are also provided within the attached data dictionary (see Tab 2). Table 7a shows the distribution of each risk variable at the hospital level.

Table 7. CABG EDAC: Frequency of ICD-10-Based Risk Variables and Adjusted OR with 95% Confidence Intervals (January 1, 2022-December 31, 2023)

Variable	Description	Frequency (%) (N=148,701)	OR (95% CI)
AGE	Age, mean (SD)	73.3 (5.1)	1.02 (1.02-1.02)
ICD-10 codes during the index admission			
IND_E8339	Other disorders of phosphorus metabolism	1.00	1.28 (1.23-1.34)
IND_I10	Essential (primary) hypertension	47.01	0.81 (0.80-0.82)
IND_I161	Hypertensive emergency	1.14	1.26 (1.20-1.31)
IND_I2109	ST elevation (STEMI) myocardial infarction involving other coronary artery of anterior wall	0.73	1.31 (1.24-1.38)
IND_I313	Pericardial effusion (noninflammatory)	0.30	1.18 (1.09-1.28)
IND_I319	Disease of pericardium, unspecified	0.60	1.12 (1.05-1.19)
IND_J189	Pneumonia, unspecified organism	1.22	1.20 (1.15-1.24)
IND_J441	Chronic obstructive pulmonary disease with (acute) exacerbation	0.62	1.29 (1.22-1.35)
IND_J449	Chronic obstructive pulmonary disease, unspecified	11.10	1.10 (1.08-1.12)
IND_K5900	Constipation, unspecified	2.62	1.08 (1.05-1.12)
IND_M1990	Unspecified osteoarthritis, unspecified site	7.70	0.86 (0.85-0.88)
IND_N170	Acute kidney failure with tubular necrosis	1.17	1.32 (1.27-1.36)
IND_N179	Acute kidney failure, unspecified	7.89	1.13 (1.11-1.15)
IND_Z6842	Body mass index [BMI] 45.0-49.9, adult	0.84	1.36 (1.30-1.42)
IND_Z7901	Long term (current) use of anticoagulants	9.27	1.22 (1.20-1.24)
IND_Z7982	Long term (current) use of aspirin	48.95	0.82 (0.81-0.83)
IND_Z79899	Other long term (current) drug therapy	34.06	0.85 (0.84-0.86)
IND_Z87891	Personal history of nicotine dependence	32.91	0.89 (0.88-0.90)
IND_Z9114	Patient's other noncompliance with medication regimen	0.45	1.18 (1.10-1.27)
ICD-10 codes in the 12 months prior to admission			
PRE_D649	Anemia, unspecified	12.54	1.13 (1.11-1.14)
PRE_E1140	Type 2 diabetes mellitus with diabetic neuropathy, unspecified	7.55	1.17 (1.15-1.19)
PRE_E1169	Type 2 diabetes mellitus with other specified complication	8.93	0.98 (0.96-1.00)
PRE_E860	Dehydration	3.36	1.17 (1.14-1.20)
PRE_I081	Rheumatic disorders of both mitral and tricuspid valves	3.60	0.96 (0.93-0.98)

