

Hospital Visits after General Surgery Procedures Performed at
Ambulatory Surgical Centers

Measure Technical Report: Public Comment

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Prepared for:

Centers for Medicare & Medicaid Services (CMS)

July 3, 2017

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4. Acknowledgements

This work is a collaborative effort. The authors gratefully acknowledge and thank the project's consultants and the participants of the project's national technical expert panel (TEP) for their support. These individuals are providing guidance on key clinical and methodological decisions, though acknowledgment of input does not imply endorsement. In addition, the authors would like to acknowledge and thank staff of the Centers for Medicare & Medicaid Services (CMS) and others for their contribution to this work. These individuals are listed below.

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5. Executive Summary

This report presents for public comment a new quality measure of general surgery procedures performed at ambulatory surgical centers (ASC). The measure assesses the quality of general surgery ASC procedures using the outcome of hospital visits – including emergency department (ED) visits, observation stays, and unplanned inpatient admissions – within 7 days of the ASC procedure. Yale New Haven Health Services Corporation—Center for Outcomes Research and Evaluation (CORE) is developing the measure for the Centers for Medicare & Medicaid Services (CMS). At this time, CMS is seeking public comment to further inform measure development.

This report presents for comment the rationale for the measure, the specific technical approach to the measure, the draft measure specifications, the measure testing results, and the national distribution of measure scores across ASC facilities. As part of the development process, CMS invites public comment on all aspects of the measure and the results. Instructions on how to submit comments are available at the following webpage:

<https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/MMS/CallforPublicComment.html>.

5.1 Rationale for Assessing Hospital Visits after Ambulatory Surgery

Ambulatory surgery is increasingly common in the United States (US). Nearly 70% of all surgeries in the US are performed in an outpatient setting with an expanding number and variety of procedures being performed at stand-alone ASCs.¹ While ambulatory surgery is considered low-risk for complications, there are well-described and potentially preventable adverse events that can occur after ambulatory surgery leading to unplanned care at a hospital. These events include uncontrolled pain, urinary retention, infection, bleeding, and venous thromboembolism.

Hospital visits following same-day surgery are an important and accepted patient-centered outcome reported in the literature.²⁻⁹ National estimates of hospital visit rates following outpatient surgery vary from 0.5-9.0%, based on the type of surgery, outcome measured (admissions alone or admissions and ED visits), and timeframe for measurement after surgery. Such events also vary among ASCs, suggesting possible variation in surgical care, post-surgical care, and the care and support provided to patients post-discharge.^{6,10-18}

We estimated the unadjusted rate of hospital visits as defined for this measure following general surgery ASC procedures. In our analysis of a national 100% dataset of Medicare Fee-for-Service (FFS) claims from Calendar Year (CY) 2015 (January 1, 2015 – December 31, 2015), the median national observed facility rate of hospital visits following general surgery procedures performed at ASCs was 2.2% (the 25th and 75th percentiles were 0.0% and 3.7%, respectively).

Of these hospital visits, 1.6% were emergency department (ED) or observation stay visits, and 0.6% were unplanned inpatient admissions. These results suggest a performance gap and opportunity for quality improvement.

Providers at ASCs are often unaware of patients' subsequent acute care visits given that patients tend to present to the ED or to hospitals unaffiliated with the ASC.¹⁹ For these reasons, a quality measure of hospital visits following ASC surgery will serve to improve transparency, inform patients and providers, and foster quality improvement.

5.2 Measure Development

CORE is developing this measure consistent with CMS's measure development guidance, using a multidisciplinary team of clinicians, health services researchers, and statisticians. Our work is supported and informed by a national technical expert panel (TEP) consisting of patients, surgeons, methodologists, researchers, and providers. With input from our experts and CMS, the Project Team has defined the measure cohort and outcome; selected and tested the risk-adjustment model; and calculated the ASC-level measure score.

5.3 Draft Measure Specifications

The population included in the measure is Medicare FFS patients aged 65 years and older undergoing outpatient general surgery procedures at ASCs.

