Methodology

U.S. News & World Report 2025-2026 Best Hospitals: Procedures & Conditions Ratings

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July 29, 2025

To Whom It May Concern:

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Executive Summary

This report describes the methodology underlying U.S. News & World Report's 2025-2026 Best Hospitals: Procedures & Conditions ratings of U.S. hospitals' performance in 22 benchmark procedures and conditions. Hospital ratings, for each procedure and condition we have sufficient data to produce one for, are displayed on scorecards on usnews.com.

The Procedures & Conditions ratings significantly extend the mission of Best Hospitals: Specialty Rankings to provide a decision tool that helps the public identify hospitals that best meet their needs. Since 1990, the Best Hospitals Specialty Rankings have focused on hospitals that excel in treating especially challenging inpatient diagnoses. However, a comparatively small number of patients need such hospitals compared with those who need relatively routine inpatient care. The procedures and conditions in which U.S. News began to rate hospitals in 2015 are much more typical of those needs and represent an integral part of the standard repertoire for most community hospitals. The ratings provide the public with information, using the best data sources we could locate, for consumers choosing, in consultation with their physicians, a local source of competent care.

U.S. News is committed to transparency and therefore publishes detailed descriptions of the methodologies used to rank and rate hospitals. Questions and constructive suggestions can be submitted to bhmethodology@usnews.com. The 2025-2026 ratings evaluate hospitals in the following procedures and conditions:

Abdominal aortic aneurysm repair (AAA)
Aortic valve surgery (AVR)
Back surgery (spinal fusion)
Chronic obstructive pulmonary disease (COPD)
Colon cancer surgery
Diabetes
Gynecological cancer surgery
Heart arrhythmia
Heart attack (AMI)
Heart bypass surgery (CABG)
Heart failure (CHF)
Hip fracture
Hip replacement
Kidney failure
Knee replacement
Leukemia, lymphoma & myeloma
Lung cancer surgery
Pacemaker implantation
Pneumonia

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Prostate cancer surgery
Stroke
Transcatheter aortic valve replacement (TAVR)

Unless otherwise noted, the metrics discussed on this document refer only to the ratings in cohorts cited above. Ratings in other procedures and conditions may be added over time.

More than 4,400 hospitals are assessed in at least one of the ratings cohorts, using methods developed by health researchers at U.S. News. Each hospital that meets the rating criteria is assigned to one of three overall performance bands – High Performing, As Expected (formerly Average) and Evaluated (formerly Below Average) – so that patients and families, in consultation with their physicians, can quickly identify hospitals whose performance meets or exceeds the national norm. In the 2025-2026 ratings, 1,624 hospitals received a High Performing rating in one or more procedures and conditions.

Sources of data include Medicare administrative claims, Medicare Care Compare, the American Hospital Association annual survey, publicly available data from clinical registries, and external designations.

These ratings reflect care received by patients age 65 and older. Older patients are at greater risk of poor health outcomes – they tend to have a higher incidence and severity of comorbidities upon admission and illnesses that are more advanced than those of younger patients. While the quality of care of over-65 patients is generally regarded as indicative of a hospital's capabilities, U.S. News' assessments are not necessarily applicable to younger patients.

A key aspect of our journalistic approach is our openness to feedback from diverse stakeholders, including patients, healthcare professionals, and the institutions we evaluate. We receive and welcome a steady stream of suggestions via our team inbox, bhmethodology@usnews.com, and we review and carefully consider feedback. We deeply appreciate the time and thought so many correspondents have invested in formulating these suggestions over the past year and in prior years. Our mission is to serve the best interests of patients and to do so, we, like other reputable journalists, are editorially independent of our employer's business operations. A health institution's license of a "Best Hospitals" badge or its purchase of advertising or other products from U.S. News does not affect whether or how that institution is ranked, either currently or in the future.

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Changes Implemented in 2025-2026

- **Two new ratings: Heart arrhythmia and Pacemaker implantation.** The Heart arrhythmia rating assessed each hospital's success in caring for patients hospitalized for atrial fibrillation and other cardiac arrhythmias, excluding those admitted for procedures involving the insertion of a pacemaker or similar device. The Pacemaker implantation rating measured hospitals' success in treating patients who require a pacemaker and have not previously received one.
- **Weight-based composite scoring.** The previous approach to calculating composite scores used a form of latent variable modeling known as confirmatory factor analysis (CFA). This year, a simpler, weight-based approach replaced CFA, making it easier to understand the composite score calculations.
- **Expanded use of existing quality measures and introduction of new quality measures across ratings.** Some existing outcomes were used in more cohorts than in the past. For example, a measure of prevention of outpatient procedural complications, which was previously used in gynecological cancer and prostate cancer ratings, were introduced in the knee replacement, hip replacement, and pacemaker implantation ratings this year. Three key outcome measures – rates of survival, patients discharged home, and patients recover at home – were used in all cohorts this year. New measures were included in the selected ratings. For example, "Time to intravenous thrombolytic therapy within 60 minutes" from the American Heart Association's Get With The Guidelines®–Stroke registry, are also being incorporated into stroke ratings. Some preexisting measures, including the advanced heart program measure and the prevention of prolonged hospitalization measure, were refined this year, and these changes are described in the main body of this report.
- **New ratings nomenclature.** As in the past, hospitals were assigned to one of three overall performance tiers (bands) in each cohort in which they are rated, and those in the best-performing band were labeled High Performing. The labels for the other two bands changed this year. The lowest performing hospitals, formerly labeled Below Average, were called Evaluated. Hospitals that are neither High Performing nor Evaluated were labeled As Expected instead of Average. This shift away from the term "average" is warranted because this year's Procedures & Conditions methodology does not directly compare each hospital's performance to the all-hospital average.
- **High Performing, As Expected, and Evaluated recognitions.** In each procedure or condition, 30 percent of hospitals analyzed, up to a maximum of about 500 hospitals, received High Performing designation. As a result, more patients living in more communities will be able to identify a hospital near home that's highly rated in

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the healthcare service they may require. The bottom 20% of hospitals eligible for ratings were classified as Evaluated. The remaining hospitals were classified under an As Expected rating.

- **Survival outcome measure includes claims data from Medicare Advantage (MA) beneficiaries.** In all 22 Procedures & Conditions ratings, hospitals' survival scores were calculated as a weighted average of scores in traditional Medicare beneficiaries and in patients insured by MA plans by service lines. The weights reflect the proportion of patients covered by traditional Medicare and MA plans, respectively, within each service line.
- **Refined how MedPAR data were used to calculate volume.** For all service lines except for ratings that use outpatient volume, total volume is the summation of fee-for-service (FFS) and MA volume by service line. For 5 service lines (gynecological cancer surgery, prostate cancer surgery, knee replacement, hip replacement, and pacemaker implantation) with outpatient volume, total volume is based on FFS inpatient and outpatient data, adjusted using an MA factor derived from FFS and MA comparisons.
- **A more comprehensive measure of nursing care.** Nursing care, previously measured in the ratings entirely by a measure of nurse staffing (relative to patient days), was assessed this year using a more comprehensive measure that considers both nurse staffing levels and the scores patients gave each hospital's nurses on a nationally standardized patient experience survey known as HCAHPS. Additionally, hospitals that reported 2.4 or more full-time-equivalent registered nurses on staff per 1,000 adjusted patient-days received the maximum normalized score (i.e., full credit) on this measure. Previously, the cap was approximately 3.0 FTE nurses per 1,000 days.
- **Comorbidity risk adjustment.** Using criteria from the Elixhauser Comorbidity Software Refined for ICD-10-CM (version v2025.1), risk adjustment of all inpatient outcome measures in all cohorts employed a set of 38 comorbidities. Documentation describing v2025.1 of the Elixhauser software is publicly available at hcup-us.ahrq.gov.
- **Updates to the prevention of outpatient complications measure.** Version 1.2 of Solventum's Ambulatory Potentially Preventable Complications (AM-PPC) logic was implemented, along with corresponding updates to the Procedure Subgroups (PSGs) and AM-PPC methodologies. Further details are provided at https://www.solventum.com/en-us/home/health-information-technology/solutions/am-ppc/.
- **Denominator refinement of the prevention of prolonged hospitalization outcome.** Patients who died during hospitalization were excluded from the denominator. The threshold for prolonged stay is defined as the greater of the 75th

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percentile value or a 3-day stay. Previously, the 75th percentile value was used as a threshold.

- **Refined ratings eligibility criteria**. (1) Hospitals must have a minimum inpatient volume of 15 to be considered for ratings, except in gynecological cancer ratings, where the combined inpatient and outpatient volume must exceed 15; (2) Hospitals must have at least one fee-for-service case during the analytic period - five calendar years for volume and the defined surveillance period for survival outcome (Appendix F); (3) Hospitals must have non-missing data for the majority of applicable outcomes to be eligible for a rating.
- **Metastatic cancer cases excluded from Orthopedics related ratings.** To improve homogeneity of the Orthopedics-related cohorts, admissions with a principal diagnosis of metastatic cancer were excluded from the denominator. This change did not affect the knee replacement and hip replacement ratings, as these already included only relevant principal diagnoses. However, a small number of patients were removed from the back surgery (spinal fusion) and hip fracture cohorts as a result.

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INTRODUCTION

First published in 2015, Best Hospitals: Procedures & Conditions is a key component of the U.S. News & World Report suite of healthcare consumer decision-support tools. For 2025-2026, hospitals are rated in 22 common inpatient procedures and conditions:

Abdominal aortic aneurysm repair (AAA)
Aortic valve surgery (AVR)
Back surgery (spinal fusion)
Chronic obstructive pulmonary disease (COPD)
Colon cancer surgery
Diabetes
Gynecological cancer surgery
Heart arrhythmia
Heart attack (AMI)
Heart bypass surgery (CABG)
Heart failure (CHF)
Hip fracture
Hip replacement
Kidney failure
Knee replacement
Leukemia, lymphoma & myeloma
Lung cancer surgery
Pacemaker implantation
Pneumonia
Prostate cancer surgery
Stroke
Transcatheter aortic valve replacement (TAVR)

Although these procedures and conditions are services common to community hospitals, many studies demonstrate wide variability between hospitals in the quality of the care they provide. Access to information about the performance of local hospitals enables patients, in consultation with their physicians, to better select hospitals that are the most likely to offer better, safer care.

By focusing on a large number of patients with relatively straightforward needs, these ratings complement the Best Hospitals specialty rankings published annually by U.S. News since 1990. Those rankings identify facilities with demonstrable ability to handle a much smaller but far more challenging patient population of difficult and high-risk cases.

Quality of care has no ready definition or definitive metric, and there is no consensus on the best way to measure it. Some of its aspects are readily quantifiable while others are more challenging

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to measure. Moreover, what matters to one patient, such as reported levels of patient satisfaction, may be of little concern to another patient, who might prioritize rates of survival or complications. In addition to offering an overall rating, we publish ratings for the individual elements that make up the overall rating.

Domains of Quality

Like the Best Hospitals specialty rankings, the Procedures & Conditions ratings use the Donabedian paradigm, which reflects the relationships between structure, process, and outcomes. Avedis Donabedian described this now widely accepted dynamic in 1966[1], which is applied to hospital care as follows:

- *Structure* refers to hospital resources connected with patient care, such as number of patients and accreditations and certifications by outside organizations.
- *Process* refers to the way in which diagnoses, treatments, and practices to avoid harm to patients are rendered – whether steps known to be effective in preventing infections and medical errors, for example, are built into hospital routine.
- *Outcomes* refers to the results of care, including death, harm to patients, preventable readmissions, unusually long hospitalizations, and other consequences.

Failing to acknowledge the influence of random variation in quality metrics can produce results that misleadingly identify one hospital as superior or inferior to another. The methodology for the Procedures & Conditions ratings takes into account not only how each hospital performs on different measures but also the level of statistical certainty of those performance metrics. Larger sample sizes produce higher statistical confidence, which can result in a high-volume hospital with modestly above average results being rated more highly than a low-volume hospital with comparatively better observed results. This is because the second hospital's performance is more likely due to chance.

An important goal of the methodology is to give patients a clear bottom line. Despite the complexity of the measurement issues and the usefulness of particular types of information such as death and readmission rates, patients deserve an overall conclusion: How well does a hospital perform in a specific procedure or condition, like heart bypass surgery, compared to other hospitals? These ratings aggregate the measures in each cohort of care into an overall assessment by placing a hospital into one of three composite bands: High Performing, As Expected, and Evaluated.

[1] Donabedian, A. 1966. Milbank Memorial Fund Quarterly. Evaluating the Quality of Medical Care. 44(3), Part 2, 166-206. doi: 10.2307/3348969. https://www.jstor.org/stable/3348969?seq=1

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Data Sources

1. **Publicly available measures**. Measures of performance are obtained from the public websites of Care Compare maintained by the Centers for Medicare & Medicaid Services (CMS), the Society of Thoracic Surgeons (STS), the American Heart Association (notably abbreviated GWTG in this document, to refer to their Get With The Guidelines® program), the American College of Cardiology (ACC), Foundation for the Accreditation of Cellular Therapy (FACT), and the National Cancer Institute (NCI).

2. **Medicare Beneficiary Summary Files (MBSF).** Administered by CMS, the Medicare beneficiary summary files contain demographic and coverage information pertaining to Medicare beneficiaries. All data are de-identified prior to being provided to U.S. News.

3. **Medicare Inpatient Limited Data Set Standard Analytical Files (LDS SAF).** Administered by CMS, the Inpatient LDS SAF contain inpatient hospitalization claims filed on behalf of patients enrolled in traditional Medicare. The LDS SAF provides a thorough administrative record for each patient across all inpatient encounters related to an episode of care. All data are de-identified prior to being provided to U.S. News.

4. **Medicare Outpatient Limited Data Set Standard Analytical Files.** The Outpatient LDS SAF contain final action claims filed by institutional providers for outpatient services covered by the Medicare Part B benefit. As with the other LDS SAF, all data are de-identified prior to being provided to U.S. News. Data from these files are used to determine the volume and complication rates of procedures performed in the outpatient setting by each hospital in the knee replacement, hip replacement, prostate cancer surgery, gynecological cancer surgery, and pacemaker implantation cohorts. Additionally, the data is used to identify patients who were first seen in an emergency department, then transferred and admitted to another hospital, and whether patients received reperfusion therapy following their stroke diagnosis. The analysis uses both the Base Files, which contain the base claim record and header information, as well as the Revenue Center Files, which contain line level HCPCS codes for each procedure.

5. **Medicare Provider Analysis and Review (MedPAR) Limited Data Set (LDS).** Data contains inpatient claims for both Medicare fee-for-service beneficiaries and certain Medicare Advantage beneficiaries - "information only" claims for MA beneficiaries submitted by facilities for calculation of disproportionate share (DSH), indirect medical education (IME) and graduate medical education (GME) payments. CMS administers the MedPAR LDS file. All data are de-identified prior to being provided to U.S. News.

6. **Medicare Skilled Nursing Facility (SNF) Limited Data Set Standard Analytical Files.** The SNF LDS SAF contain final action claims filed by institutional providers for

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skilled nursing facility services covered by the Medicare Part A benefit. As with the other LDS SAF, all data are de-identified prior to being provided to U.S. News. Data from these files are used to augment information on discharge, admission, and time at home.

7. **American Hospital Association (AHA) Annual Survey.** Through its Health Forum arm, the AHA surveys all U.S. hospitals annually (including AHA nonmembers) to obtain operational and clinically relevant information, such as types and levels of staffing. The collected data is the most complete of its kind available on U.S. hospitals.