Variable	Description	Frequency (%) (N=148,701)	OR (95% CI)
PRE_I160	Hypertensive urgency	3.17	1.20 (1.17-1.23)
PRE_I739	Peripheral vascular disease, unspecified	14.36	1.08 (1.06-1.09)
PRE_I959	Hypotension, unspecified	3.82	1.14 (1.12-1.17)
PRE_J449	Chronic obstructive pulmonary disease, unspecified	13.50	1.26 (1.24-1.28)
PRE_N289	Disorder of kidney and ureter, unspecified	2.96	1.01 (0.98-1.04)
PRE_R059	Cough, unspecified	10.08	1.12 (1.11-1.14)
PRE_R0602	Shortness of breath	37.62	1.11 (1.10-1.13)
PRE_R109	Unspecified abdominal pain	7.59	1.19 (1.17-1.21)
PRE_R300	Dysuria	3.10	1.02 (0.99-1.05)
PRE_Z0000	Encounter for general adult medical examination without abnormal findings	26.32	0.95 (0.94-0.96)
PRE_Z125	Encounter for screening for malignant neoplasm of prostate	11.05	0.95 (0.93-0.97)
ICD-10 codes either during the index admission or 12 months prior to admission			
E1151	Type 2 diabetes mellitus with diabetic peripheral angiopathy without gangrene	12.28	1.08 (1.07-1.10)
E1165	Type 2 diabetes mellitus with hyperglycemia	26.84	1.11 (1.10-1.13)
E6601	Morbid (severe) obesity due to excess calories	11.20	1.15 (1.13-1.17)
E871	Hypo-osmolality and hyponatremia	8.22	1.21 (1.19-1.23)
I130	Hypertensive heart and chronic kidney disease with heart failure and stage 1 through stage 4 chronic kidney disease, or unspecified chronic kidney disease	12.46	1.25 (1.23-1.27)
I25118	Atherosclerotic heart disease of native coronary artery with other forms of angina pectoris	32.50	0.91 (0.90-0.93)
Z6841	Body mass index [BMI] 40.0-44.9, adult	4.74	1.23 (1.20-1.26)
Other risk variables			
MCCFI	MCC Frailty	11.72	1.27 (1.25-1.29)
MALE	Male	74.40	0.81 (0.80-0.82)
HX_SHOCK	Cardiogenic Shock	7.80	1.32 (1.29-1.34)
MA	MA (versus FFS)	51.35	1.10 (1.08-1.11)

Table 7a: CABG EDAC: Hospital-Level Distribution of Risk Variables (Hospitals with >= 25 admissions, N=966)

Variable	Mean	Std Dev	Median	25th Percentile	75th Percentile	Min	Max
AGE	73	1	73	73	74	70	76
Variable	**Mean (%)**	**Std Dev (%)**	**Median (%)**	**25th Percentile (%)**	**75th Percentile (%)**	**Min (%)**	**Max (%)**

E1151	12.4	6.2	11.4	8.4	14.9	0	42.3
E1165	26.4	9.5	25	19.6	32.3	6.2	62.9
E6601	11.2	4.8	10.8	8	13.8	0	37.1
E871	8.4	4.8	7.5	5.5	10.5	0	35.8
I130	12.2	6.5	11.1	7.9	15.4	0	67.3
I25118	31	13.4	30	21.1	40.2	0	85.2
IND_E8339	1.2	2	0.4	0	1.5	0	24.2
IND_I10	47.1	11.3	48.6	40.5	54.9	7	82.7
IND_I161	1.3	1.5	0.9	0	1.8	0	11.5
IND_I2109	0.8	1.1	0.5	0	1.2	0	11.9
IND_I313	0.3	0.9	0	0	0.4	0	9.2
IND_I319	0.6	1.1	0	0	0.9	0	9.5
IND_J189	1.4	1.9	0.9	0	2	0	17
IND_J441	0.7	1.1	0	0	1	0	9.6
IND_J449	11.5	6.1	10.6	7.3	14.5	0	47.2
IND_K5900	2.9	3.2	2	0.8	3.9	0	25.4
IND_M1990	7.6	6.5	5.9	3	10.6	0	48.3
IND_N170	1.4	2.3	0.7	0	1.8	0	32.1
IND_N179	8.5	6.6	6.8	4.1	10.8	0	47.4
IND_Z6842	0.9	1	0.7	0	1.3	0	7.7
IND_Z7901	9.3	4.4	9	6.2	11.9	0	38.8
IND_Z7982	48.4	16.4	51	38.9	59.6	0	87.9
IND_Z79899	33.7	26.4	33.3	6.7	55.9	0	94.6
IND_Z87891	32.5	8.5	32.6	27.4	38	0	65.7
IND_Z9114	0.5	0.8	0	0	0.8	0	6.9
PRE_D649	12.4	4.8	12.2	9.2	14.9	0	34.5
PRE_E1140	7.6	3.4	7.3	5.3	9.6	0	22.2
PRE_E1169	9.1	7.2	6.9	4.3	11.2	0	42.5
PRE_E860	3.4	2.1	3.1	2	4.6	0	14.3
PRE_I081	3.5	3.9	2.6	1.1	4.8	0	56.9
PRE_I160	3.1	2.5	2.7	1.6	4.3	0	24.5
PRE_I739	14.3	5.9	13.8	10.1	17.4	1.4	51.6
PRE_I959	3.6	2.4	3.3	2	4.7	0	21.6
PRE_J449	13.5	5.9	12.9	9.5	16.9	0	46.3
PRE_N289	2.9	2	2.7	1.6	4	0	17.9
PRE_R059	10	3.9	9.7	7.5	12.1	0	41.5
PRE_R0602	37.6	10.3	36.8	30.8	43.8	11.5	84.1
PRE_R109	7.8	3.5	7.4	5.3	9.5	0	25.9
PRE_R300	3.2	2.1	2.9	1.8	4.2	0	15.4
PRE_Z0000	25.7	9.8	25	19	31.7	1.4	65.6