The measure's outcome is any unplanned hospital visit (ED visit, observation stay, or unplanned inpatient admission) by a patient occurring within 7 days of an index ASC procedure (a patient's initial ASC procedure).

The measure is risk-adjusted in order to help ensure that differences in the measure score do not reflect differences in the mix of patients and procedures across ASCs, the model adjusts for patient demographics (age), surgical procedural complexity, type of general surgery procedure, and patient comorbidities. We adjust for these characteristics because they vary across ASC patient populations and influence the outcome.

The measure score is an ASC-level risk-standardized hospital visit rate (RSHVR). The RSHVR is calculated as the ratio of the predicted to the expected number of post-surgical unplanned hospital visits among an ASC's patients, multiplied by the national observed rate of unplanned hospital visits. For each ASC, the numerator of the ratio is the number of hospital visits predicted for the ASC's patients, accounting for its observed rate, the number and complexity of general surgery procedures performed at the ASC, and the case mix. The denominator is the number of hospital visits expected nationally for the ASC's case/procedure mix. To calculate an ASC's predicted-to-expected (P/E) ratio, the measure uses a two-level hierarchical logistic

regression model (see [Appendix D](#)). The log-odds of the outcome for an index procedure is modeled as a function of the patient demographic, comorbidity, and procedure characteristics, and a random ASC-specific intercept. A ratio greater than one indicates that the ASC's patients have more hospital visits than expected, compared to an average ASC with similar patient and procedural complexity. A ratio less than one indicates that the ASC's patients have fewer post-surgical hospital visits than expected, compared to an average ASC with similar patient and procedural complexity. An ASC's P/E ratio is then multiplied by the overall national rate of unplanned hospital visits to calculate the ASC-level RSHVR. This approach is analogous to an observed-to-expected ratio, but accounts for within-facility correlation of the observed outcome and sample size differences and accommodates the assumption that underlying differences in quality across ASCs lead to systematic differences in outcomes.

5.4 Distribution of Measure Scores

There was variation in risk-standardized scores across ASCs nationally. In a national Medicare FFS claims dataset for 2014 and 2015 that included 304,139 procedures at 3,662 ASCs, the facility measure scores ranged from 0.94% to 4.55%, with a median RSHVR of 2.19% (the 25th and 75th percentiles were 2.03% and 2.46%, respectively).

5.5 Summary

This report describes the measure specifications and preliminary results for a risk-standardized quality measure of 7-day unplanned hospital visits following general surgery procedures performed at ASCs. Stakeholder and expert input has informed measure development throughout. The purpose of this measure is to illuminate variation in quality of care for general surgery procedures across ASCs, inform patient choice, and drive quality improvement. CMS invites comments on the measure's purpose, design, and potential implementation.

6. Introduction and Call for Public Comment

6.1 Background

National efforts to measure the quality of ambulatory surgical care are essential given the increasing number of ambulatory surgical centers (ASCs) in the United States (US), and the growing variety of procedures performed at ASCs. ASCs have become an increasingly common setting for the provision of low-risk surgical and medical procedures in the US, including the provision of many types of general surgical care.¹ ASCs have gained favor among patients given their tendency toward shorter wait times, decreased need for hospitalization, and more rapid return to work when compared with patients managed in hospital settings.¹ In 2014 alone, more than 3.4 million Medicare Fee-for-Service (FFS) beneficiaries were treated at ASCs. Associated Medicare spending for all types of ASC procedures per beneficiary increased by an average of 2.8% per year between 2010 and 2014, and by 5.2% in 2015, resulting in total expenditures of \$4.1 billion on ASC services in 2015.²⁰ Due to advances in surgical and anesthetic techniques, nearly 70% of all surgical procedures in the US are performed in ambulatory settings, with many of these procedures taking place as same-day surgeries at ASCs.¹ The resultant shift in ASC utilization has led to an increase not only in ASCs' operative volume, but also in the average age and complexity of patients managed at ASCs.^{20,21}

General surgery procedures are commonly performed at ASCs. Based on our analyses of Medicare FFS patients aged 65 years and older, from January 1, 2015 through December 31, 2015, 3,256 ASCs performed 149,932 general surgery procedures of the types included in this measure (see Section 3.3 for cohort definition); 1,157 (35.5%) of those ASCs performed at least 25 cases.