8. **Hospital Consumer Assessment of Healthcare Providers and Systems Survey (HCAHPS)**. The federal government releases quarterly results of ongoing surveys of recently discharged inpatients conducted by more than 4,000 hospitals. The Procedures & Conditions ratings incorporate overall patient satisfaction scores and patient experience scores with nursing care into the methodology. The overall scores comprise a rolling 12-month assessment of inpatients' opinions about their stay in various respects such as staff communication, treatment of pain and overall opinion of the hospital. Patient experience with nursing care is examined using 3 survey questions, and this measure is used to calculate a part of the nurse staffing and communication measure. Other HCAHPS survey results are displayed but not integrated into the ratings. Because the government aggregates HCAHPS data across each hospital, patients' opinions about their care in specific departments cannot be determined.

9. **Orthopedic Board Certification Data.** Information on physicians' board certification status in orthopedic surgery is obtained from the American Board of Orthopaedic Surgery (ABOS), the National Board of Physicians and Surgeons (NBPS), and the American Osteopathic Association (AOA), via Doximity. (Disclosure: U.S. News & World Report holds an equity interest in Doximity.)

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Eligibility Criteria and Selection of Procedures and Conditions

Procedures and conditions are selected based on the frequency of admission in the Medicare population, the ability to make hospital-to-hospital comparisons, and the presence of a sufficient degree of risk or complexity such that the quality of a hospital's performance could be important.

Table 1: *Procedures and Conditions and Number of Patient Visits by Cohort, 2019-2023**

	Estimated Medicare Volume	
	Rated Hospitals	*All Hospitals*
Abdominal aortic aneurysm repair	106,222	108,538
Aortic valve surgery	61,685	63,772
Back surgery (Spinal fusion)	440,812	442,510
Chronic obstructive pulmonary disease (COPD)	1,375,354	1,377,447
Colon cancer surgery	202,497	208,101
Diabetes	371,654	379,336
Gynecological cancer surgery‖	120,753	122,567
Heart arrhythmia	1,850,028	1,854,514
Heart attack	1,256,055	1,262,889
Heart bypass surgery	392,149	392,415
Heart failure	3,422,947	3,424,634
Hip fracture	1,320,326	1,321,896
Hip replacement‖	1,100,141	1,113,112
Kidney failure	1,383,229	1,387,874
Knee replacement‖	2,035,716	2,065,292
Leukemia, lymphoma & myeloma	265,180	271,162
Lung cancer surgery	124,179	126,529
Pacemaker implantation‖	942,900	946,982
Pneumonia	3,396,481	3,397,143
Prostate cancer surgery‖	168,213	183,201
Stroke	1,574,411	1,579,889
Transcatheter aortic valve replacement (TAVR)	369,372	369,521

* *Estimates include fee-for-service and Medicare Advantage visits.*
‖ *The volume measure also includes procedures performed on an outpatient basis.*

Table 1 above lists the procedures and conditions assessed for publication, along with Medicare volume at both rated hospitals and at all hospitals, rated and unrated. As **Table 1** shows, most Medicare patient visits in these cohorts received care at hospitals that received a rating.

Only Medicare-covered patients aged 65 or older were included in the analysis. These hospital visits are referred to simply as "visits." Visits are aggregated from multiple claims (if needed), then excluded from cohort eligibility if they are missing key information for modeling purposes, contain data that were logically inconsistent, or otherwise indicate data entry errors, i.e.:

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- The patient did not appear in the MBSF
- The patient sex was not identified
- The length of stay was greater than 365 days
- The patient date of death was prior to the admission date or relevant procedure date
- The patient had multiple dates of death
- The discharge was against medical advice

Visits from patients less than 65 years old are also excluded, because they represent a distinct population with a different medical profile than other Medicare patients.

All cohorts except for the gynecological cancer surgery cohort require hospitals to have at least 15 total inpatient visits over the five-year evaluation window to be eligible for the ratings (more on volume measure under the Structural Measure section). Gynecological cancer has a lower incidence rate compared to more common cancers such as lung and prostate cancers. Hence, for the gynecological cancer cohort, hospitals with at least 15 inpatient and outpatient combined visits are eligible for the rating. For the 2025-2026 ratings, the 5-year evaluation window spans January 2019 through December 2023 (referred to as 2019-2023 throughout this document).

Hospitals must also meet these three eligibility criteria to be rated: 1) Hospitals must have at least one Fee-For-Service (FFS) visit that qualifies for the survival outcome. In other words, they must have non-missing FFS death random effects. 2) Hospitals also must have at least one FFS visit during the 5-calendar year analytic period. For example, hospitals that started offering knee replacement surgeries near the end of our analytic period will be rated (provided they meet the other eligibility criteria mentioned earlier) if they performed at least one procedure during the mortality surveillance period and conducted at least one procedure during the 5-year analysis period. 3) Beginning with the 2025-2026 cycle, hospitals must have non-missing data for the majority of outcome measures to be eligible for rating. If a hospital is missing 50% or more of the required outcomes for a given cohort, it was not be eligible for ratings and was not assessed.

The cohorts created in this project are not identical to those created by CMS or other organizations in their performance measures. In defining inclusion and exclusion criteria, three aims are paramount for maximizing statistical and clinical accuracy:

1. **Maximal homogeneity:** patients are as alike as possible other than with regard to factors that could be adequately managed through risk-adjustment.
2. **Maximal sample size:** selection of procedure and condition cohorts is limited to those with a sufficiently large volume of care for statistical robustness and meaningfulness.
3. **Minimal coding variation:** coding definitions are relatively immune to large variations due to differences in coding practices. In considering this issue, it is particularly important to try to avoid systematic biases that might benefit particular organizations

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and encourage gaming, as opposed to random coding variations that would simply add noise and reduce precision.

These three goals are not in harmony. While (1) argues for narrowly defined patient cohorts, (2) and (3) argue for broader inclusion criteria. This dynamic factors into determining which procedures and conditions we rate.

When we rate procedures or conditions for which CMS has also developed quality measures, we largely derive cohort definitions and specifications using CMS's algorithms. However, based on our analyses and findings from scientific literature, our cohort and outcome inclusion/exclusion criteria may differ from CMS. Our aim is to mitigate any potential effect of variations in hospitals' coding practices on the homogeneity of the cohort or the results of the outcome analyses. Using procedure codes to exclude patients from a cohort or to risk-adjust may be inappropriate if the choice of code and/or procedure is within a doctor's or hospital's discretion. In such cases, exclusion or risk-adjustment by procedure code could encourage upcoding, or perversely reward a hospital for performing a higher-risk procedure when a lower-risk alternative may be indicated, such as selection of open surgery over a minimally invasive procedure.

To the extent that a hospital's use of different interventions and associated procedure codes is a reliable indicator of a patient's risk, the desire for homogeneity suggests using procedure codes for risk-adjustment or to define exclusion criteria. However, to the extent that the use of different procedures represents a hospital's decisions in treating an otherwise homogeneous group of patients, procedure codes should not be used in this way. This last issue is of particular concern, since using procedure codes in this way could encourage manipulation of data. With these considerations in mind, we define our cohorts as follows:

Procedures

Abdominal aortic aneurysm repair. This cohort includes predominantly endovascular (closed) repair of abdominal aortic aneurysm, with the exception of risk-adjusted survival, where we include open repair and adjust for approach. This cohort excludes repairs in other locations, as well as ruptured aneurysms and those with a claim admission type code of "1", indicating an emergent procedure. Patients undergoing emergent surgery typically are unable to choose which hospital they visit.

Aortic valve surgery. This cohort includes isolated open surgical aortic valve replacement and excludes concurrent coronary artery bypass. Transcatheter aortic valve therapies, which have become increasingly common since the time period covered by this analysis, are analyzed separately in the TAVR cohort, described in further detail below.

Back surgery (spinal fusion). This cohort includes thoracolumbar, lumbar, and lumbosacral spinal fusions, performed on patients with degenerative spinal conditions, and excludes spinal fractures or dislocations, spinal cord injuries, congenital or other anomalies, inflammatory

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spondylopathy, osteoporosis, and traumas, which may indicate non-elective spine surgery. The denominator also excludes cases in which the principal diagnosis codes indicate a post-back surgery visit, such as aftercare or metastatic cancer.

Colon cancer surgery. This cohort includes colon resection for colon cancer.

Gynecological cancer surgery. This cohort includes primary oophorectomy, hysterectomy, salpingectomy, and trachelectomy for ovarian or uterine cancer. The volume measure includes uterine cancer procedures performed on an outpatient basis during the analytic period.

Heart bypass surgery. This cohort includes isolated open coronary artery bypass graft (CABG) and excludes concurrent valve replacement, repair, and other significant cardiac procedures. The denominator definition is closely aligned with that of the corresponding CMS procedure-specific mortality measure.

Hip fracture. This cohort includes surgical repairs for pathologic or traumatic fractures of the hip, femoral head, or upper femur, and excludes fractures which received only medical care, minor procedures, or percutaneous interventions. The denominator also excludes visits with principal diagnosis codes indicating metastatic cancer.

Hip replacement. This cohort includes primary arthroplasty of the hip for osteoarthritis and excludes partial joint replacement, revision, concurrent fracture, and concurrent hip and knee replacement. The volume measure includes procedures performed on an outpatient basis from January 2020 through the end of the analytic period. The denominator also excludes visits with principal diagnosis codes indicating metastatic cancer.

Knee replacement. This cohort includes primary arthroplasty of the knee for osteoarthritis and excludes partial joint replacement, revision, and concurrent hip and knee replacement. The volume measure includes procedures performed on an outpatient basis during the analytic period. The denominator also excludes visits with principal diagnosis codes indicating metastatic cancer.

Lung cancer surgery. This cohort includes lobectomy, pneumonectomy, and sublobar resection, for lung cancer.

Pacemaker implantation. This cohort includes initial permanent cardiac pacemaker implantation, including leadless pacemakers. This cohort excludes visits with procedure codes indicating removal, revision, or replacement of existing pacemakers or cardiac leads. The volume measure includes procedures performed on an outpatient basis during the analytic period.

Prostate cancer surgery. This cohort includes prostatectomy, as well as resection or excision of related structures often removed during the process of prostatectomy, including bilateral seminal vesicles, vas deferens, and pelvic lymph nodes, for prostate cancer. The volume measure

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includes procedures performed on an outpatient basis during the analytic period.

TAVR. This cohort includes all approaches (e.g. transfemoral and transapical) of isolated transcatheter aortic valve replacement. This procedure has emerged in recent years as a feasible, safe, and less invasive alternative to surgical aortic valve replacement (AVR). In 2011, TAVR was approved as an alternative to AVR for high risk patients. Since then approval has expanded, and the volume of TAVR in the Medicare SAF database now eclipses that of surgical AVR.

Conditions

Heart arrhythmia. This cohort includes patients with a principal diagnosis of heart arrhythmia. It excludes congenital heart block and other conditions such as ventricular fibrillation and complete atrioventricular block, which are typically associated with higher mortality rates.

Heart Failure. This cohort includes principal nonhypertensive congestive heart failure, congestive heart failure, and certain other heart failure subgroups.

COPD. This cohort includes both principal chronic obstructive pulmonary disease and bronchiectasis and principal acute respiratory failure with secondary diagnosis of COPD with exacerbation. The denominator definition is closely aligned with that of the corresponding CMS condition-specific mortality measure.

Diabetes. This cohort includes principal Type I and Type II diabetes mellitus, as well as certain "other specified" diabetes mellitus.

Heart attack. This cohort includes principal acute myocardial infarction and excludes cardiac arrest and cardiogenic shock. The denominator definition is closely aligned with that of the corresponding CMS condition-specific mortality measure.

Kidney failure. This cohort includes principal acute kidney failure and excludes end stage renal disease indicated by diagnosis or Medicare status code as well as concurrent kidney transplant.

Leukemia, lymphoma & myeloma. This cohort includes principal leukemia, lymphoma and myeloma, as well as secondary leukemia with a principal diagnosis indicating treatment via chemotherapy.

Pneumonia. This cohort includes both isolated principal pneumonia and principal sepsis with secondary pneumonia and without a secondary severe sepsis. The denominator definition is closely aligned with that of the corresponding CMS condition-specific mortality measure.

Stroke. The stroke cohort includes principal ischemic stroke. The denominator definition is closely aligned with that of the corresponding CMS condition-specific mortality measure.

Visits that meet criteria for both a procedure and a condition cohort during the same inpatient visit are usually limited to inclusion in the procedure cohort. However, if a visit is associated with either the TAVR or AVR cohort and the CHF cohort, or a visit is associated with the

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CABG or pacemaker implantation cohort and either the heart attack or CHF cohort, the visit is included in both the procedure cohort and the condition cohort.

Inclusion of Providers and Case

No application, data submission, or other action is required for consideration of Best Hospitals for Procedures & Conditions ratings. All facilities listed in the AHA Annual Survey Database are automatically considered, whether or not they have responded to the AHA's survey.

All hospitals represented in the 2023 AHA survey were initially considered for inclusion in the ratings analysis, unless categorized on the survey by a control (CNTRL) code (40-48) indicating federal government ownership.

Hospitals were also excluded if they lacked a valid six-digit Medicare provider number (MPN) to attribute to their AHA entity. In some cases, we attributed visits from multiple MPNs to a single AHA entity. This occurred when, in the judgment of U.S. News, the AHA entity encompassed the operations of two or more clinically integrated facilities or campuses that maintained separate MPNs during any portion of the analytic period.

In the condition cohorts only, we excluded hospitals with primary service (SERV) codes indicating service types other than general acute care, tuberculosis and other respiratory diseases, and heart, from rating eligibility, except in relevant specialties. Cancer hospitals were included only for the colon cancer surgery, lung cancer surgery, gynecological cancer surgery, prostate cancer surgery, and leukemia, lymphoma & myeloma cohorts; respiratory hospitals were included only for lung cancer surgery, COPD, and pneumonia cohorts; and heart hospitals were excluded for diabetes, pneumonia, and kidney failure cohorts.

Additionally, we excluded a small number of hospitals whose fee-for-service claims and Medicare Advantage data exhibited certain unusual patterns, such as unexpectedly high prevalence of certain rare comorbidities or combinations of comorbidities. Because coding practices at those hospitals appeared to be anomalous, we concluded it was appropriate to exclude their claims from outcomes models and treat those hospitals as ineligible for the ratings.

After applying the provider-level eligibility criteria, the number of rated and assessed (rated and unrated) hospitals is shown in **Table 2.**

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Table 2: *Number of Hospitals, by Cohort*

	Rated	All
Abdominal aortic aneurysm repair	1,204	1,533
Aortic valve surgery	728	992
Back surgery (Spinal fusion)	1,728	2,010
Chronic obstructive pulmonary disease (COPD)	3,921	4,178
Colon cancer surgery	2,243	3,115
Diabetes	2,819	4,016
Gynecological cancer surgery	740	1,150
Heart arrhythmia	3,401	4,077
Heart attack	2,611	3,785
Heart bypass surgery	1,018	1,097
Heart failure	3,966	4,179
Hip fracture	2,905	3,184
Hip replacement	2,454	2,991
Kidney failure	3,495	4,126
Knee replacement	2,679	3,086
Leukemia, lymphoma & myeloma	1,802	3,112
Lung cancer surgery	1,034	1,423
Pacemaker implantation	1,954	2,288
Pneumonia	4,101	4,183
Prostate cancer surgery	1,045	1,985
Stroke	3,138	3,999
Transcatheter aortic valve replacement (TAVR)	807	837

Outcomes

Outcomes are primarily derived from the 2019-2023 LDS SAF inpatient data set, which enables us to capture and attribute them to the index hospital, even if a patient experienced that outcome outside of that hospital or at a different facility. The surveillance periods from which index visits are drawn vary, depending on the pre- and post-admission or surgery surveillance requirements specific to each measure, in order to capture the most recent data available that meet those requirements (details can be found in Appendix F).