PRE_Z125	11.1	6.7	10.3	5.9	14.9	0	37
Z6841	4.7	2.6	4.4	2.9	6.2	0	17.1

5.4.3a Attach Descriptive Statistics for Risk/Case-mix Variables

5565-SupplementalAttachment-Spring2026_1.pdf

5.4.4 Risk/Case-Mix Adjustment Modeling and/or Stratification Results

Table 7 shows the risk variable frequencies and odds ratios for the final risk variables selected by the process described in Section 5.4.2. Risk variables are also provided within the attached data dictionary (see Tab 2).

Economic Disadvantage

Because our risk variable selection process (see Section 5.4.2) used an empirical approach based on individual ICD-10 codes related to a patients' clinical status at admission and in the 12 months prior to admission, we separately considered dual eligibility and the relationships between clinical variables and dual eligibility.

To understand the incremental impact of the dual eligible (DE) variable on the CABG EDAC measure, we assessed the following: prevalence among the cohort and among hospitals, unadjusted outcome rates, association with the unadjusted outcome, odds ratios in a bivariate and multivariable model, model calibration, and impact on measure scores. Each analysis is described in more detail below. All analyses used the CY2022/2023 dataset (two years of Medicare Advantage (MA)+Fee-for-Service (FFS) data, January 1, 2022-December 31, 2023).

As shown in Table 8, 7.2% of admissions for patients hospitalized for an isolated CABG procedure were dually eligible and mean unadjusted days in acute care were higher for admissions for patients with vs. without the DE variable (150 vs. 91, respectively). At the hospital level, the median proportion of admissions for patients with the DE variable was 5.2%, among the 1,114 hospitals with at least one qualifying inpatient admission (25^{th} percentile, 2.8%, 75^{th} percentile, 9.7%)

Bivariate odds ratios for admissions for patients with and without the DE variable (not adjusting for other covariates) show higher odds of EDAC for dually eligible patients (1.46 [95% CI: 1.43-1.48], however the risk is attenuated after the addition of the other risk variables in the model (1.30 [95% CI: 1.28-1.32], demonstrating the overlap between the DE variable and the clinical risk variables in the final model.

We also examined model calibration for the DE variable to determine if the risk model (without including DE) performs well for admissions with and without the DE variable (see Figure 6 in the Supplemental Attachment). The results show that the model is well-calibrated for both sets of admissions.

Table 8. CABG EDAC: Proportion of Admissions and Unadjusted Outcomes for Admissions with vs. without Dual Eligibility (January 1, 2022 - December 31, 2023, N=148,701)

Variable	N	Patient Prevalence (%)	Mean Unadjusted Days in Acute Care (SD) per 100 Discharges
Dual Eligible (DE)	10,746	7.2	150 (369)
Not Dual Eligible	137,955	92.8	91 (273)

Impact on Measure Scores

While admission-level, unadjusted days in acute care for dually eligible patients are higher than for patients who are not dually eligible, we also know that the patient-level risk conferred by economic and clinical risk variables overlap. Therefore, we wanted to additionally understand the impact of the DE variable at the hospital level on the risk-adjusted CABG EDAC measure score. To do so, we calculated measure scores with and without the DE variable in the risk model and then calculated the differences in measure scores and the correlation between measure scores (Table 9 below, and Figure 7 in the Supplemental Attachment).