6.2 Definition of an Ambulatory Surgical Center (ASC)

Medicare defines ASCs as healthcare facilities that operate “exclusively for the purpose of providing surgical services to patients not requiring hospitalization and in which the expected duration of services [does] not exceed 24 hours following an admission” (42 CFR 416.2).²² ASCs vary in their organizational and financial structures. Many ASCs are hospital-owned; most are run by groups of physicians in the same specialty area and are limited to a single type of procedure, such as eye or orthopedic surgery. Other ASCs conduct procedures in two or more specialty areas.

The types of general surgery procedures performed at ASCs range from very minor procedures, such as skin sutures, to more major operations, such as gastric bypass. These procedures typically have less than 90-minute operating times and 4- to 6-hour same-day recovery periods. The surgeries performed usually do not (1) involve major or prolonged invasion of body

cavities; (2) require active medical monitoring and care overnight; (3) result in extensive blood loss; (4) directly involve major blood vessels; or (5) involve care that is either emergent or life-threatening (42 CFR 416.65).²²

6.3 Importance of Assessing Unplanned Hospital Visits after ASC Procedures

Despite the increasing availability and utilization of ASCs, there are few quality measures to gauge ASC performance. Existing ASC quality measures tend to focus on very rare, patient safety-related events. For example, one measure counts cases in which wrong site, wrong side, wrong patient, wrong procedure, or wrong implant events occurred.²² Understanding that such rare, patient safety-related events are important to assess, generally lacking at this time are measures designed to capture more common adverse outcomes that patients experience, such as pain, bleeding, urinary retention, and other complications requiring acute care hospital visits or admissions.

Measuring ASC outcomes is an important strategy for improving transparency and fostering quality improvement. Facilities and surgical teams may be unaware of their patients' adverse events and hospitalizations following ASC procedures because separate providers (for example, emergency room physicians) tend to provide post-surgical care when it is required. For this reason, measuring unanticipated hospital visits following ASC procedures can more broadly reflect the quality of ASC care. Such visits are an unexpected and potentially preventable outcome for patients with a low anticipated perioperative risk.

In the literature, hospital visit rates following outpatient surgery vary from 0.5-9.0%, based on the type of surgery, outcome measured (admissions alone or admissions and ED visits), and timeframe for measurement after surgery.²⁻⁹ These hospital visits can occur due to a range of well-described adverse events, including major adverse events, such as bleeding, wound infection, septicemia, and venous thromboembolism. Patients also frequently report minor adverse events – for example, uncontrolled pain, nausea, and vomiting – that may result in unplanned acute care visits following surgery.

Several factors make unanticipated hospital visits a priority quality indicator. Because ASC providers are not aware of all post-surgical hospital visits that occur among their patients, reporting this outcome will help to illuminate problems that may not be currently visible. In addition, the outcome of hospital visits is a broad, patient-centered outcome that reflects the full range of reasons leading to hospital use among patients undergoing same-day surgery. Public reporting of this outcome measure will provide ASCs with critical information and incentives to implement strategies to reduce unplanned hospital visits.

CMS is developing this measure for general surgery procedures at ASCs because:

1. The procedures lead to related and preventable complications resulting in unplanned hospital visits;
2. Hospital visit rates are elevated within the first week following the procedures; and
3. Thousands of facilities in the US perform general surgery procedures.