Certain visits were excluded from outcome analyses to control for the disruptive and variable effects of the Covid-19 pandemic. A FFS visit was excluded if it: a) occurred in March 2020; b) occurred in 2020 and the patient was diagnosed with Covid-19; or c) occurred between April 1, 2020 and December 31, 2020, and the hospital in which the visit occurred experienced a Covid-19 rate higher than the national mean or 15%, whichever was lower, during the month in which the visit

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occurred. If the patient was diagnosed with Covid-19 in 2021 and onward, the visit is not excluded but is risk-adjusted instead. For MA visits, patients with Covid-19 diagnoses were excluded from 2020, and they are risk adjusted in the model starting from 2021 and onward.

Most of the claims-based outcomes are risk-adjusted using a mixed effects (hierarchical) logistic regression model (the patients recover at home outcome uses a linear mixed effect model) that controls for potential confounders, with a random intercept for hospital identity. The hospital-level random effects quantify how each hospital's intercept deviates from the overall mean. For example, a random effect of k for Hospital A implies that, on average, Hospital A's outcome differs from the grand mean across all hospitals by k units

Details on the results and performance of risk-adjustment models for each cohort are listed under "Evaluation of Risk-Adjustment Models". In all instances, hospital-specific random intercepts are treated as continuous measures in composite modeling in order to make maximum use of the information contained in the variable, and to minimize the risk of measurement error due to categorization. Categorical groupings and descriptions of hospital-specific random intercepts are displayed on scorecards. The details are listed under "Categorical Display".

In addition to SAF LDS inpatient data, MedPAR LDS data was used to include Medicare Advantage patient information to build comprehensive survival outcome measures. The survival outcome is the only measure that incorporates data from both FFS and MA patients. SAF LDS outpatient data was used, together with SAF LDS inpatient data, to construct the Prevention of outpatient procedural complications measure (as defined below).

The following claims-based and/or risk-adjusted outcomes are used in the composite models to evaluate each hospital's performance relative to others in the cohort. The weight of each outcome in each cohort is depicted under Table 7 in the "Normalization and Weighting" section. Surveillance windows for index cases are provided in parentheses after each description.

1. **Mortality within 30 days (labeled "Survival" on scorecards), all cohorts**. For traditional Medicare visits, the 30 day window begins from the procedure or intervention date for procedure cohorts, and from the admission date for condition cohorts. For Medicare Advantage visits, the 30 day window begins from the admission date. Data sources include both SAF LDS and MedPAR LDS data. Because MedPAR LDS data is available by fiscal year, and SAF LDS data is available by calendar year, the surveillance periods differ depending on the type of Medicare data used. The random effects from FFS and MA models are combined using a weighted average, where the weights are determined based on the proportion of FFS and MA data relative to the total (FFS and MA) data. If there is no MA volume (FFS volume is the total volume), only the random effects from the FFS model are used for the mortality outcome. The random effects for the mortality outcome based on FFS data must not be missing for the hospital to be rated. (FFS: 12/1/2018 - 12/1/2023; MA: 10/1/2018 - 9/30/2023)

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2. **Unplanned readmission within 30 days ("Hospital readmission prevention"), procedure cohorts and leukemia, lymphoma & myeloma cohort.** Reflects unplanned inpatient readmission within 30 days of discharge, similar to the CMS hospital-wide 30-day unplanned readmission measure definition[2]. For some cohorts, this measure may reflect additional cohort-specific criteria[3,4,5]. If random effects are missing, they are replaced with a value of 0 (no different from the overall average). (12/1/2018 - 12/1/2023)
3. **Surgical site infection ("Infection prevention"), hip replacement, knee replacement, AAA, CABG, and AVR cohorts**. Reflects development of a surgical site infection following the index procedure. Published literature[6,7,8,9,10] indicates that a careful approach to constructing claims-based infection measures can accurately identify hospitals with unusually low or high infection rates. If random effects are missing, they are replaced with a value of 0 (no different from the overall average). (12/31/2017 - 12/31/2022 for hip replacement and knee replacement, 11/1/2018 - 11/1/2023 for AAA, CABG, and AVR)
4. **Revision within 1 year ("Prevention of revision surgery"), hip replacement and knee replacement cohorts**. Reflects subsequent procedure to address problems with a joint replacement within 1 year of the original surgery. If random effects are missing, they are replaced with a value of 0 (no different from the overall average). (12/31/2017 - 12/31/2022)

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[2] Horwitz, L. I., Partovian, C., Lin, Z., Grady, J. N., Herrin, J., Conover, M., Drye, E. E. (2014). Development and use of an administrative claims measure for profiling hospital-wide performance on 30-day unplanned readmission. *Annals of Internal Medicine*, *161*(0), S66–S75. http://doi.org/10.7326/M13-3000

[3] Center for Medicare & Medicaid Services. (n.d.). *Coronary Artery Bypass Graft (CABG) Surgery 30-day readmission rate*. Measure Details. https://cmit.cms.gov/cmit/#/FamilyView?familyId=337.

[4] Center for Medicare & Medicaid Services. (n.d.). *30-Day Unplanned Readmissions for Cancer Patients*. Measure Details. https://cmit.cms.gov/cmit/#/FamilyView?familyId=4.

[5] Center for Medicare & Medicaid Services. (n.d.). *Total Hip Arthroplasty (THA) and/or Total Knee Arthroplasty (TKA) 30-day readmission rate*. Measure Details. https://cmit.cms.gov/cmit/#/FamilyView?familyId=349.

[6] Calderwood, M. S., A. Ma, Y. M. Khan, M. A. Olsen, D. W. Bratzler, D. S. Yokoe, D. C. Hooper*, et al.* "Use of Medicare Diagnosis and Procedure Codes to Improve Detection of Surgical Site Infections Following Hip Arthroplasty, Knee Arthroplasty, and Vascular Surgery." *Infect Control Hosp Epidemiol* 33, no. 1 (Jan 2012): 40-9.

[7] Letourneau, A. R., M. S. Calderwood, S. S. Huang, D. W. Bratzler, A. Ma, and D. S. Yokoe. "Harnessing Claims to Improve Detection of Surgical Site Infections Following Hysterectomy and Colorectal Surgery." *Infect Control Hosp Epidemiol* 34, no. 12 (Dec 2013): 1321-3.

[8] Calderwood, M. S., K. Kleinman, D. W. Bratzler, A. Ma, R. E. Kaganov, C. B. Bruce, E. C. Balaconis*, et al.* "Medicare Claims Can Be Used to Identify Us Hospitals with Higher Rates of Surgical Site Infection Following Vascular Surgery." *Med Care* 52, no. 10 (Oct 2014): 918-25.

[9] Calderwood, M. S., K. Kleinman, D. W. Bratzler, A. Ma, C. B. Bruce, R. E. Kaganov, C. Canning*, et al.* "Use of Medicare Claims to Identify Us Hospitals with a High Rate of Surgical Site Infection after Hip Arthroplasty." *Infect Control Hosp Epidemiol* 34, no. 1 (Jan 2013): 31-9.

[10] Calderwood, M. S., Kleinman, K., Murphy, M. V., Platt, R., Huang, S. S. "Improving Public Reporting and Data Validation for Complex Surgical Site Infections After Coronary Artery Bypass Graft Surgery and Hip Arthroplasty." Open Forum Infectious Diseases 1, no. 3 (Dec 2014).

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5. **Prolonged hospitalizations ("Prevention of prolonged hospitalization"), procedure cohorts except for back surgery (spinal fusion)**. Reflects length of stay duration in the highest quartile. The denominator excludes patients who died during hospitalization. The threshold for prolonged hospitalization is set as the greater of either the 75th percentile value or a 3-day length of stay. If random effects are missing, they are replaced with a value of 0 (no different from the overall average). (12/1/2018 - 12/1/2023)
6. **Discharge to a location other than the patient's home ("Patients discharged home"), all cohorts.** Reflects discharge to a location other than home, such as a long-term acute care facility or a different hospital. More details are provided in Appendix A. For the medical (except for leukemia, lymphoma & myeloma cohort) and fracture cohorts, the outcome is capped at the 75th percentile value. As a result, hospitals that discharge patients to skilled nursing facilities (SNFs) for rehabilitation will still be eligible for a top score in this measure, to account for the fact that rehabilitation is often an appropriate next step of care. If random effects are missing, they are replaced with a value of 0 (no different from the overall average). (12/31/2018 - 12/31/2023)
7. **Stroke on procedure date ("Prevention of stroke"), CABG, AVR, and TAVR cohorts.** Reflects stroke on the index procedure date. If random effects are missing, they are replaced with a value of 0 (no different from the overall average). (12/31/2018 - 12/31/2023)
8. **Time spent at home within 30 days of discharge ("Patients recover at home"), all cohorts.** Reflects days spent at home within the 30 days after a hospital visit. Any day that a patient was an inpatient in acute care, had an outpatient visit (including observation stay or emergency department visit), or was in a skilled nursing facility was treated as a day away from home. For the medical (except for leukemia, lymphoma & myeloma cohort) and fracture cohorts, the outcome is capped at the 75th percentile value. As a result, hospitals that discharge patients to skilled nursing facilities (SNFs) for rehabilitation will still be eligible for a top score in this measure, to account for the fact that rehabilitation is often an appropriate next step of care. If random effects are missing, they are replaced with a value of 0 (no different from the overall average). (12/1/2018 - 12/1/2023)
9. **Ambulatory potentially preventable complications ("Prevention of outpatient procedural complications"), gynecological cancer surgery, prostate cancer surgery, knee replacement, hip replacement, and pacemaker implantation cohorts.** Reflects how well the hospital prevents patients from having to visit an emergency department or being hospitalized for complications after an outpatient procedure. More details are provided in Appendix B. To minimize the impact of outliers when scoring hospitals on this measure, the outcome is capped at the 99th percentile value. (12/1/2018 - 12/1/2023)

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Process Measures

We evaluate a variety of process measures, obtained primarily from the CMS Care Compare website as well as the inpatient claims data sets. The following measures are included in the composite model for one or more cohorts. Patient Experience and Nurse Staffing and Communication measures are used in all 22 cohorts:

1. **Noninvasive breathing aid, CHF and COPD cohorts.** Percentage of patients who need assistance with breathing treated with noninvasive breathing aid, which means that the hospital uses a mask, instead of inserting a breathing tube or performing surgery, to provide respiratory support. The measure is capped at 20%, based on input from clinicians, recognizing that not all patients are appropriate candidates for noninvasive breathing aid.
2. **Patient experience, all cohorts.** Overall hospital linear mean score (variable name: H_HSP_RATING_LINEAR_SCORE) of recently discharged patient experience from the HCAHPS survey from the 4/1/2023-3/31/2024 data[11]. We use this score over the star rating because it is a continuous measure that provides more information.

   In cancer cohorts (colon cancer surgery, lung cancer surgery, gynecological cancer surgery, prostate cancer surgery, and leukemia, lymphoma & myeloma cohort), the PPS-exempt Cancer Hospital (PCH) HCAHPS dataset was used for hospitals exempt from the CMS IRF PPS. For hospitals that have multiple Medicare Provider Numbers (MPNs) in the standard HCAHPS data, we calculated the average of their HCAHPS scores.

   In the back surgery (spinal fusion), hip fracture, hip replacement, and knee replacement cohorts, HCAHPS scores were adjusted to account for the fact they tend to be higher at specialty hospitals versus general acute-care hospitals. Based on our own research and feedback from the medical community, we believe this is due to different characteristics in the patient population and not wholly the result of different outcomes. The group mean adjustment we are introducing brings the mean HCAHPS scores at specialty hospitals closer to the mean scores at general hospitals to ensure that scores are comparable across hospital service categories. The adjustment formula is as follows:

$$y_q = \max(0, x_q - \left(\frac{1 - x_q}{1 - \overline{x}_q}\right) \times (\overline{x}_q - \overline{x}_p))$$

   where y_q and x_q refer to a specialty hospital's adjusted and unadjusted HCAHPS scores, respectively; $\overline{x}_q$ is the mean score at all specialty hospitals; and $\overline{x}_p$ is the mean score at all general hospitals. As a result of this adjustment, a specialty hospital with a perfect unadjusted score will receive a perfect adjusted score, whereas a specialty hospital with an unadjusted score equal to the mean score among specialty hospitals will receive an adjusted score equal

[11] The current version of the survey is available at http://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/HospitalQualityInits/HospitalHCAHPS.html.

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to the mean score among general hospitals.

Hospitals with missing values are replaced with the overall mean. For the 2025-2026 cycle, the overall mean of patient experience was 87.5.

3. **Nurse staffing and communication.** This measure is a composite of two equally weighted subcomponents: the Nurse staffing ratio and the Patient experience with nursing care linear score (each weighted at 50%).
    - Patient experience with nursing care linear score (variable name: H_COMP_1_LINEAR_SCORE) is based on recently discharged patient experience from the HCAHPS survey from the 4/1/2023-3/31/2024 data[12]. We use this score over the star rating because it is a continuous measure that provides more information. The adjustment that was applied to the overall HCAHPS score, based on hospital type (specialty vs. general acute care), is also applied to this measure at the individual hospital level using the same formula described in item 2 above regarding patient experience. Missing values were imputed using linear regression, with the nurse staffing ratio serving as the predictor variable.
    - Nurse staffing ratio, calculated as the number of nurses involved in direct patient care at a hospital, is known to play a major role in the quality of care[13,14,15,16,17,18]. For this project, we conceptualize a nurse staffing index as a ratio reflecting inpatient and outpatient nursing. Nurse staffing index was calculated using AHA survey data from the most recent year available (i.e., the 2023 AHA survey database was used for the 2025-2026 publications). The numerator is the total number of staff (employed) registered nurses (RNs), converted to full-time equivalents (FTEs). For example, two half-time nurses add up to one FTE. Only non-supervisory nurses with an RN degree from an approved nursing school and a current state registration are included. Making sense of nurse staffing requires comparing the number of staff to the total workload.

      The two most commonly used approaches are total patient days and adjusted average daily census of patients, and we use the latter for the composite models for the Procedures & Conditions ratings, as it better conceptualizes the total workload of

[12] The current version of the survey is available at http://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/HospitalQualityInits/HospitalHCAHPS.html.