Results show that measure scores calculated with and without the DE variable in the risk model are highly correlated (correlation coefficient 0.9983), and differences between measure scores are very small (Table 9). We also examined the hospital-proportion of admissions of patients within the measure cohort with DE and the distribution of hospital measures scores (Figure 8 in the Supplemental Attachment) and found that the distribution of measure scores within quintiles of the hospital proportion of admissions for patients in the measure cohort with DE overlaps across quartiles. This means hospitals in the fifth quintile can perform as well as hospitals in the first through fourth quintiles, concluding that most of the impact of the DE variable is accounted for within our empirically based risk model that uses primarily clinical risk variables to adjust the measure score.

Table 9. CABG EDAC: Differences in Measure Scores and Correlation Between Measure Scores, for Measure Scores Calculated with and without Dual Eligibility (DE) (January 1, 2022-December 31, 2023)

Variable	Median Differences in Measure Scores	IQR (25^{th} percentile to 75^{th} percentile)	Pearson Correlation Coefficient
DE	**0.67**	**-0.43 to 1.38**	**0.9983 (p<0.0001)**

Conclusion

Overall, our results show that economically disadvantaged patients have a higher risk of the EDAC outcome, but that there is little impact at the hospital level on measure scores due to an empirically derived risk model which addresses most of the influence on the EDAC outcome for these patients. Patients who are dually eligible have higher unadjusted rates of the outcome, but the impact of the DE variable on measure scores is minimal: measure scores calculated with and without the DE variable are highly correlated (near 1), and differences between measure scores calculated with and without the DE variable are small. In addition, the distribution of measure scores across quintiles of the hospital proportion of admissions for patients in the cohort with DE overlap. These empiric results support the decision to not adjust the measure for the DE variable.

Adjusting for the DE variable may also mask signals that arise from systematic differences in the quality of care between hospitals serving more versus fewer dually eligible patients and would hold hospitals that serve these patient population to different standards of care. We also note that this measure is not in a pay-for-performance program.

5.4.4a Attach Risk/Case-mix Adjustment Modeling and/or Stratification Specifications

5565-SupplementalAttachment-Spring2026_2.pdf

5.4.5 Calibration and Discrimination

Methods

To assess model performance, we assessed model discrimination and calibration.

To assess discrimination, we computed two discrimination statistics, the **c-statistic** and **predictive ability**. The c-statistic is the probability that predicting the outcome is better than chance, which is a measure of how accurately a statistical model is able to distinguish between a patient with and without the outcome. Predictive ability measures the ability to distinguish high-risk subjects from low-risk subjects; therefore, for a model with good predictive ability, we would expect to see a wide range in observed outcomes between the lowest and highest deciles of predicted outcomes. To calculate the predictive ability, we calculated the range of mean acute care days between the lowest and highest predicted deciles of hospital visit probabilities.

For **model calibration**, we assessed calibration plots, with mean predicted and mean observed days in acute care plotted against deciles of predicted days in acute care. The closer the predicted days are to the observed days, the better calibrated the model is. We assess calibration for all admissions, and for important subsets: (admissions for patients with and without dual eligibility, and Medicare Advantage vs. Medicare FFS).

Results

Please see Table 10, and Figures 9 and 10 in the Supplemental Attachment for the model testing results. The results are also described below.

The c-statistic, calculated using CY2022/2023 data, was 0.650 (Table 10). Predictive ability ranged from 0.45 to 2.16 mean acute care days across predicted-risk deciles. .

Table 10. CABG EDAC: Model Testing Statistics (January 1, 2022 – December 31, 2023)

C-Statistic	Predictive Ability (Mean Acute Care Days)
0.650	0.45-2.16

Risk decile plots show that higher deciles of the predicted outcomes are associated with higher observed outcomes in both CY2022 and the CY2022/2023 dataset (Figures 9 and 10). We also found good calibration for admissions for Medicare Advantage vs. Medicare FFS beneficiaries,

and adequate calibration for admissions for patients who are dually eligible vs those who are not (please note that there is a very low proportion of non-dually eligible admissions in the cohort). Please see Figure 6 and Figure 11 in the Supplemental Attachment

5.4.5a Attach Calibration and Discrimination Testing Results

5565-SupplementalAttachment-Spring2026_3.pdf

5.4.6 Interpretation of Risk/Case-mix Factor Findings

Discrimination

The c-statistic of 0.650 indicates acceptable model discrimination for a post-discharge hospital utilization measure. The model's predictive ability, reflected in the range of mean acute care days between the lowest and highest predicted-risk deciles, indicates that the model distinguishes higher-risk patients from lower-risk patients.