6.4 Related Measures Under Development

We have developed four other risk-adjusted outpatient procedure measures that use the same 7-day unplanned hospital visit outcome, two of which have been endorsed by the National Quality Forum (NQF) and two of which are currently under development:

- Facility 7-Day Risk-Standardized Hospital Visit Rate after Outpatient Colonoscopy (NQF endorsed #2539)
- Hospital Visits after Hospital Outpatient Surgery (NQF endorsed #2687)
- Hospital Visits after ASC Orthopedic Procedures
- Hospital Visits after ASC Urology Procedures

7. Measure Development Methods

7.1 Overview of Measure Development Process

CORE is leading the development of the general surgery ASC measure under the guidance of CMS. The CORE Project Team consists of a multidisciplinary group of clinicians, health services researchers, and statisticians with expertise in outcome measure development. We are obtaining clinical input from general surgery consultants. Additionally, we convened, through a public process, a national TEP to advise us on this measure and two other related ASC measures. The TEP is comprised of individuals with diverse perspectives and backgrounds, and includes clinicians, surgeons, patients, patient advocates, and other stakeholders with expertise in ambulatory surgery, performance measurement, quality improvement, and patient safety. Details of the TEP's input are available for download at: <https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/MMS/CallforPublicComment.html>. At this time, we are soliciting additional stakeholder input through this public comment period. After the public comment period closes, we will revise this measure as appropriate in response to comments.

7.2 Data Sources

The measure requires a data source that allows us to link patient data across care settings to identify appropriate surgical procedures for inclusion, comorbidities for risk adjustment, and the outcome of hospital visits. Therefore, claims data are used to calculate the measure results, as they support these linkages, are available for the patient population of interest, and do not require ASCs to submit any data to CMS.

To develop and test the patient-level model, we used a national dataset of Calendar Year (CY) 2015 (January 1, 2015 – December 31, 2015) claims data from the Health Account Joint Information (HAJI) database that included Medicare Inpatient, Outpatient, and Carrier (Part B Physician) claims (hereinafter, Medicare FFS CY 2015 Dataset). Outpatient general surgery procedures performed at ASCs were identified using the full set of Medicare beneficiaries' claims from the Carrier non-institutional claims, which includes the ASC facility claim (with a unique facility identifier). The outcomes of ED visits and observation stays after general surgery ASC procedures were identified from the hospital outpatient institutional claims and inpatient hospital admissions from the inpatient institutional claims. The measure cohort included patients who underwent general surgery ASC procedures in CY 2015. Inpatient and outpatient claims data from the year prior (CY 2014) were used to identify comorbidities for risk adjustment for these patients.

To align with CMS's intention to use more than 1 year of data for public reporting to ensure reliable estimates, we calculated ASCs' measure scores and the measure score reliability for a two-year reporting period. Specifically, to calculate ASCs' measure scores, we used two years of claims data from 2014 and 2015 (January 1, 2014 – December 31, 2015; hereinafter, Medicare FFS 2014-2015 Dataset). To calculate measure score reliability for a two-year reporting period, we used split samples of four years of claims data from 2012-2015 (January 1, 2012 – December 31, 2015).

7.3 Cohort Definition

The target population for this measure is Medicare FFS patients aged 65 years and older, undergoing outpatient general surgery procedures that are within the scope of general surgery training. Specifically, the cohort of procedures includes the following types of procedures: abdominal, alimentary tract, breast, skin/soft tissue, wound, and varicose vein. The Medicare FFS population was chosen because of the availability of a national dataset (Medicare claims) that could be used to develop, test, and publicly report the measure. The target population is defined based on the following inclusion and exclusion criteria.

7.3.1 Inclusion Criteria

Included patients

- Medicare FFS patients aged 65 years and older.

Rationale: Medicare beneficiaries under age 65 typically are a highly diverse group with a higher burden of disability, and it is therefore difficult to adequately risk adjust for the under-65 population.

- Patients with continuous enrollment in Medicare FFS Parts A and B in the 12 months prior to the surgery.

Rationale: Patients with full enrollment have claims available for identifying comorbidities for risk adjustment.