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[16] Lankshear AJ, Sheldon TA, Maynard A. (2005) Nurse Staffing and Healthcare Outcomes. Advances in Nursing Science. 28(2) (pp163-174)

[17] Hickham DH, Severance S, Feldstein A. (2003) The Effect of Health Care Working Conditions on Patient Safety. AHRQ Evidence Report/Technology Assessment (74)

[18] Needleman J, Buerhaus P, Pankratz VS, Leibson CL, Stevens SR, Harris M. (2011) Nurse Staffing and Inpatient Hospital Mortality. New England Journal of Medicine 364(11) (pp1037-1045)

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nursing, taking into account both inpatient and outpatient revenue adjusted by the number of days that the facility is open during the reporting period. The adjusted average daily census of patients obtained from the AHA survey database reflects the number of days of inpatient care plus an estimate of the volume of outpatient services, expressed in units equivalent to an inpatient day in terms of level of effort. The latter is derived by first multiplying the number of inpatient days by the ratio of outpatient revenue per outpatient visit to inpatient revenue per inpatient day (to get the number of patient days attributable to outpatient services), then adding that to the number of inpatient days. The adjusted patient days for each year is mathematically expressed as the following:[19]

$$\frac{\text{inpatient days} + \left(\text{inpatient days} \times \frac{\text{outpatient revenue}}{\text{inpatient revenue}}\right)}{\text{number of days in the reporting period}}$$

The nurse staffing index is then calculated as a ratio of FTE registered nurses divided by adjusted patient days. To validate unexpected outlier values, we asked certain hospitals to review and verify their values and, in some cases, to provide detailed staffing data; after reviewing the provided information, in some cases, we made adjustments to a hospital's nurse staffing index. To further reduce the effect of outliers, we imposed a ceiling threshold at 2.4.

4. **Board certified physicians, hip fracture, hip replacement, and knee replacement cohorts (Percentages of operations performed by board-certified orthopedic physicians).** Percentage of hip replacement, knee replacement, and hip fracture visits, respectively, performed by board-certified orthopedic surgeons. This measure accounts for both MDs and DOs. Board-certified orthopedic surgeons are identified in data provided by ABOS and AOA to Doximity prior to February 4, 2025 and self-reported by NBPS-certified orthopedic surgeons to Doximity prior to February 4, 2025. If they appear in either data source, they are recognized for this measure. Surgeons are linked to the hospitals where they operate using National Provider Identifier information on Medicare claims rather than hospital affiliations reflected in doctors' Doximity profiles. All missing percentages were imputed with 0%.
5. **Public transparency, heart attack, heart arrhythmia, heart failure, stroke, AVR, CABG, lung cancer surgery, pacemaker implantation, and TAVR cohorts.** Public transparency measures were incorporated into nine ratings, based on hospitals' public reporting status in relevant clinical registries. This is done in part to encourage all hospitals, regardless of performance, to release their data and by doing so expand the data universe. As a result, it has the advantages of allowing researchers to evaluate the results of hospital ratings, facilitating informed decision making by patients, and demonstrating a public commitment of pursuing quality improvement. **Table 3** shows which registries correspond to each cohort.

[19] This can be found in the survey code book for the AHA annual survey.

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- **American Heart Association (AHA) Get With The Guidelines® (GWTG) registry recognized hospital.** Hospitals receive credit in this measure by voluntarily reporting quality metrics to the public through websites maintained by the AHA under its GWTG quality improvement programs. In order to receive a credit, hospitals must have opted into the public reporting program and been appearing on their public reporting site by 4/30/2024.
- **American College of Cardiology (ACC) recognized hospital.** Hospitals receive credit for participating in the ACC National Cardiovascular Data Registry data-reporting initiatives if they also agreed to allow their ACC-calculated results to be publicly reported on the ACC's website by 12/27/2024. To receive credit for ACC public reporting, hospitals must have voluntarily agreed to allow data from at least one of these registries to be posted on the ACC registry website, www.CardioSmart.org/find-your-heart-a-home.
- **Society of Thoracic Surgeons (STS) recognized hospital.** Hospitals receive credit in heart bypass surgery, aortic valve surgery, and lung cancer surgery cohorts if they received scores calculated by STS that were publicly reported via the STS website by 7/26/2024. Published research by STS-affiliated researchers[20] and independent analysis by U.S. News found that hospitals that do not publicly report via STS performed worse than STS reporters on quality measures such as risk-adjusted mortality, morbidity and readmissions following heart surgery. While not establishing the direction of causality, these observed correlations between STS-mediated transparency and better outcomes support the use of transparency as an indicator of higher quality of care.[21]
- **STS/ACC TVT registry recognized hospital.** Hospitals receive credit for participating in the STS/ACC TVT Registry, created and maintained through a collaboration between STS and ACC, if they also allowed their results to be publicly reported on the registry website by 1/7/2025.

6. **Timely treatment of stroke patients, stroke cohort.** Percentage of stroke patients receiving timely treatment. This quantified how often the hospital provides time-sensitive medical intervention, specifically intravenous thrombolytic therapy, within 60 minutes or less. Data is based on publicly shared data from American Heart Association's GWTG®- Stroke registry as described in item 5 above. The ceiling threshold is set at 85%. Hospitals that do not participate in AHA's GWTG stroke registry received 0% (i.e. no credits from this measure).
7. **Restoration of blood flow, stroke cohort.** Percentage of ischemic stroke patients treated

[20] Shahian, David M., et al. "The Society of Thoracic Surgeons voluntary public reporting initiative: the first 4 years." Annals of surgery 262.3 (2015): 526-535.

[21] Data was extracted from the STS website (https://publicreporting.sts.org/) in January, 2024 and contains information up until June 2023.

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with reperfusion therapy, either with intravenous tissue plasminogen activator or mechanical thrombectomy. Relevant procedures in the inpatient setting, identified using ICD codes for alteplase administration and mechanical thrombectomy, as well as procedures in the outpatient setting (emergency department), identified with HCPCS codes for reperfusion therapy prior to inpatient admission, were used to capture the reperfusion therapy administered to stroke patients. The ceiling threshold is set at 10%.

Table 3: *Public Transparency*

Cohort	**Public Reporting Program**	**Source**
AVR	STS ACSD	Society of Thoracic Surgeons
CABG	STS ACSD	Society of Thoracic Surgeons
TAVR	STS/ACC TVT	Society of Thoracic Surgeons
Lung cancer surgery	STS GTSD	Society of Thoracic Surgeons
Heart attack	ACC NCDR*	American College of Cardiology
(either registry)	GWTG-Heart†	American Heart Association
Heart arrhythmia	ACC NCDR*	American College of Cardiology
(either registry)	GWTG-Heart†	American Heart Association
Heart failure	ACC NCDR*	American College of Cardiology
(either registry)	GWTG-Heart†	American Heart Association
Pacemaker implantation	ACC NCDR*	American College of Cardiology
(either registry)	GWTG-Heart†	American Heart Association
Stroke	GWTG-Stroke	American Heart Association

* *For ACC NCDR credit, hospital has to publicly report data in at least one of the following registries: EP Device Implant (formerly ICD), Chest Pain - MI, or CathPCI.*
† *For GWTG-Heart credit, hospital has to publicly report data in at least one of the following registries: AFib, Coronary Artery Disease, Heart Failure, or Resuscitation.*

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Structural Measures

Structural measures of health care include institutional capacity, accreditation and certification status, technological readiness, and other resources. Structural measures that have been associated with delivering high-quality care are included. The number of patients measure, referred to as volume, is included in the composite models of all 22 cohorts.

1. **Number of patients (Volume), all cohorts.** There is widespread evidence that hospitals performing a procedure more frequently get better outcomes. Volume derived from Medicare claims is therefore included as a measure. We include all visits within our analysis periods when calculating the volume measure for each cohort.

   In order to account for total knee replacement transitioning to the outpatient setting[22], we combine knee volume from the Outpatient LDS SAF with inpatient volume. We apply the same strategy for hip replacement, prostate cancer surgery, gynecological cancer surgery, and pacemaker implantation cohorts.

   For the five cohorts where outpatient volume is included, the method for calculating total volume differs from the other 17 cohorts. In the 17 cohorts without outpatient volume, total volume is the sum of Fee-for-Service volume from SAF data and Medicare Advantage volume from MedPAR data. For the five cohorts that include outpatient volume, total volume is the sum of FFS inpatient volume, MA inpatient volume, and an estimated MA-adjusted outpatient volume. This estimate is calculated by multiplying the FFS outpatient volume by a factor, which is determined by dividing the total FFS and MA inpatient volume by the FFS inpatient volume. To prevent the factor from artificially inflating the total volume, it is capped at a maximum value of 25.

   Hospitals with very low volumes – defined as fewer than 15 inpatient cases over five years for most cohorts – are not rated because their numbers are too low to establish whether the quality of care is different from average.

   In addition, in order to reduce the effect of outliers, we imposed a ceiling threshold on the volume measure. If a hospital's total volume over five years exceeded 200 cases or corresponded to greater than modified Z-score 3, whichever is higher, it's winsorized and replaced with the volume that corresponds to a modified Z-score equals 3 or 200. The formula for the modified Z-score is $0.6745(xi - \tilde{x}) / MAD$, where:

   xi: Hospital's own value

   $\tilde{x}$: The median across all hospitals

   MAD: The median absolute deviation across all hospitals

[22] Total Knee Arthroplasty (TKA) Removal from the Medicare Inpatient-Only (IPO) List and Application of the 2-Midnight Rule. (2019, January 24). MLN Matters, SE19002.

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Table 4 shows the threshold for each cohort above which volume was winsorized.

Table 4: *Winsorized Volume Threshold by Cohort*

Cohort	Winsorized Volume Threshold
Abdominal aortic aneurysm repair	200
Aortic valve surgery	200
Back surgery (Spinal fusion)	554
Chronic obstructive pulmonary disease (COPD)	877
Colon cancer surgery	200
Diabetes	245
Gynecological cancer surgery*	225
Heart arrhythmia	814
Heart attack	514
Heart bypass surgery	970
Heart failure	1,907
Hip fracture	1,332
Hip replacement*	852
Kidney failure	801
Knee replacement*	1,639
Leukemia, lymphoma & myeloma	200
Lung cancer surgery	209
Pacemaker implantation*	1,213
Pneumonia	2,070
Prostate cancer surgery*	200
Stroke	697
Transcatheter aortic valve replacement (TAVR)	1,222

* *The volume measure also includes procedures performed on an outpatient basis.*

2. **Recognized cancer center; lung cancer surgery, colon cancer surgery, gynecological cancer surgery, prostate cancer surgery, and leukemia, lymphoma & myeloma cohorts.** In five cancer cohorts, this 3-level measure identifies whether a hospital is recognized as a designated cancer center by the National Cancer Institute (NCI), a member of the American College of Surgeons (ACS) Commission on Cancer, or both. Hospitals recognized by both organizations received the highest score on this measure, those with neither received the lowest score, and those recognized by only one organization but not the other received a partial score. The NCI funds clinical trials and other advances in care, and has three classification levels. The lowest is basic cancer center, and credit is not awarded for this designation. Hospitals designated as clinical cancer centers, the second level, and comprehensive cancer centers, the highest level, as of February 13, 2025 were credited. The ACS provides tools and resources to help hospitals deliver high quality, patient-centered care. This data is sourced from the FY2023 AHA Annual Survey database (variable name:

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MAPP2).

3. **Advanced heart program, heart failure cohort**. Indicates whether a hospital provided CHF patients with either a left ventricular assist device (LVAD) implantation or a heart transplant. LVAD implantation is identified through claims submitted to the CMS using fee-for-service data. Heart transplants are credited either based on CMS claims data-when the appropriate procedure codes are present-or by verifying that the hospital has a Medicare-approved heart transplant program recognized by CMS as of 1/31/2025.
4. **Recognized cellular therapy program, leukemia, lymphoma & myeloma cohort.** Whether the hospital is certified by the Foundation for the Accreditation of Cellular Therapy (FACT) for bone marrow and tissue transplants as of February 13, 2025. Full points are given if accreditation was for either allogeneic transplants, autologous transplant, or immune effector cellular therapy.

Risk-Adjustment for Medicare Claims-Based Outcomes

When comparing outcomes between hospitals, adjusting for differences in the patients treated at each hospital is critical. A hospital with a 5% mortality rate might be superior to a hospital with a 1% mortality rate if most of the patients at the first hospital are expected to die and most of the patients at the second hospital are low risk.

We use multilevel logistic regression models to adjust for differences in case mix between hospitals. Multilevel models are a form of regression that allocates variance between variables on two or more levels. We use the empirical Bayes estimate of the hospital intercept as an estimate of each hospital's value for a given outcome. Multilevel modeling accounts for clustering of patient observations within hospitals and allows for a more precise rating of hospitals with lower patient volume and fewer outcomes.

We select covariates for inclusion in risk-adjustment models based on the literature, discussions with clinicians in relevant specialties and a causal-inference model aimed at achieving unbiased estimation of the effect of treatment at a particular hospital on a given outcome.

The causal model (Appendix C) indicates that an unbiased estimate of the effect of treatment at a given hospital as compared to a hospital selected at random from among those eligible for rating in a cohort, requires adjustment for age, sex, comorbidities, severity of index condition, socioeconomic status (SES), admission urgency, inbound transfer status, and year of admission. In certain instances, we control for the severity of the index condition (these are illustrated under the **Risk-Adjustment Variables** section). Because severity is correlated with many of the other covariates for which we adjusted, we suspect residual confounding is negligible. "Strengths and Limitations" contains further discussion of this issue.

For all outcomes analyses, inbound transfers and transfers from emergency departments are not excluded. Instead, inbound transfer status is factored into the outcomes model as a

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risk-adjustment in all 22 cohorts. Additionally, inpatient source admission code of 05 (transfer from a SNF or ICF) and visits that were determined to have been admissions from a SNF were excluded from the Patients discharged home and Patients recover at home measures (details in Appendix A). In stroke, transfers from emergency departments are risk-adjusted. For condition cohorts except for the leukemia, lymphoma & myeloma cohort (CHF, COPD, heart attack, heart arrhythmia, stroke, pneumonia, kidney failure, and diabetes), visits with outbound transfer status are excluded from the analyses.

Risk-Adjustment Variables

- **Age at admission**. Age in years was used as a continuous variable in FFS risk models, sourced from the Master Beneficiary Summary File, and as a categorical variable in MA risk models, derived from claims data.
- **Sex**. Male or female.
- **Inbound transfer status.** Transfer from the initial receiving hospital may indicate a complex case. Visits are classified as an inbound transfer if consecutive inpatient claims data show a discharge and admission for a patient between two different hospitals within 1 day[23] Additionally, for the stroke cohort, the status of transfers from the emergency department was risk-adjusted. Transfers were identified with consecutive outpatient and inpatient claims in FFS data and with the admission source code "4: Transfer from hospital (Different Facility)" in MA data, because longitudinal tracking of patients is not possible in MedPAR LDS data.
- **Year of hospital admission**. Quality of care tends to improve over time, so year-over-year risk of adverse outcomes should decrease.
- **Elixhauser comorbidities.** Comorbidities identified by Elixhauser et al[24] are highly predictive of mortality.[25] All 38 comorbidities identified with AHRQ's Elixhauser comorbidity software version 2025.1, released in November. 2024, which overlaps with the study period of 2019-2023, are individually adjusted for. A weighted comorbidity index is not used; instead, each comorbidity was included as a separate binary measure variable denoting its presence or absence. For leukemia, lymphoma & myeloma cohort, leukemia Elixhauser comorbidity flag was removed from outcome models.
- **Medicare status code**. The reason(s) why the patient is eligible for Medicare: age, disability, or end-stage renal failure. Medicare status code is conceptualized as a proxy for comorbidities. This covariate is omitted in the kidney failure cohort because this cohort

[23] Visits with admit codes (D, E, 5) or preceding discharge codes (1, 3, 4, 6, 8, 21, 50, 51, 61, 62, 63, 64, 65, 70, 81, 83, 84, 86, 87, 89, 90, 91, 92, 93, 95) indicating that the patient was received from or discharged to any location other than another acute care facility were excluded from transfer status.

[24] Elixhauser, Anne, et al. Comorbidity measures for use with administrative data. *Medical care* 36.1 (1998): 8-27.