Calibration

Higher deciles of predicted risk are associated with higher observed outcomes, indicating good model calibration.

Overall Interpretation

Interpreted together, these diagnostic results indicate that the risk-adjustment model adequately accounts for differences in patient characteristics, or case mix.

5.4.7 Final Approach to Address Risk Factors

Statistical risk adjustment model with risk factors

6.1.1 Current Status

Not in use

6.1.2 Current or Planned Use(s)

Public Reporting, Quality Improvement with Benchmarking (external benchmarking to multiple organizations)

6.1.4 Attributes for Accountability Use

The target population includes Medicare beneficiaries enrolled in Medicare Advantage or Fee-for-Service. The accountable entity is the hospital, and the care setting is inpatient. This EDAC measure is a risk-adjusted outcome measure that is appropriate for a range of accountability programs; the existing implemented EDAC measures are in a pay-for-reporting program. The measure is not adjusted for economic disadvantage (dual eligibility [DE]) as we have shown

empirically that there is little impact at the hospital level on measure scores due to an empirically derived risk model which addresses most of the influence on the EDAC outcome for these patients (please see Section 5.4.4). Adjusting for the DE variable may also mask signals that arise from systematic differences in the quality of care between hospitals serving more versus fewer dually eligible patients and would hold hospitals that serve these patient population to different standards of care.

6.2.1 Actions of Measured Entities to Improve Performance

Hospitals seeking to improve their performance on the CABG EDAC measure must implement comprehensive strategies that enhance discharge planning, strengthen post-discharge care coordination, and reduce unnecessary acute care utilization. Since this measure captures ED visits, observation stays, and unplanned readmissions within thirty days post-discharge, improving performance requires a patient-centered approach that focuses on proactive management of care transitions and early intervention (please see the CABG Logic Model).

Guidelines for best practice provide direction for hospitals that can lower the number of acute care days after CABG by implementing specific structural and procedural changes. For coronary artery revascularization, the 2021 ACC/AHA/SCAI guideline highlights the value of patient-centered care, which includes multidisciplinary team coordination, post-discharge care planning, and shared decision-making (Lawton et al., 2022). To avoid difficulties during recovery, the 2024 EACTS guidelines also suggest early outpatient care and standardized perioperative drug regimens (Jeppsson et al., 2024). Hospitals that put these recommendations into practice will be in a better position to cut down on unnecessary acute care days, especially if they have specialized cardiac care teams, case management systems, and easy interaction with outpatient doctors.

A robust body of research shows that hospitals can lower the number of acute care days after CABG by implementing specific interventions described below. Studies underscore the role of remote monitoring and digital follow-up platforms in reducing post-CABG acute care use. Patients who were discharged following surgery and who received virtual care and remote automated monitoring had lower rates of acute hospital utilization than those who received standard care, as well as better detection of medication errors and earlier intervention, according to the PVC-RAM-1 randomized controlled trial (McGillion et al., 2021). Similar to this, Lobdell et al. (2023) detailed a paradigm change in post-cardiac surgery treatment through remote monitoring, which enhanced adherence to care regimens and allowed for earlier detection of complications amenable to ambulatory care such as arrhythmia, surgical site pain, and superficial infections, as well as clinical deterioration. These results provide credence to the inclusion of telehealth platforms and mobile health tools connected to multidisciplinary structures of care equipped to respond to these tools in discharge procedures, particularly for high-risk patients who have little access to in-person treatment. A meta-analysis from 2025 identified effective surveillance strategies instituted within 7-14 days after discharge that included digital tools to screen for arrhythmias and telemonitoring for symptoms of heart failure (Masuda et al., 2020). Early post-discharge clinic follow up which enabled medication reconciliation, cardiovascular medication optimization, wound checks and signs of potential infections as well as evaluation of volume status, was beneficial (Mokhtassi et al., 2025). Moreover, early referral for cardiac rehabilitation has shown consistent success with both inpatient and ambulatory based programs reducing readmissions and improving long term outcomes (Lawton et al., 2022; Ogawa et al., 2021; American College of