Included procedures

- The target group of procedures was surgical procedures that (1) are routinely performed at ASCs, (2) involve risk of post-surgery hospital visits, and (3) are within the scope of general surgery training. See [Appendix A](#) for a complete listing of all Current Procedural Terminology (CPT®) procedure codes included in the measure cohort.

- The measure includes a subset of procedures (indicated below) on Medicare’s list of covered ASC procedures for 2014 and 2015. This list of surgeries is publicly available at: https://www.cms.gov/medicare/medicare-fee-for-service-payment/ascpayment/11_addenda_updates.html (download April 2017 ASC Approved HCPCS Code and Payment Rates, Addendum AA). Surgeries on the ASC list of covered procedures do not involve or require major or prolonged invasion of body cavities, extensive blood loss, major blood vessels, or care that is emergent or life threatening.¹
- To focus the measure only on the subset of surgeries on Medicare’s list of covered ASC procedures that impose a meaningful risk of post-procedure hospital visits, the measure includes only “major” and “minor” procedures, as indicated by the Medicare Physician Fee Schedule global surgery indicator (GSI) values of 090 and 010, respectively. The GSI code reflects the number of post-operative days that are included in a given procedure’s global surgical payment and identifies surgical procedures of greater complexity and follow-up care. This list of GSI values is publicly available at: <https://www.cms.gov/Medicare/Medicare-fee-for-service-payment/physicianfeesched/pfs-federal-regulation-notices-items/cms-1590-fc.html> (download CY 2013 PFS Addenda, Addendum B).

Rationale: Ambulatory procedures include a heterogeneous mix of non-surgical procedures, minor surgeries, and more substantive surgeries. We aim to include major and minor surgeries but not very low-risk (very minor) surgeries or non-surgical procedures that typically have a high volume and a very low outcome rate.

- To identify the subset of ASC general surgery procedures, we obtained input from clinical consultants and TEP members to identify procedures within the scope of general surgery using the Clinical Classifications Software (CCS) developed by the Agency for Healthcare Research and Quality (AHRQ). We did not include gastrointestinal endoscopy, endocrine, or vascular procedures, other than varicose vein procedures, because reasons for hospital visits are typically related to patients’ underlying comorbidities. See [Table A1](#) for a complete list of all CPT® procedure codes included in the measure cohort.

¹ This list of surgeries was used for several reasons. The ASC list is publicly available, is annually reviewed and updated by Medicare, and includes a transparent public comment submission and review process for addition and/or removal of procedures. Using an existing, defined list of same-day surgical procedures, rather than defining surgical procedures de novo, is useful for long-term measure maintenance. Procedures included on Medicare’s list of covered ASC procedures are defined using Healthcare Common Procedure Coding System (HCPCS) and CPT® codes.

7.3.2 Exclusion Criteria

- Procedures for patients who survived at least 7 days, but were not continuously enrolled in Medicare FFS Parts A and B in the 7 days after the surgery are excluded.

Rationale: These patients are excluded to ensure all patients have full data available for outcome assessment.

7.4 Outcome

7.4.1 Definition of Outcome

The outcome is any unplanned hospital visit within 7 days of an outpatient general surgery. The outcome of hospital visits is the focus of this measure because this is a broad, patient-centered outcome that captures the full range of hospital visits resulting from adverse events or poor care coordination following outpatient surgery. This measure's goal is to assess and illuminate variation in risk-adjusted hospital visits following surgery for quality improvement purposes.

A hospital visit is defined as any ED visit, observation stay, or unplanned inpatient admission occurring after the ASC procedure; "planned" admissions for follow-up care are not included, as these hospital visits do not reflect quality differences. Hospital acute care visits and admissions are well-described and recognized indicators of quality for outpatient surgery at ASCs (see [Section 6.3](#)).

ED visits and observation stays are defined using billing codes identified in Medicare Part B outpatient hospital claims (see [Appendix B](#)).