[25] Elixhauser Comorbidity Software Refined for ICD-10-CM Healthcare Cost and Utilization Project (HCUP). November 2024. Agency for Healthcare Research and Quality, Rockville, MD. www.hcup-us.ahrq.gov/toolssoftware/comorbidityicd10/comorbidity_icd10.jsp.

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excludes kidney transplant and ESRD flagged either by diagnosis or by Medicare status.

- **Socioeconomic status**. Patients with lower incomes are typically sicker when they arrive at the hospital, and may face more challenges in obtaining or managing their care after they are discharged. This can affect their risk of death, readmission and complications. When hospitals differ by the socioeconomic status of their patients, this can create bias in comparing outcomes. Our risk-adjustment models include "dual-eligibility" as a measure of socioeconomic background, and patients who are eligible for both Medicare and Medicaid are treated as a separate risk group. For MA patients, this covariate is not included in the model due to the lack of unique patient identifiers in the MedPAR LDS data.
- **Covid-19 diagnosis.** Patients diagnosed with Covid-19 in 2021 (and onward) are risk-adjusted in all P&C outcomes models.
- **Condition cohort-specific covariates.**
    - History of mechanical ventilation, CHF and COPD cohorts (not included in MA patients' risk adjustment outcome models)
    - A binary variable indicating whether a patient had ever left against medical advice, CHF and COPD cohort (not included in MA patients' risk adjustment outcome models)
    - Heart failure with systolic dysfunction, CHF cohort
    - Respiratory failure, COPD cohort
    - A binary measure indicating whether a patient was diagnosed with acute leukemia is included in the leukemia, lymphoma & myeloma cohort.
    - As briefly illustrated above, a binary variable indicating whether a patient was transferred from an emergency department, stroke cohort (not included in MA patients' risk adjustment outcome models)
    - A binary variable indicating whether a patient had previously been diagnosed with a transient ischemic attack (TIA), stroke cohort (not included in MA patients' risk adjustment outcome models)
    - A continuous NIHSS score, stroke cohort
        - For stroke visits in which NIHSS was not recorded, it is imputed using multiple imputation, generating imputed values by fitting a linear mixed effects model with patient-level and hospital-level attributes in order to incorporate the hierarchical structure of patient-visit data
    - Binary variables indicating whether a patient had a diagnosis of ST elevation myocardial infarction (STEMI) of anterior wall, STEMI of inferior wall, or non-ST elevation myocardial infarction (NSTEMI), heart attack cohort.
    - A binary measure indicating whether a patient had a diagnosis of sepsis, pneumonia cohort
    - Binary variables indicating whether a patient was diagnosed with diabetes ketoacidosis (DKA) and hypoglycemia, diabetes cohort

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- **Surgical cohort-specific covariates.**
  - A binary variable indicating whether the operation was performed on both joints simultaneously (bilaterally), hip replacement and knee replacement cohorts.
  - A binary variable indicating approach (open or endoscopic), AAA cohort only in mortality model (in other outcome models of AAA, open approach cases are removed from the outcome model denominator).
  - A binary variable indicating diagnosis of CHF or heart attack, CABG cohort.
  - An ordinal variable indicating the type of degenerative condition (e.g., scoliosis), back surgery (spinal fusion) cohort
  - A binary variable indicating whether a patient had ovarian cancer, gynecological cancer surgery cohort.
  - A variable indicating history of stroke in the year prior to surgery, TAVR, AVR, and CABG cohorts only in the stroke outcome model.

Evaluation of Risk-Adjustment Models

The accuracy of risk-adjustment models is measured by two statistics, the C-statistic and the Hosmer-Lemeshow goodness of fit statistic. The C-statistic estimates the probability that if one subject who experienced an outcome (death, for example) and another who did not are drawn randomly from the data, the model will assign a higher probability of death to the person who died. A C-statistic of .5 indicates the model has no better than random chance at predicting the outcome. A C-statistic in the .60-.69 range indicates limited discrimination, .70-.79 indicates reasonable discrimination and above .8 indicates good discrimination.

Table 5 and Table 6 provide the C-statistics and Hosmer-Lemeshow goodness of fit statistics of outcome analyses for all cohorts for FFS data and MA data, respectively. Typically, the C-statistic for mortality models implemented using clinical data range from approximately .75-.85[26]. Our models for outcomes are generally of similar predictive quality as those based on clinical data. Our models for the hospital readmission prevention outcome and others have lower predictive power, with C-statistics similar to those in the published literature drawing on claims data. The Hosmer-Lemeshow goodness of fit statistic looks at whether the observed number of outcomes matches the expected number predicted by the model in samples of the population. As this test is not informative for samples over 25,000, we use a procedure designed to evaluate Hosmer-Lemeshow fit in large samples, in which multiple Hosmer-Lemeshow tests are conducted on small samples of the data. A Hosmer-Lemeshow test results in a p-value, which conventionally indicates likely bad fit when below 0.05 and unlikely bad fit when closer to 1. For the stroke cohort, 10 sets of fit indices are combined together using Rubin's rule after imposing multiple imputation.

[26] e.g.: Kozower, Benjamin D., et al. "STS database risk models: predictors of mortality and major morbidity for lung cancer resection." *The Annals of Thoracic Surgery* 90.3 (2010): 875-883; Hamel, Mary Beth, et al. "Surgical outcomes for patients aged 80 and older: morbidity and mortality from major noncardiac surgery." *Journal of the American Geriatrics Society* 53.3 (2005): 424-429.

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Table 5: *Predictive Accuracy of FFS Risk-adjustment Models**

Cohort	Outcome	C-statistic	Mean (min, max) of Large-sample HL Tests
AAA	Survival	0.825	0.50 (0.01,0.90)
	Patients discharged home	0.837	0.51 (0.05,0.99)
	Prevention of prolonged hospitalizations	0.797	0.28 (0.01,0.98)
	Infection prevention	0.704	0.62 (0.15,0.97)
	Hospital readmission prevention	0.672	0.52 (0.19,0.85)
AVR	Survival	0.769	0.48 (0.03,0.95)
	Patients discharged home	0.821	0.49 (0.05,0.99)
	Prevention of prolonged hospitalizations	0.807	0.36 (0.00,0.95)
	Infection prevention	0.801	0.42 (0.01,0.93)
	Prevention of stroke	0.793	0.49 (0.02,0.80)
	Hospital readmission prevention	0.653	0.47 (0.22,0.79)
Back surgery (Spinal fusion)	Survival	0.772	0.61 (0.00,0.99)
	Patients discharged home	0.792	0.57 (0.05,0.89)
	Hospital readmission prevention	0.660	0.35 (0.07,0.83)
COPD	Survival	0.765	0.58 (0.16,1.00)
	Patients discharged home	0.750	0.47 (0.07,0.89)
Colon cancer surgery	Survival	0.824	0.54 (0.23,0.92)
	Patients discharged home	0.837	0.36 (0.00,0.83)
	Prevention of prolonged hospitalizations	0.804	0.31 (0.12,0.64)
	Hospital readmission prevention	0.632	0.29 (0.00,0.90)
Diabetes	Survival	0.772	0.56 (0.01,0.99)
	Patients discharged home	0.735	0.42 (0.01,0.89)
Gynecological cancer surgery	Survival	0.820	0.69 (0.18,0.96)
	Patients discharged home	0.823	0.42 (0.10,0.83)
	Prevention of prolonged hospitalizations	0.767	0.32 (0.01,0.59)
	Hospital readmission prevention	0.649	0.38 (0.06,0.71)
Heart arrhythmia	Survival	0.824	0.51 (0.11,0.90)
	Patients discharged home	0.832	0.45 (0.07,0.85)
Heart attack	Survival	0.813	0.45 (0.01,0.91)
	Patients discharged home	0.813	0.31 (0.00,0.71)
CABG	Survival	0.794	0.51 (0.00,0.91)
	Patients discharged home	0.807	0.38 (0.11,0.80)
	Prevention of prolonged hospitalizations	0.795	0.39 (0.09,0.95)
	Infection prevention	0.826	0.39 (0.10,0.68)
	Prevention of stroke	0.741	0.53 (0.01,0.92)
	Hospital readmission prevention	0.667	0.37 (0.00,0.97)
CHF	Survival	0.715	0.38 (0.09,0.86)
	Patients discharged home	0.720	0.51 (0.04,0.91)
Hip fracture	Survival	0.774	0.46 (0.25,0.87)
	Patients discharged home	0.777	0.21 (0.00,0.92)
	Prevention of prolonged hospitalizations	0.740	0.62 (0.12,0.97)
	Hospital readmission prevention	0.640	0.31 (0.08,0.48)

Continued on next page

Table 5 – continued from previous page

Cohort	Outcome	C-statistic	Mean (min, max) of Large-sample HL Tests
Hip replacement	Survival	0.816	0.63 (0.00,1.00)
	Patients discharged home	0.819	0.50 (0.00,0.92)
	Prevention of prolonged hospitalizations	0.805	0.56 (0.00,0.79)
	Prevention of revision surgery	0.671	0.34 (0.05,0.77)
	Infection prevention	0.762	0.49 (0.04,0.89)
	Hospital readmission prevention	0.692	0.44 (0.00,0.87)
Kidney failure	Survival	0.770	0.43 (0.07,0.94)
	Patients discharged home	0.746	0.41 (0.05,0.81)
Knee replacement	Survival	0.790	0.60 (0.06,1.00)
	Patients discharged home	0.808	0.46 (0.19,0.84)
	Prevention of prolonged hospitalizations	0.784	0.51 (0.20,0.96)
	Prevention of revision surgery	0.696	0.57 (0.09,0.98)
	Infection prevention	0.793	0.50 (0.01,1.00)
	Hospital readmission prevention	0.689	0.50 (0.05,0.87)
Leukemia, lymphoma & myeloma	Survival	0.767	0.32 (0.01,0.90)
	Patients discharged home	0.808	0.30 (0.01,0.88)
	Hospital readmission prevention	0.602	0.42 (0.12,0.83)
Lung cancer surgery	Survival	0.835	0.51 (0.14,0.90)
	Patients discharged home	0.837	0.36 (0.03,0.77)
	Prevention of prolonged hospitalizations	0.774	0.39 (0.11,0.85)
	Hospital readmission prevention	0.641	0.46 (0.07,0.99)
Pacemaker implantation	Survival	0.775	0.63 (0.24,0.95)
	Patients discharged home	0.779	0.35 (0.00,0.86)
	Prevention of prolonged hospitalizations	0.763	0.45 (0.01,1.00)
	Hospital readmission prevention	0.663	0.41 (0.01,0.84)
Pneumonia	Survival	0.748	0.38 (0.05,0.75)
	Patients discharged home	0.764	0.30 (0.02,0.74)
Prostate cancer surgery	Survival	0.904	0.72 (0.41,0.97)
	Patients discharged home	0.910	0.53 (0.05,0.93)
	Prevention of prolonged hospitalizations	0.859	0.27 (0.00,0.96)
	Hospital readmission prevention	0.735	0.16 (0.00,0.71)
Stroke	Survival	0.881	0.55 (0.03,0.98)
	Patients discharged home	0.829	0.24 (0.01,0.70)
TAVR	Survival	0.743	0.44 (0.02,0.90)
	Patients discharged home	0.808	0.57 (0.13,0.88)
	Prevention of prolonged hospitalizations	0.810	0.43 (0.06,0.75)
	Prevention of stroke	0.719	0.32 (0.00,0.87)
	Hospital readmission prevention	0.651	0.55 (0.16,0.88)

* *C-statistic and Hosmer-Lemeshow goodness-of-fit statistics are not applicable to the Patients recover at home outcome, so they were excluded.*

Table 6: *Predictive Accuracy of MA Risk-adjustment Models*

Cohort	Outcome	C-statistic	Mean (min, max) of Large-sample HL Tests
Abdominal aortic aneurysm repair	Survival	0.795	0.56 (0.10,0.99)
Aortic valve surgery	Survival	0.793	0.45 (0.11,0.88)
Back surgery (Spinal fusion)	Survival	0.759	0.68 (0.20,0.99)
Chronic obstructive pulmonary disease (COPD)	Survival	0.766	0.47 (0.13,0.82)
Colon cancer surgery	Survival	0.817	0.45 (0.01,0.92)
Diabetes	Survival	0.779	0.43 (0.00,0.78)
Gynecological cancer surgery	Survival	0.819	0.52 (0.01,0.95)
Heart arrhythmia	Survival	0.806	0.35 (0.00,0.93)
Heart attack	Survival	0.786	0.43 (0.03,0.90)
Heart bypass surgery	Survival	0.771	0.49 (0.02,0.89)
Heart failure	Survival	0.714	0.54 (0.09,0.97)
Hip fracture	Survival	0.767	0.38 (0.02,0.69)
Hip replacement	Survival	0.839	0.61 (0.00,1.00)
Kidney failure	Survival	0.773	0.42 (0.05,0.97)
Knee replacement	Survival	0.801	0.59 (0.00,1.00)
Leukemia, lymphoma & myeloma	Survival	0.754	0.44 (0.01,0.93)
Lung cancer surgery	Survival	0.797	0.64 (0.20,0.95)
Pacemaker implantation	Survival	0.778	0.64 (0.35,0.91)
Pneumonia	Survival	0.750	0.58 (0.07,0.96)
Prostate cancer surgery	Survival	0.893	0.60 (0.13,0.97)
Stroke	Survival	0.873	0.45 (0.01,0.95)
Transcatheter aortic valve replacement (TAVR)	Survival	0.743	0.52 (0.00,0.91)

Construction of Composite Scores and Ratings

A major issue in constructing a composite score of quality of surgical or medical care is deciding how much weight to assign to each individual quality measure in the overall score. Some approaches, such as averaging a set of measures with equal weight on each, do not reflect the significance of each quality measure. The previous method for Procedures & Conditions ratings, which relied on confirmatory factor analysis, had some constraints as well. While it provided a data-driven approach, it offered limited flexibility for incorporating quality measures that were supported by clinical expertise and theory. As a result, the relative weights and indicators in the composite model could vary depending on the data within a surveillance period or analytical timeline.

Starting with the 2025-2026 edition, Best Hospitals: Procedures & Conditions relies on a weight-based approach similar to the method used in Best Hospitals Specialty Rankings. Weights were determined based on several factors: the availability of each quality measure, its clinical importance, its relevance to the corresponding patient cohort, and additional considerations such as the distribution of the measure and whether the measure is relatively resilient to variations in coding

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and documentation practices.

The composite score for each hospital is calculated by summing the scores from individual quality measures, each normalized and multiplied by its assigned weight within the relevant cohort. This final composite score serves as a summary of multiple quality indicators within a specific cohort. It provides patients and hospitals with a useful heuristic for evaluating the quality of care delivered for a particular condition or procedure. These scores can also be used for comparing performances across hospitals.

Normalization and Weighting

All measures are normalized using a min-max approach, which scales values based on the (observed or theoretical) minimum and maximum values in the dataset. All outcome measures use observed values when applying min-max normalization. All process and structural components are normalized using theoretical minimum and maximum values:

- Board certified physicians: The theoretical minimum value is 0%, and the theoretical maximum value is 100%.
- Noninvasive breathing aid: The theoretical minimum value is 0%, and the theoretical maximum value is a capped value, 20%.
- Number of patients: The theoretical minimum value is 1, and the theoretical maximum value is defined by the ceiling threshold and varies by cohort
- Nurse staffing ratio: The theoretical minimum value is 0, and the theoretical maximum value is defined by the ceiling threshold, 2.4.
- Patient experience and Patient experience with nursing care: both HCAHPS measures use the theoretical minimum value of 0%, and the theoretical maximum value of 100%.
- Timely treatment of stroke patients: The theoretical minimum value is 0%, and the theoretical maximum value is a capped value at 85%.
- Restoration of blood flow: The theoretical minimum value is 0%, and the theoretical maximum value is a capped value at 10%.
- Other structural, categorical measures use theoretical minimum and maximum values as well. For example, Recognized cancer center, the theoretical minimum and maximum values are 0 (not recognized by NCI nor ACS) and 2 (recognized by both NCI and ACS), respectively.