Cardiology/American Heart Association Task Force on Performance Measures, 2018). The most impactful transitional care programs involve care coordination and multi-disciplinary management. In one study, implementation of a nurse practitioner led post-discharge intervention focused on disease management and early follow up reduced 30-day readmission rates from 14.4% to 6.8% (Chudgar et al., 2022). Given that the average readmission costs are estimated at $13,400 per episode, preventing even a modest number of readmissions results in substantial cost savings

Contextually informed education and patient engagement are equally important. Mobile health applications combining education and patient engagement greatly enhanced medication adherence and clinical outcomes for patients with coronary heart disease, including those recovering from CABG, according to a systematic study by Zhu et al. (2024). More treatment adherence and fewer complications have been associated with structured discharge education on wound care, medication use, and symptom awareness, as well as explicit directions for follow-up consultations (Akbari & Celik, 2015). According to Rahpeima et al. (2022), interdisciplinary discharge planning greatly decreased readmissions after cardiac procedures and enhanced patient adherence. Additionally, it has been demonstrated that pharmacist-led medication reconciliation at discharge lowers medication mistakes, which are a significant cause of problems following CABG (Pereira et al., 2017).

Hospitals that engage in ongoing data review and root cause analysis are better equipped to identify care gaps and refine interventions. Hospitals should prioritize providing enhanced transitional care to patients who are most at risk for post-discharge problems by using proven tools from the Society of Thoracic Surgeons (STS) risk models (Shahian et al., 2018). This type of risk stratification allows hospitals to tailor programs and surveillance intensity to the risk attributed to individuals. Joining the STS Adult Cardiac Surgery Database also makes it easier to obtain information for quality improvement and benchmark performance. Mejia et al. (2024) showed in a statewide intervention that data-driven coaching and staff training enhanced clinician involvement in QI procedures and standardized treatment protocols, thereby improving CABG outcomes. In cardiac surgery, these initiatives are in line with larger initiatives to foster accountability and lessen variability in care transitions.

The cumulative effect of these interventions is reflected in improved care coordination, reduced acute care utilization, and better patient outcomes. According to Becker et al. (2021), communication-focused discharge treatments increased patient satisfaction and decreased readmission rates. Reduced ED visits and observation stays have been associated with improved outpatient follow-up, especially when accompanied by telehealth and remote monitoring (McGillion et al., 2021; Lobdell et al., 2023). Better integration between hospital and outpatient care, longer-lasting decreases in acute care utilization, and enhanced performance on publicly available quality metrics like the Hospital Readmissions Reduction Program (HRRP) are all results of enhanced discharge procedures and patient engagement strategies.

In addition to clinical gains, the CABG EDAC measure supports health system-level impacts. According to cost-effectiveness studies, CABG prevents expensive complications and recurrent hospitalizations, which results in positive returns when combined with evidence-based post-discharge therapies (Chew et al., 2022). In order to enable a thorough assessment of hospital performance, quality assessment approaches for CABG have emphasized the significance of adding outcome indicators such as EDAC (Li et al., 2022). Studies show that when recovery is easy and supported, patients' health-related quality of life and satisfaction with care improve

(Hämäläinen et al., 2023; Lie et al., 2012). The clinical and experiential aspects of care transitions must be addressed by hospitals, according to these studies.

References

Akbari, M., & Celik, S. S. (2015). The effects of discharge training and counseling on post-discharge problems in patients undergoing coronary artery bypass graft surgery. *Iranian Journal of Nursing and Midwifery Research, 20*(4), 442–449. https://doi.org/10.4103/1735-9066.161007

American College of Cardiology/American Heart Association Task Force on Performance Measures. (2018). 2018 ACC/AHA clinical performance and quality measures for cardiac rehabilitation: A report of the American College of Cardiology/American Heart Association Task Force on Performance Measures. Journal of the American College of Cardiology. Advance online publication. https://www.acc.org/Latest-in-Cardiology/ten-points-to-remember/2018/03/28/16/17/2018-ACC-AHA-Clinical-Performance-and-Quality-Measures-for-CR?utm