7.4.2 Outcome Timeframe

The outcome of hospital visits is limited to 7 days since existing literature suggests that the vast majority of adverse events after outpatient surgery occur within the first 7 days following the surgery.^{4,23} In addition, our data analysis showed the highest rates of hospital visits occurring within 7 days of outpatient general surgery. As the results in [Figure 1](#) show, among general surgery procedures, the daily rate of unplanned hospital visits was highest immediately following the procedure and leveled off to a baseline rate of approximately 2.0 visits per 1,000 procedures after 7 days. Based on empiric analyses and expert input from our surgical consultants and TEP members, we conclude that unplanned hospital visits within 7 days is the optimal timeframe to ensure capture of surgery-related adverse events and to minimize capture of hospital visits unrelated to the surgery.

7.4.3 Multiple Qualifying Procedures within a 7-Day Period

In rare instances (3.8%), an index procedure is followed by another qualifying ASC general surgery procedure within 7 days. When there are 2 or more qualifying surgical procedures within a 7-day period, the measure considers all procedures as index procedures; however, the timeframe for outcome assessment is defined as the interval between procedures (including the day of the next procedure) for the first procedure and then 7 days after the last procedure. If the timeframe for outcome assessment were 7 days after each procedure that occurs within a 7-day period, it would be possible for a single outcome to be attributed to 2 or more index procedures. For example, consider the following scenario: Procedure #1 on Day 1, Procedure #2 on Day 4, and ED visit on Day 6. Using the standard 7-day timeframe, the outcome on Day 6 would get attributed to both procedures. Using the refined coding, however, the outcome on Day 6 would get attributed to only Procedure #2, and Procedure #1 would not have an outcome because there was no unplanned hospital visit between Procedures #1 and #2.

7.4.4 All-Cause Hospital Visits

We measure all-cause, unplanned hospital visits to encourage facilities to minimize all types of risks that may lead to the need for a hospital visit after ASC surgery. Measuring only hospital visits that are overtly related to a procedure, such as pain and bleeding, would limit the measure's impact on quality improvement efforts. Measuring all-cause patient outcomes encourages facilities to minimize the risk of a broad range of outcomes, including the risk of dehydration, nausea and vomiting, dizziness, and urinary retention. These are common problems that may or may not be related to a recent ASC surgery. Thus, the measure is structured so that facilities that most effectively minimize patient risk of these outcomes will perform better on the measure.

The rate of hospital visits is not expected to be zero since some patients will have visits for reasons completely unrelated to the procedure. The measure is risk adjusted for patient demographics, clinical characteristics, and surgical procedural complexity so that facilities that experience more unrelated visits due to a generally higher-risk patient mix are not disadvantaged.

7.4.5 Removal of Planned Admissions from the Outcome

For inpatient admissions occurring after general surgery procedures performed at ASCs, only unplanned admissions are included in the measure outcome. "Planned" admissions are those planned by providers for anticipated medical treatment or procedures that must be provided in the inpatient setting; these are not included in the outcome because variation in planned admissions would not reflect quality of care differences.

To identify admissions as planned or unplanned, we applied an algorithm previously developed for CMS's hospital readmission measures, the CMS Planned Readmission Algorithm Version 4.0. In brief, the algorithm uses the procedure codes and principal discharge diagnosis code on each hospital claim to identify admissions that are typically planned. A few specific, limited types of care are always considered planned (for example, major organ transplant, rehabilitation, or maintenance chemotherapy). Otherwise, a planned admission is defined as a non-acute admission for a scheduled procedure (for example, total hip replacement or cholecystectomy). Post-discharge admissions for an acute illness or for complications of care are never considered planned.

See [Appendix B](#) for the detailed planned admission algorithm.

7.5 Model Development

7.5.1 Overview

The measure adjusts for ASC case-mix differences across facilities based on patient demographics, clinical characteristics, surgical procedural complexity, and procedure type. Risk adjustment is necessary to ensure that variation in the measure score among ASCs is due to differences in quality of care rather than differences in case mix.