Each measure is normalized into a distribution ranging from 0 to 1. Outcome measures are normalized with the lowest observed score being normalized to 0 and the highest observed score (or a capped value if a ceiling threshold was applied) being normalized to 1 among ratings-eligible hospitals by the cohort. Structure and process measures are normalized using the theoretical minimum and maximum values specified above. After all measures are normalized, each is multiplied

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by its assigned weight, and the weighted values are summed to produce a composite score for each hospital. The specific weights for each measure by cohort are shown in **Table 7**. Outcome measures carry the heaviest weight, ranging from 57.5% to 75%.

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Table 7. Weights of Quality Measures for Hospital Composite Scores[27]									
Measure Group	**Measures**	**CHF**	**COPD**	**AMI**	**Diabetes**	**AKF**	**Pneumonia**	**Stroke**	**Heart Arrhythmia**
Outcomes	**Patients discharged home**	15	15	15	15	15	15	15	15
	Patients recover at home	15	15	15	15	15	15	15	15
	Survival	40	42.5	42.5	45	45	45	35	42.5
Process	**Noninvasive breathing aid**	2.5	2.5	0	0	0	0	0	0
	Nurse staffing and communication	5	5	5	5	5	5	5	5
	Patient experience	5	5	5	5	5	5	5	5
	Public transparency	2.5	0	2.5	0	0	0	2.5	2.5
	Restoration of blood flow	0	0	0	0	0	0	5	0
	Timely treatment of stroke patients	0	0	0	0	0	0	2.5	0
Structure	**Advanced heart program**	2.5	0	0	0	0	0	0	0
	Number of patients	12.5	15	15	15	15	15	15	15

[27] The values in each column sum to 100% for each procedure or condition.

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Table 7. Weights of Quality Measures for Hospital Composite Scores (cont.)						
Measure Group	Measures	Leukemia, lymphoma & myeloma	Colon cancer surgery	Lung cancer surgery	Gynecological cancer surgery	Prostate cancer surgery
	Hospital readmission prevention	5	5	5	5	5
	Patients discharged home	10	10	10	10	10
	Patients recover at home	10	10	10	10	10
	Prevention of outpatient procedural complications	0	0	0	5	5
	Prevention of prolonged hospitalizations	0	5	5	5	5
Outcomes	Survival	45	40	37.5	25	25
	Nurse staffing and communication	5	5	5	5	5
	Patient experience	5	5	5	5	5
Process	Public transparency	0	0	2.5	0	0
	Number of patients	15	17.5	17.5	27.5	27.5
	Recognized cancer center	2.5	2.5	2.5	2.5	2.5
Structure	Recognized cellular therapy program	2.5	0	0	0	0

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Table 7. Weights of Quality Measures for Hospital Composite Scores (cont.)						
Measure Group	**Measures**	**AAA**	**AVR**	**TAVR**	**CABG**	**Pacemaker implantation**
Outcomes	Hospital readmission prevention	5	5	5	5	5
	Infection prevention	5	5	0	5	0
	Patients discharged home	10	10	10	10	10
	Patients recover at home	10	10	10	10	10
	Prevention of outpatient procedural complications	0	0	0	0	5
	Prevention of prolonged hospitalizations	5	5	5	5	5
	Prevention of stroke	0	5	5	5	0
	Survival	35	27.5	32.5	27.5	32.5
Process	Nurse staffing and communication	5	5	5	5	5
	Patient experience	5	5	5	5	5
	Public transparency	0	2.5	2.5	2.5	2.5
Structure	Number of patients	20	20	20	20	20

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Table 7. Weights of Quality Measures for Hospital Composite Scores (cont.)					
Measure Group	**Measures**	**Hip fracture**	**Back surgery (spinal fusion)**	**Hip replacement**	**Knee replacement**
Outcomes	Hospital readmission prevention	5	10	5	5
	Infection prevention	0	0	5	5
	Patients discharged home	10	10	5	5
	Patients recover at home	10	10	5	5
	Prevention of outpatient procedural complications	0	0	5	5
	Prevention of prolonged hospitalizations	5	0	5	5
	Prevention of revision surgery	0	0	10	10
	Survival	37.5	30	17.5	17.5
Process	Board certified physicians	2.5	0	2.5	2.5
	Nurse staffing and communication	5	5	5	5
	Patient experience	5	5	5	5
Structure	Number of patients	20	30	30	30

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Hospital Ratings Assignment

We assign each rated hospital in a cohort to one of three bands: Evaluated, As Expected, or High Performing. The lesser of the top 30% of rated hospitals or the top 500 hospitals in each cohort are initially designated as High Performing. Additionally, any hospitals whose composite scores (rounded to one decimal place) match the lowest score within the initial High Performing group are also classified as High Performing.

The bottom 20% of hospitals in each cohort are classified as Evaluated. Additionally, any hospitals whose composite scores (rounded to one decimal place) match the highest score within the Evaluated group are also included in the Evaluated ratings.

All remaining hospitals are classified in the As Expected rating category.

To ensure that hospitals designated as High Performing meet rigorous national quality benchmarks, we apply additional criteria beyond the initial classification. High Performing hospitals are expected to consistently deliver superior patient outcomes across multiple metrics, with a particular focus on survival, which we deem the most important outcome.

Thus, although hospitals are initially classified as High Performing if they fall within the top 30% of all rated hospitals (up to a maximum of 500 hospitals), this designation is not automatically granted. If a hospital's overall patient survival outcome fell into the lowest performance category (labeled Poor), it did not receive the High Performing rating, regardless of its initial classification. This year, in some cohorts, several hospitals met this exclusion criterion and were therefore not awarded High Performing status.

Conversely, hospitals that were not initially classified as High Performing - because they were not in the top 30% or not among the top 500 - still received this designation if they met all of the following criteria:

1. The hospital received an initial overall performance rating of As Expected.
2. The random effects for mortality from both the fee-for-service (FFS) and Medicare Advantage (MA) data models are greater than 0, indicating better-than-average performance. If a hospital only serves FFS beneficiaries, the MA random effect may be missing and is not required.
3. The survival outcome falls within the highest performance band, labeled Excellent.
4. The majority of outcome metrics fall within the Average, Better Than Average, or Excellent performance bands.
5. The volume band must be at least Average, which means that the volume band should fall within the Average, High, or Very High bands.

Table 8 presents the distribution of ratings by cohort after applying these criteria.

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Table 8: *Ratings Distribution by Cohorts*

Cohort	High Performing	As Expected	Evaluated
Abdominal aortic aneurysm repair	365	597	242
Aortic valve surgery	223	358	147
Back surgery (Spinal fusion)	500	887	341
Chronic obstructive pulmonary disease (COPD)	512	2621	788
Colon cancer surgery	503	1289	451
Diabetes	506	1739	574
Gynecological cancer surgery	231	373	136
Heart arrhythmia	519	2192	690
Heart attack	517	1570	524
Heart bypass surgery	312	509	197
Heart failure	652	2517	797
Hip fracture	502	1817	586
Hip replacement	499	1475	480
Kidney failure	535	2247	713
Knee replacement	500	1648	531
Leukemia, lymphoma & myeloma	500	933	369
Lung cancer surgery	316	507	211
Pacemaker implantation	500	1059	395
Pneumonia	639	2627	835
Prostate cancer surgery	318	521	206
Stroke	523	1984	631
Transcatheter aortic valve replacement (TAVR)	246	399	162

Table 9 compares the number and percentage of High Performing hospitals - out of all rated hospitals - for each procedure and condition between last year's and this year's edition. This comparison reflects important changes in Procedures & Conditions methodology this year. Previously, the criteria for awarding High Performing status were more restrictive for procedural cohorts, resulting in fewer hospitals receiving this designation. Conversely, the former methodology tended to be more generous in assigning High Performing status to non-procedural (medical condition) cohorts. These differences largely stemmed from how factor scores and their standard errors were calculated using the confirmatory factor analysis (CFA) model in earlier editions.

This year, we refined our approach to provide a more balanced assessment of hospital performance. The updated methodology enables readers to more reliably identify hospitals within or near their communities that demonstrate consistently strong overall performance, with a particular emphasis on patient outcomes such as survival. By doing so, the revised approach offers a clearer, and fairer representation of high quality care across both surgical and medical cohorts.

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Table 9: Comparison of High-Performing Distributions: 2024 vs. 2025 Editions

	High performing Counts (2024)	High performing % (2024)	High performing Counts (2025)	High performing % (2025)
Abdominal aortic aneurysm repair	117	9.9%	365	30.3%
Aortic valve surgery	146	19.5%	223	30.6%
Back surgery (Spinal fusion)	185	10.8%	500	28.9%
Chronic obstructive pulmonary disease (COPD)	773	19.5%	512	13.1%
Colon cancer surgery	463	21.0%	503	22.4%
Diabetes	278	9.9%	506	17.9%
Gynecological cancer surgery	131	17.0%	231	31.2%
Heart arrhythmia			519	15.3%
Heart attack	896	34.7%	517	19.8%
Heart bypass surgery	240	23.5%	312	30.6%
Heart failure	1088	27.2%	652	16.4%
Hip fracture	232	7.9%	502	17.3%
Hip replacement	593	24.1%	499	20.3%
Kidney failure	624	17.9%	535	15.3%
Knee replacement	610	22.4%	500	18.7%
Leukemia, lymphoma & myeloma	392	21.9%	500	27.7%
Lung cancer surgery	241	24.1%	316	30.6%
Pacemaker implantation			500	25.6%
Pneumonia	722	17.5%	639	15.6%
Prostate cancer surgery	250	24.4%	318	30.4%
Stroke	582	20.0%	523	16.7%
Transcatheter aortic valve replacement (TAVR)	120	15.4%	246	30.5%

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Validation of Procedures & Conditions Ratings

The primary means of evaluating construct validity of our measurement models and resulting composite scores is a multi-trait matrix, by which we compare the relative correlations of hospital ratings across cohorts. Specifically, we hypothesize that hospital composite scores for heart bypass surgery, aortic valve surgery, and TAVR would be more closely correlated with each other than with the other procedure cohorts, and that the two cardiac surgeries would be least correlated with the condition cohorts. Similarly, we hypothesize that hip replacement and knee replacement ratings would be highly intercorrelated, and less well correlated with other procedures, and that they, like the cardiac surgeries, would be least correlated with condition cohorts. Finally we hypothesize that composite scores among condition cohorts would be strongly intercorrelated, and less well correlated with procedure ratings. The correlations align with our expectations, and they provide strong evidence of construct validity. We also hypothesize that hospitals who are ranked (i.e. perform extremely well) in specialty care would more often be rated High Performing in related Procedures & Conditions cohorts.

We further investigate validity by examining concordance of the CABG and AVR ratings with ratings published by Society of Thoracic Surgeons (STS). The U.S. News and STS ratings cover different time periods and patient populations. The U.S. News ratings are based on three domains of quality, while the STS ratings do not use structural indicators. U.S. News and STS use different statistical models to generate composite scores and assign performance ratings for cardiac surgery at the hospital level. Despite these methodological differences, there remains a modest correlation between the two rating systems, with only a small number of hospitals showing discordant ratings. The results of this comparative analysis are presented in **Table 10** and **Table 11**.

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Table 10: *Concordance With ACSD Aortic Valve Surgery Star Rating*

	ACSD Star Rating			
	1	2	3	Not Reported
Evaluated	3	68	0	76
As Expected	0	282	3	73
High Performing	2	173	23	25

Table 11: *Concordance With ACSD Heart Bypass Surgery Star Rating*

	ACSD Star Rating			
	1	2	3	Not Reported
Evaluated	19	41	0	137
As Expected	34	296	42	137
High Performing	3	135	155	19

We further evaluate the validity of the stroke ratings. Here, we evaluate the results of outcomes models, with or without stroke severity risk adjustment. The NIHSS score, which quantifies stroke severity on a numeric scale from 0 to 42, is widely used for risk-adjustment. Studies demonstrate that the NIHSS score has a strong association with patient condition, and potentially could improve model discrimination and performance.[28] Indeed, **Table 12** shows that the inclusion of a NIHSS score covariate improved model fit appreciably.

One challenge is the scarcity of the NIHSS score in claims data. Among all ischemic stroke visits between 2019 to 2023, only 62.8% document this score. Our examination of claims data suggests that the availability of the NIHSS score is highly associated with hospital-, patient-, and visit-level attributes; in other words, the reasons for missing data are not completely random and cannot be ignored. Consequently, analyses based on complete cases or case-wise deletion may cause substantial bias. We instead choose to impute the missing NIHSS score, generating imputed values by fitting a hierarchical linear regression with hospital-level random effects. This modeling strategy is considered a superior strategy for handling missing data.[29]

[28] Fonarow, G. C., Pan, W., Saver, J. L., Smith, E. E., Reeves, M. J., Broderick, J. P., Kleindorfer, D. O., Sacco, R. L., Olson, D. M., Hernandez, A. F., Peterson, E. D., & Schwamm, L. H. (2012). Comparison of 30-day mortality models for profiling hospital performance in acute ischemic stroke with vs without adjustment for stroke severity. JAMA, 308(3), 257–264. https://doi.org/10.1001/jama.2012.7870

[29] Lall, R. (2017). How Multiple Imputation Makes a Difference. Political Analysis, 24(4), 414-433.

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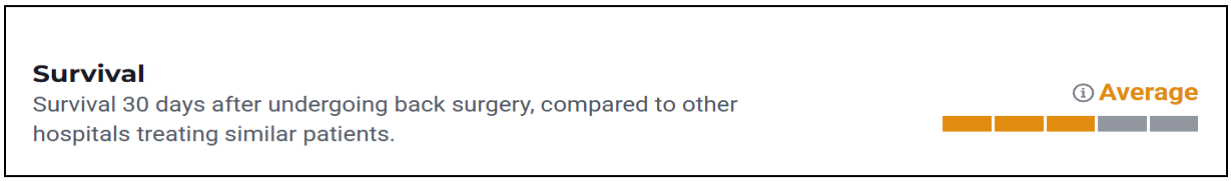
Table 12: *C-statistics of Stroke Risk Models*

	w/o NIHSS risk adjustment	w/ NIHSS risk adjustment
Patients discharged home	0.80	0.83
Survival	0.79	0.88

Categorical Display

When calculating hospital-level composite scores, we use the continuous form of each measure when possible. For the purpose of making information more accessible for patients, we display categorical groupings (bands) and descriptions of each continuous outcome or process measure on scorecards. See an example of the survival band below for the back surgery (fusion) cohort.



Our approach to estimating each hospital's *outcome* band falls under the general rubric of statistical significance testing. This band is reflective of a hospital's estimated risk-adjusted value on the outcome compared to other hospitals, as well as its Medicare claims volume and the incidence of that outcome. We compare each hospital's risk-adjusted outcome value to a normal distribution, taking into account both the point estimate and the precision—the greater a hospital's volume, the more certain we are of its estimated outcome value.