Becker, C., Zumbrunn, S., Beck, K., Vincent, A., Loretz, N., Müller, J., Amacher, S. A., Schaefert, R., & Hunziker, S. (2021). Interventions to improve communication at hospital discharge and rates of readmission: A systematic review and meta-analysis. *JAMA Network Open, 4*(8), e2119346. https://doi.org/10.1001/jamanetworkopen.2021.19346

Chew, D. S., Cowper, P. A., Al-Khalidi, H., Anstrom, K. J., Daniels, M. R., Davidson-Ray, L., Li, Y., Michler, R. E., Panza, J. A., Piña, I. L., Rouleau, J. L., Velazquez, E. J., & Mark, D. B. (2022). Cost-effectiveness of coronary artery bypass surgery versus medicine in ischemic cardiomyopathy: The STICH randomized clinical trial. *Circulation, 145*(11), 819–828. https://doi.org/10.1161/CIRCULATIONAHA.121.056276

Chudgar, N. P., Zhu, R., Gray, K. D., Chiu, R., Carrera, A. D., Lang, S. J., Avgerinos, D. V., & Mack, C. A. (2022). Implementing a high-value care discharge protocol in patients undergoing CABG reduces readmission. The Annals of Thoracic Surgery, 113(4), 1112–1118. https://doi.org/10.1016/j.athoracsur.2021.07.036

Hämäläinen, L., Kohonen, M., & Laurikka, J. (2023). Health-related quality of life is improved after coronary artery bypass graft surgery: A 1-year follow-up study. *Scandinavian Cardiovascular Journal, 57*(1), 2284083. https://doi.org/10.1080/14017431.2023.2284083

Jeppsson, A., Rocca, B., Hansson, E. C., Gudbjartsson, T., James, S., Kaski, J. K., Landmesser, U., Landoni, G., Magro, P., Pan, E., Ravn, H. B., Sandner, S., Sandoval, E., Sousa Uva, M., Milojevic, M., & EACTS Scientific Document Group. (2024). 2024 EACTS guidelines on perioperative medication in adult cardiac surgery. *European Journal of Cardio-Thoracic Surgery*. https://doi.org/10.1093/ejcts/ezae355

Lawton, J. S., Tamis-Holland, J. E., Bangalore, S., Bates, E. R., Beckie, T. M., Bischoff, J. M., Bittl, J. A., Cohen, M. G., DiMaio, J. M., Don, C. W., Fremes, S. E., Gaudino, M. F., Goldberger, Z. D., Grant, M. C., Jaswal, J. B., Kurlansky, P. A., Mehran, R., Metkus, T. S., Nnacheta, L. C., … Zwischenberger, B. A. (2022). 2021 ACC/AHA/SCAI guideline for coronary artery revascularization: A report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. Journal of the American College of Cardiology,

79(2), e21–e129. https://doi.org/10.1016/j.jacc.2021.09.006

Li, Z., Shirakawa, N., Chen, A., Ji, F. H., & Liu, H. (2022). Methodology in coronary artery bypass surgery quality assessment. *Journal of Geriatric Cardiology, 19*(11), 867–875. https://doi.org/10.11909/j.issn.1671-5411.2022.11.006

Lie, I., Bunch, E. H., Smeby, N. A., Arnesen, H., & Hamilton, G. (2012). Patients' experiences with symptoms and needs in the early rehabilitation phase after coronary artery bypass grafting. *European Journal of Cardiovascular Nursing, 11*(1), 14–24. https://doi.org/10.1016/j.ejcnurse.2010.09.004

Lobdell, K. W., Crotwell, S., Watts, L. T., LeNoir, B., Frederick, J., Skipper, E. R., Russell, G. B., Habib, R., Maxey, T., & Rose, G. A. (2023). Remote monitoring following adult cardiac surgery: A paradigm shift? *JTCVS Open, 15*, 300–310. https://doi.org/10.1016/j.xjon.2023.07.003