In other words, we determine display categories based on the confidence level of each hospital's differences from the mean by measure and by cohort. A hospital falls into the Average band if its performance is not statistically different from the mean at the 75% confidence level. If a hospital performs better than the average with at least 75% confidence, it is classified in the Better than Average band. And if the confidence level reaches 90%, it is placed in the Excellent band. Conversely, hospitals with statistically worse performance fall into the Worse than Average and Poor bands, which mirror the thresholds used for Better than Average and Excellent bands. Because these categories are determined by statistical significance rather than absolute values, **the cutoff points vary by hospital and by measure.**

doi:10.1093/pan/mpw020

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For rare outcomes, such as death after knee replacement, relatively few hospitals have a rate designating it as above average. The bands displayed provide a heuristic for each underlying continuous metric we use to evaluate a hospital's performance.

One exception is Prevention of outpatient procedural complications outcome. In the Procedures & Conditions, we use predefined thresholds to classify hospitals into five categorical bands. For the Specialty rankings, hospitals are grouped into five bands based on quintiles.

Strengths and Limitations

Our study makes use of many data sets, which allow us to consider indicators from most, if not all, domains relevant to hospital quality measurement. We employ statistical procedures that simultaneously minimize measurement error and empirically combine indicators to maximize quality measurement validity. We conduct extensive research on the validity of our results, including using multitrait matrices and comparing with external data sets, and we benefit from input from diverse stakeholders, including patients, health service researchers, clinicians, and hospital leaders.

Quality measurement derived from the Medicare population is generally believed to be representative of what would emerge from the overall population, and affords sufficient statistical power to distinguish between providers, even when procedures may be relatively rare. The LDS SAF and LDS MedPAR data imperfectly mirror the overall hospital inpatient population because, other than those with disabilities or end-stage kidney disease, Medicare members in the analysis are age 65 and older. However, these data are widely used in academic literature to permit meaningful comparisons of rates of death, complications, readmission, infection and other outcomes on a like-to-like basis across most hospitals. How these older patients fare represents a test of hospital performance that is more revealing than results would be from a population that includes younger and healthier patients. Broad "all-payer" data that would permit such an evaluation for all hospitals, moreover, is unavailable, and the population tracked is large and clearly defined.

A noteworthy limitation of the ratings is that the outcome indicators rely on administrative data, which could lead to bias in several ways. As previously discussed, controlling for severity of the index condition is required to achieve adequate case-mix adjustment. We believe we have largely mitigated this problem by adjusting for a number of variables that are correlated with severity of the index condition, such as transfer status and urgency of admission, and by using other statistical procedures that account for measurement error. It is possible, however, that our results are biased by residual confounding. Similarly, ascertainment of some outcomes, e.g. stroke or surgical-site infection, requires accurate coding across hospitals.[30] Prior studies have demonstrated, for example, that capturing stroke with different coding algorithms in administrative data results in a tradeoff

[30] Calderwood, M. S., A. Ma, Y. M. Khan, M. A. Olsen, D. W. Bratzler, D. S. Yokoe, D. C. Hooper, et al. "Use of Medicare Diagnosis and Procedure Codes to Improve Detection of Surgical Site Infections Following Hip Arthroplasty, Knee Arthroplasty, and Vascular Surgery." Infect Control Hosp Epidemiol 33, no. 1 (Jan 2012): 40-9.

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between sensitivity and specificity.[31] Differences in claims coding practices could result in bias.

Another issue is our use of data sets with incomplete hospital-level data. Some of the reported data sets may have robust data for hospitals participating in the related programs, but only have a limited set of hospitals participating (or with data made available). Not all hospitals, for example, have HCAHPS overall scores via Care Compare. We use imputation methods to address incomplete data. For example, for risk-adjusted outcome measures, missing values are imputed using values that represent either the grand mean of hospital performance by the model. While it is not possible to guarantee that the assumptions underlying these imputations are fully met, this approach helps maintain consistency across analyses and reduces potential bias introduced by excluding hospitals with incomplete data.

Future Opportunities

Like healthcare delivery itself, quality measurement warrants continuous improvement. Among the opportunities we recognize to improve this methodology, those that stand out include: further incorporation of outpatient claims data, particularly for services such as many orthopedic procedures that are increasingly performed in outpatient setting; analysis of additional procedures and conditions, to provide decision support to more patients; and the development of additional candidate measures, including a larger portfolio of risk-adjusted outcome measures and additional measures of process, appropriateness and value. In addition, U.S. News recognizes that socioeconomic disparities plague the healthcare system in this country, and acknowledges the importance of addressing the role these disparities play in outcomes of care. We have begun to measure and publicly report on socioeconomics at the hospital level.

[31] Tirschwell DL, Longstreth WT Jr. Validating administrative data in stroke research. Stroke. 2002; 33(10): 2465-2470. doi:10.1161/01.str.0000032240.28636.bd

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Best Regional Hospitals

U.S. News first published Best Regional Hospitals in 2011 to offer patients a heuristic comparison of community hospitals located in or near the community where they reside. A goal of Best Regional Hospitals is to help healthcare consumers identify suitable hospitals without necessitating travel. A Best Regional Hospital is a hospital that offers a full range of services (as opposed to a specialty hospital) and that has at least eight High Performing ratings in Best Hospitals Procedures & Conditions, and at least 5 more High Performing ratings than Evaluated ratings. In our view, a hospital must perform at a high level in a variety of common procedures and conditions in order to warrant recognition as one of the best hospitals in its state or metro area.

In a given state or metro area, a hospital on the Best Hospitals Honor Roll outranks all other hospitals not on the Honor Roll, regardless of point totals. Other hospitals located in each region are ranked according to the number of points they earn: Hospitals earn two points for each of the eleven data-driven Best Hospitals specialties (excluding rehabilitation and the three expert opinion-based specialties) in which they are nationally ranked and one point for each specialty (if a hospital is not ranked in the top 50, it can be recognized as High Performing in a specialty if its score is in top 10% of all hospitals receiving a score in that specialty) and each of the 22 procedures and conditions in which they are rated High Performing (TAVR and AVR are combined into a single cohort for point calculations, making a total of 21 cohorts). In addition, hospitals lose one point for each procedure or condition in which they were Evaluated. A combined score for the AVR and TAVR procedures is used rather than assigning points for each individually, because these procedures are different approaches to treating the same disease. In order to be considered High Performing for the combined score, a hospital has to be High Performing in at least one of the procedures and at least As Expected in the other. If a hospital only provides one of the two procedures, its score for that procedure is used. Rehabilitation and three expert opinion-based specialties are used only to calculate Honor Roll points and are not used to calculate Best Regional Hospitals. Details about the Honor Roll Hospitals calculations can be found in *section V. Honor Roll and Best Regional Hospitals*, of the Best Hospitals: Specialty Rankings report. Details of the scoring methodology for the Best Regional Hospitals are available at http://health.usnews.com/health-care/best-hospitals/articles/faq-how-and-why-we-rank-and-rate-hospitals

Best Regional Hospitals eligibility details are outlined in Appendix D, while scoring details are outlined in Appendix E.

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Geographical Definitions

Regional rankings are displayed for every state and for the 103 metro areas with the largest estimated populations based on the 2020 census, provided there is at least one Best Regional Hospital located in the state or metro area. In 2025-2026, 504 hospitals are recognized as Best Regional Hospitals. In all, hospitals are ranked in 96 metro areas.

U.S. News generally uses the U.S. Census Bureau list of Metropolitan Statistical Areas (MSAs) to define metro areas, but we depart from MSAs in cases where we use larger Combined Statistical Areas (CSAs) or combined adjacent MSAs to include nearby smaller cities with nationally ranked hospitals. For example, we use the Detroit CSA instead of the Detroit MSA; we use the Denver CSA instead of the Denver MSA; we combine the Durham-Chapel Hill and Raleigh-Cary MSAs to define the Raleigh-Durham metro area; we combine the Ogden-Clearfield and Salt Lake City MSAs to define the Salt Lake City metro area; and we combine the Winston-Salem and Greensboro-High Point MSAs to define the Greensboro/Winston-Salem metro area.

Some metropolitan areas, such as Cincinnati and New York City, cross state lines. That is also true for Washington, D.C., which is included in Best Regional Hospitals as a metro area (encompassing parts of Maryland and Virginia) but not a state. Rankings are not published for U.S. territories.

U.S. News groups counties and county equivalents, like parishes, into approximately 200 regions that reflect geography, local customs, and regional health care markets. Best Regional Hospitals are recognized but not numerically ranked in regions that are not major metro areas.

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Appendix A: Patients Discharged Home & Patients Recover at Home

The denominator for the Patients discharged home outcome measure includes only patients who were discharged following a visit qualifying as an index visit in one of the 22 Procedures and Conditions cohorts. Discharge status codes of 07 (left against medical advice or discontinued care), 20 (expired, did not recover - Christian Science), 21 (court/law enforcement), 30 (still a patient), 40 (expired at home, hospice claim), 41 (expired in facility, hospice claim), 42 (expired place unknown, hospice claim), 50 (hospice – home), 62 (discharged/transferred to an IRF including distinct parts units of a hospital) or 87 (to court/law enforcement with a planned acute care hospital inpatient readmission) are excluded, as are visits with a missing or invalid discharge status code. Visits with an inpatient source admission code of 05 (transfer from a SNF or ICF) and 08 (court/law enforcement) are also excluded. Similarly, visits that are determined to have been admissions from a SNF, because in Medicare SNF claims data, the patient was observed in a SNF immediately prior to being admitted to a hospital, are excluded.

Discharge to a location other than home is indicated by one of the following patient discharge status codes: 02, 03, 04, 05, 09, 43, 51, 61, 63, 64, 65, 66, 69, 70, 82, 83, 84, 85, 88, 89, 90, 91, 92, 93, 94, 95.

Discharge codes 01 (home/self care), 06 (home with care of organized home health service organization), 81 (home/self care with planned readmission), and 86 (home with care of organized home health service organization with planned readmission) are included as a successful discharge directly to home.

The denominator for the outcome measure "Patients recover at home" includes only patients who were discharged following a visit qualifying as an index visit in one of the 22 Procedures and Conditions cohorts. Discharge status codes of 07 (left against medical advice or discontinued care), 21 (court/law enforcement), 30 (still a patient), 50 (hospice – home), or 87 (to court/law enforcement with a planned acute care hospital inpatient readmission) are excluded, as are visits with a missing or invalid discharge status code. Visits with an inpatient source admission code of 05 (transfer from a SNF or ICF) and 08 (court/law enforcement) are also excluded. Similarly, visits that are determined to have been admissions from a SNF, because in Medicare SNF claims data, the patient was observed in a SNF immediately prior to being admitted to a hospital, are excluded.

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Appendix B: Prevention of Outpatient Procedural Complications

To identify outpatient procedures for this measure, potentially preventable complication rates for outpatient procedures were produced using the Solventum Ambulatory Potentially Preventable Complication (AM-PPC) v1.2 Methodology (Solventum was formerly known as 3M Health Information Systems). We applied the Solventum AM-PPC grouper software to Medicare hospital fee-for-service outpatient claims and inpatient claims from 2019 to 2023. The Solventum AM-PPC grouper software assigns qualifying outpatient visits to one of several defined procedure groups or PSGs, which are roughly analogous to MS-DRGs but apply to outpatient procedures.

We used a subset of PSG 183 (Prostatectomy) and PSG 185 (Other Prostate Procedures) to identify prostate cancer surgeries and a subset of PSG 144 (Hysterectomy) to identify uterine cancer (a subset of the gynecological cancer surgery cohort) surgeries. We also used subsets of PSG 11 (Hip Arthroplasty), PSG 13 (Knee Arthroplasty), and PSG 55 (Pacemaker/AICD Procedures) to identify hip replacement, knee replacement, and pacemaker implantation procedures, respectively.

Additionally, for prostate cancer, uterine cancer, knee replacement, and hip replacement procedures, the principal diagnosis related to the procedure must be present for the case to be included in the denominator for measuring Prevention of outpatient procedural complications. For pacemaker implantation procedures, we exclude cases where procedure codes for pacemaker revision or replacement are documented during the same visit, in order to identify only initial implantations.

The Solventum AM-PPC v1.2 methodology also identifies potentially preventable complications, which are harmful events or negative outcomes (e.g., infections, mechanical complications, bleeding/clotting, pneumonia/pulmonary, etc.) that develop and are discovered during emergency room visits or inpatient stays following an elective outpatient procedure. Although AM-PPCs can also identify potentially preventable complications that present during post-procedural outpatient visits, our measures did not include these events because of limitations in the completeness of the available Medicare data.

The measure evaluates the ability of hospitals to successfully perform procedures without complications using an observed- to -expected ratio of potentially preventable complications. Each hospital's observed complication count is calculated as the total number of outpatient procedures

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with a clinically relevant complication of care occurring within 30 days across all procedures assigned to the cohort.

To calculate the expected complication count for each hospital, each at-risk encounter is first assigned a complication risk rate, which is calculated for each age group (65–74, 75–84, and 85 or older years old) in each PSG assigned to the cohort. These complication risk rates are calculated by dividing the nationwide sum of all procedures with complications by the nationwide sum of all at-risk procedures within each age category and PSG group. Then, all complication risk rates for a given hospital in a given cohort are summed to generate the hospital-level expected complication counts for that cohort. Lastly, the observed complication count was divided by the expected complication count to generate a hospital-level, cohort-specific observed-to-expected ratio (OER).

Because OERs have a skewed distribution with a small number of extremely high values, OER values were winsorized at the 99th percentile of the OERs in each cohort before being incorporated into the corresponding cohort's composite model. Raw PPC OERs range from 0 to a theoretical maximum of infinity, with lower values indicating better than expected performance, and higher values indicating worse -than -expected performance on the measure. However, for public display, we flip the direction of AM-PPC OER values to match the orientation of other quality measures that we publish, in which higher values indicate better performance. We publish categorical values ranging from 1 to 5 based on the predefined values of the flipped OER values on each hospital's scorecard. These bands are meant to help users of rankings quickly compare how hospitals perform relative to each other. However, in specialty rankings, we use quintiles to assign 5 categorical bands to AM-PPC OER values.

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Table 13. List of PSGs for Prevention of Outpatient Complications

PSGs		Attributed Cohort
PSG	PSG Description	
11	Hip arthroplasty	Hip Replacement
13	Knee arthroplasty	Knee Replacement
55	Pacemaker/AICD procedures	Pacemaker Implantation
144	Hysterectomy procedures	Gynecological Cancer Surgery
183	Prostatectomy	Prostate Cancer Surgery
185	Other Prostate Procedures	

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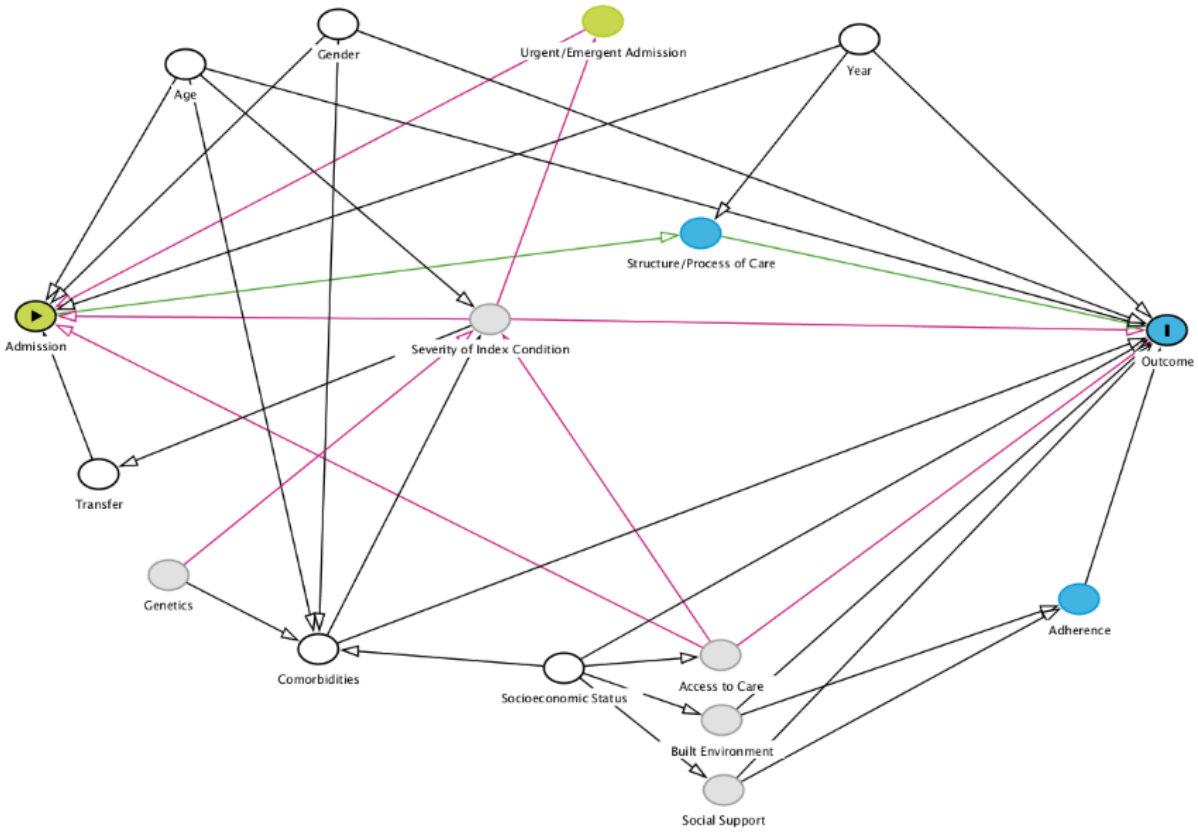
Appendix C: Causal Model for Risk-adjustment

The following directed acyclic graph[32] shows the hypothesized relationship between covariates, hospital selection and outcomes. The causal model is based on a risk-adjustment model using FFS data.



[32] Johannes Textor, Juliane Hardt, and Sven Knuppel. Dagitty: A graphical tool for analyzing causal diagrams. Epidemiology, 22(5):745, 2011.

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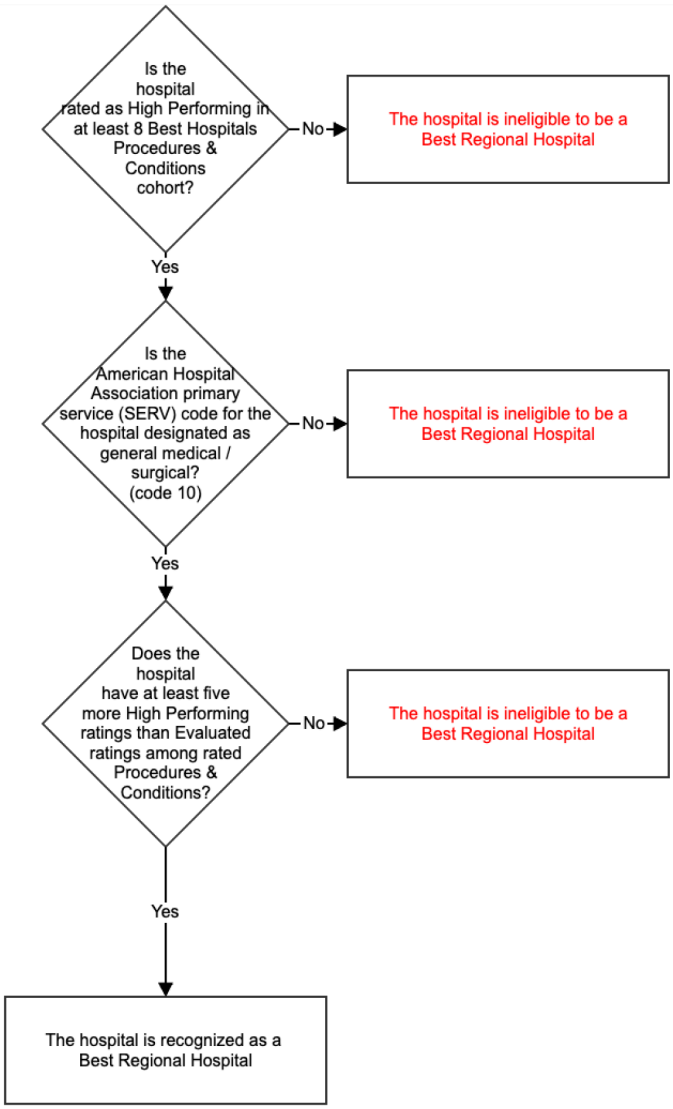
Appendix D: Best Regional Hospitals

The following diagram outlines the guidelines that determine whether or not a hospital is recognized as a Best Regional Hospital.



Note:
For eligibility and scoring purposes here, the TAVR and AVR cohorts in Best Hospitals Procedures & Conditions were combined into a single cohort. Therefore, despite there being 22 Procedures & Conditions cohorts, a hospital was effectively scored in 21 for Best Regional Hospitals.
A hospital rated High Performing in both individual cohorts or rated High Performing in one and As Expected in the other received a High Performing rating in the combined cohort.
A hospital rated Evaluated in both individual cohorts or Evaluated in one and As Expected in the other received an Evaluated rating in the combined cohort.
A hospital receiving a rating in only one of the individual cohorts received the single cohort rating for the combined cohort.

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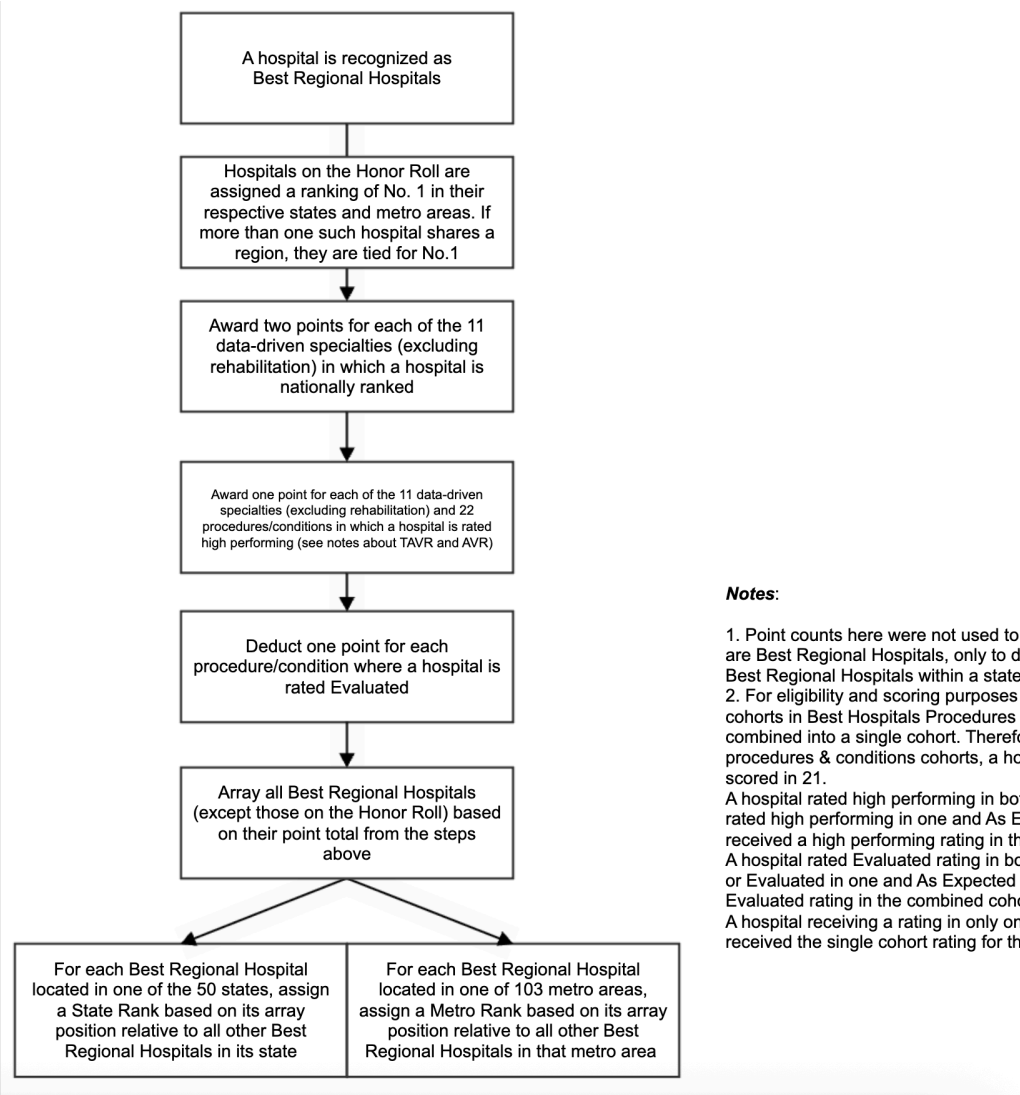
Appendix E: Calculation of State and Metro Rankings

The following diagram outlines the scoring methodology that determines the state and metro area rankings of Best Regional Hospitals.



Notes:

1. Point counts here were not used to determine which hospitals are Best Regional Hospitals, only to determine rank ordering of Best Regional Hospitals within a state or metro area.
2. For eligibility and scoring purposes here, the TAVR and AVR cohorts in Best Hospitals Procedures & Conditions were combined into a single cohort. Therefore, despite there being 22 procedures & conditions cohorts, a hospital was effectively scored in 21.

A hospital rated high performing in both individual cohorts or rated high performing in one and As Expected rating in the other received a high performing rating in the combined cohort.

A hospital rated Evaluated rating in both individual cohorts or Evaluated in one and As Expected in the other received an Evaluated rating in the combined cohort.

A hospital receiving a rating in only one of the individual cohorts received the single cohort rating for the combined cohort.

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Appendix F: Study Periods for Key Indicators and Cohorts

Outcome Measures		
Indicator	**Source File**	**Time Period**
Survival	Inpatient LDS SAF; MedPAR LDS	FFS: 12/1/2018 - 12/1/2023; MA: 10/1/2018 - 9/30/2023
Hospital readmission prevention	Inpatient LDS SAF	12/1/2018 - 12/1/2023 for procedure cohorts (AAA, AVR, back surgery (spinal fusion), colon cancer surgery, CABG, hip fracture, hip replacement, knee replacement, gynecological cancer surgery, lung cancer surgery, prostate cancer, TAVR, and pacemaker implantation) and leukemia, lymphoma & myeloma cohort
Infection prevention	Inpatient LDS SAF	12/31/2017 - 12/31/2022 for hip replacement and knee replacement; 11/1/2018 - 11/1/2023 for AAA, CABG, and AVR
Prevention of revision surgery	Inpatient LDS SAF	12/31/2017 - 12/31/2022 for hip replacement and knee replacement

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Prevention of prolonged hospitalization	Inpatient LDS SAF	12/1/2018 - 12/1/2023 for procedure cohorts except for back surgery (spinal fusion) (AAA, AVR, colon cancer surgery, CABG, hip fracture, hip replacement, knee replacement, gynecological cancer surgery, lung cancer surgery, prostate cancer surgery, TAVR, and pacemaker implantation)
Patients discharged home	Inpatient LDS SAF; Skilled Nursing LDS SAF	12/31/2018 - 12/31/2023
Prevention of outpatient procedural complications	Inpatient LDS SAF; Outpatient LDS SAF	12/1/2018 - 12/1/2023 for gynecological cancer surgery, prostate cancer surgery, knee replacement, hip replacement, and pacemaker implantation
Prevention of stroke	Inpatient LDS SAF	12/31/2018 - 12/31/2023 for CABG, AVR, and TAVR
Patients recover at home	Inpatient LDS SAF; Outpatient LDS SAF; Skilled Nursing LDS SAF	12/1/2018-12/1/2023
Process Measures		
Noninvasive breathing aid	Inpatient LDS SAF	1/1/2019 - 12/31/2023 for CHF and COPD

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Patient experience & Patient experience with Nursing Care	CMS Hospital Consumer Assessment of Healthcare Providers and Systems Survey (HCAHPS)	4/1/2023 - 3/31/2024
Board certified physicians	American Board of Orthopaedic Surgery (ABOS); National Board of Physicians and Surgeons (NBPS); American Osteopathic Association (AOA)	Provided by ABOS and AOA to Doximity prior to 2/4/2025 and/or self-reported by NBPS-certified orthopedic surgeons to Doximity prior to 2/4/2025 for hip fracture, knee replacement, and hip replacement
Restoration of blood flow	Inpatient LDS SAF Outpatient LDS SAF	1/1/2019 - 12/31/2023 for stroke
GWTG recognized hospital & Timely treatment of stroke patient	American Heart Association Get With The Guidelines® (GWTG)	Hospitals must have opted into the public reporting program and been appearing on the GWTG public site by 4/30/2024
ACC recognized hospital	American College of Cardiology (ACC) National Cardiovascular Data Registry (NCDR)	Hospitals must have opted into the public reporting program by 12/27/2024
STS recognized hospital	Society of Thoracic Surgeons (STS)	Hospitals must have opted into the public reporting program by 7/26/2024
Nurse staffing ratio	2023 AHA Annual Survey	FY 2023

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STS/ACC TVT registry recognized hospital	Collaboration between Society of Thoracic Surgeons (STS) and the American College of Cardiology (ACC)	Hospitals must have opted into the public reporting program by 1/7/2025
Structure Measures		
Number of patients (Volume)	Inpatient LDS SAF MedPAR LDS	FFS: 1/1/2019 - 12/31/2023; MA: 10/1/2018 - 9/30/2023
	Outpatient LDS SAF	1/1/2020 - 12/31/2023 for hip replacement; 1/1/2019 - 12/31/2023 for knee replacement, prostate cancer surgery, gynecological cancer surgery, and pacemaker implantation
NCI cancer center	National Cancer Institute (NCI)	Hospitals must be designated as NCI clinical or comprehensive cancer centers as of 1/19/2024 for cancer cohorts (gynecological cancer surgery, prostate cancer surgery, colon cancer surgery, lung cancer surgery, leukemia, lymphoma & myeloma)
ACS cancer center	2023 AHA Annual Survey	FY 2023 for cancer cohorts (gynecological cancer surgery, prostate cancer surgery, colon cancer surgery, lung cancer surgery, leukemia, lymphoma &

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		myeloma)
Advanced heart program	Inpatient LDS SAF CMS Heart Transplant Program	1/1/2019 - 12/31/2023 for CHF Hospital must have a Medicare-approved heart transplant program recognized by CMS as of 1/31/2025 for CHF
Recognized cellular therapy program	Foundation for the Accreditation of Cellular Therapy (FACT)	Hospitals must be certified by FACT for bone marrow and tissue transplants as of 1/31/2025 for leukemia lymphoma & myeloma

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