Masuda, Y., Luo, H. D., Kang, G. S., Teoh, K. L., & Kofidis, T. (2020). Meta-analysis of the benefit of beta-blockers for the reduction of isolated atrial fibrillation incidence after cardiac surgery. JTCVS Open, 3, 66–85. https://doi.org/10.1016/j.xjon.2020.07.004

McGillion, M. H., Parlow, J., Borges, F. K., Marcucci, M., Jacka, M., Adili, A., & Sessler, D. I. (2021). Post-discharge after surgery virtual care with remote automated monitoring-1 (PVC-RAM-1) technology versus standard care: Randomised controlled trial. *BMJ, 374*, n2209. https://doi.org/10.1136/bmj.n2209

Mejia, O. A. V., Borgomoni, G. B., de Freitas, F. L., Furlán, L. S., Orlandi, B. M. M., Tiveron, M. G., Silva, P. G. M. B. E., Nakazone, M. A., Oliveira, M. A. P., Campagnucci, V. P., Normand, S. L., Dias, R. D., Jatene, F. B., & REPLICCAR Study Group. (2024). Data-driven coaching to improve statewide outcomes in CABG: Before and after interventional study. *International Journal of Surgery, 110*(5), 2535–2544. https://doi.org/10.1097/JS9.0000000000001153

Mokhtassi, S. S., Bulut, H. I., Salmasi, Y., & Khoshbin, E. (2025). Expert review of the strategies to optimize long-term outcomes after coronary artery bypass grafting. Reviews in Cardiovascular Medicine, 26(11), 39887. https://doi.org/10.31083/RCM39887

Ogawa, M., Satomi-Kobayashi, S., Yoshida, N., Tsuboi, Y., Komaki, K., Wakida, K., Gotake, Y., Izawa, K. P., Sakai, Y., & Okada, K. (2021). Effects of acute-phase multidisciplinary rehabilitation on unplanned readmissions after cardiac surgery. The Journal of Thoracic and Cardiovascular Surgery, 161(5), 1853–1860.e2. https://doi.org/10.1016/j.jtcvs.2019.11.069

Pereira, P., Kapoor, A., Sinha, A., Agarwal, S. K., Pande, S., Khanna, R., Srivastava, N., Kumar, S., Garg, N., Tewari, S., & Goel, P. (2017). Do practice gaps exist in evidence-based medication prescription at hospital discharge in patients undergoing coronary artery bypass surgery & coronary angioplasty? *Indian Journal of Medical Research, 146*(6), 722–729. https://doi.org/10.4103/ijmr.IJMR_1905_15

Rahpeima, E., Bijani, M., Karimi, S., Alkamel, A., & Dehghan, A. (2022). Effect of the implementation of interdisciplinary discharge planning on treatment adherence and readmission in patients undergoing coronary artery angioplasty. *Investigación y Educación en Enfermería,*

40(2), e08. https://doi.org/10.17533/udea.iee.v40n2e08

Shahian, D. M., Jacobs, J. P., Badhwar, V., D'Agostino, R. S., Bavaria, J. E., Prager, R. L., Kurlansky, P. A., Furnary, A. P., Rankin, J. S., Filardo, G., & Edwards, F. H. (2018). The Society of Thoracic Surgeons 2018 adult cardiac surgery risk models: Part 1—Background, design considerations, and model development. *The Annals of Thoracic Surgery, 105*(5), 1411–1418. https://doi.org/10.1016/j.athoracsur.2018.03.002

Zhu, Y., Zhao, Y., & Wu, Y. (2024). Effectiveness of mobile health applications on clinical outcomes and health behaviors in patients with coronary heart disease: A systematic review and meta-analysis. *International Journal of Nursing Sciences, 11*(2), 258–275. https://doi.org/10.1016/j.ijnss.2024.03.012

6.2.5a Potential Unintended Consequences

All quality measures have the potential for unintended consequences. Early discharge, contributing to post-discharge mortality, is a conceptual concern for readmission measures. The CABG EDAC measure mitigates this by accounting for survival time. We note that if implemented, this measure will not be in a pay-for-performance program. CMS is committed to monitoring unintended consequences, including changes in coding practice and outcomes.

7.1 Supplemental Attachment

5565-SupplementalAttachment-Spring2026_1.pdf

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