The measure score is an ASC-level risk-standardized hospital visit rate (RSHVR). The RSHVR is calculated as the ratio of the predicted to the expected number of post-surgical unplanned hospital visits among ASC's patients, multiplied by the national observed rate of unplanned hospital visits. For each ASC, the numerator of the ratio is the number of hospital visits predicted for the ASC's patients, accounting for its observed rate, the number and complexity of general surgery procedures performed at the ASC, the procedure type, and the case mix. The denominator is the number of hospital visits expected nationally for the ASC's case/procedure mix. To calculate an ASC's predicted-to-expected (P/E) ratio, the measure uses a two-level hierarchical logistic regression model (see [Appendix D](#)). The log-odds of the outcome for an index procedure is modeled as a function of the patient demographic, comorbidity, and procedure characteristics, and a random ASC-specific intercept. A ratio greater than one indicates that the ASC's patients have more visits than expected, compared to an average ASC with similar patient and procedural complexity. A ratio less than one indicates that the ASC's patients have fewer post-surgical visits than expected, compared to an average ASC with similar patient and procedural complexity. An ASC's P/E ratio is then multiplied by the overall national rate of unplanned hospital visits to calculate the ASC-level RSHVR. This approach is analogous to an observed-to-expected ratio, but accounts for within-facility correlation of the observed outcome and sample size differences and accommodates the assumption that underlying differences in quality across ASCs lead to systematic differences in outcomes, and is tailored to

and appropriate for a publicly reported outcome measure as articulated in published scientific guidelines.²⁴⁻²⁶

7.5.2 Candidate Risk Factors for Patient-Level Risk Adjustment

The measure adjusts for differences in patient comorbidities, demographics, and in procedure-related differences in risk across ASCs. We identified potential candidate risk factors through: 1) prior work on related quality measures (including the related urology and orthopedic ASC measures); 2) a focused literature review; and 3) TEP and expert input.

Candidate risk factors identified from work on related measures included opioid abuse, chronic anticoagulant use, tobacco use disorder, benign prostatic hyperplasia, morbid obesity, Work RVU, number of qualifying procedures, and procedure type. We used work RVU of the procedure to address surgical procedural complexity, an approach employed by the American College of Surgeons National Surgical Quality Improvement Program (NSQIP).²⁷

To identify additional clinical and procedural risk factors, we searched the literature for relevant peer-reviewed publications of variables that predicted hospital visits after outpatient general surgery procedures using Ovid MEDLINE and PubMed. The search yielded a total of 138 studies potentially relevant to the general surgery measure. Of these studies, 131 were excluded after review of the abstract, and 3 were excluded after full-text review. We added variables identified in the literature to our list of candidate risk factors if they were significantly associated with unplanned hospital visits in bivariate or multivariable analyses at the 0.05 level. From the 4 studies, we identified two variables not already included: anesthesia type and operating time.^{28,29} However, we did not include anesthesia type or operating time because we do not risk adjust for discretionary procedure differences (such as approach to anesthesia or surgical techniques).

To define the clinical risk factors in claims data, we used CMS's Version 22 hierarchical condition categories (HCCs) to operationalize the candidate clinical comorbidities. The HCCs classify 68,000 International Classification of Diseases, Tenth Revision (ICD-10-CM) and over 15,000 ICD-9-CM diagnosis codes into clinically coherent condition categories. Then, to consolidate similar risk factors into fewer, broader risk variables, we examined the frequency, bivariate direction and strength of association with the outcome of the individual risk factors defined by condition categories or ICD-10-CM codes, and then combined risk factor diagnoses into clinically coherent comorbidity variables. For example, we created a "cancer" variable that combined several individual cancer diagnoses.

Our expert clinical consultants and the TEP reviewed this preliminary list of risk variables and suggested additional variables: failure to thrive (poor nutritional status), history of falling, sleep

apnea, and history of steroid use. We added all suggested candidate variables; the final list included 80 candidate risk variables and is shown in [Appendix D, Table D1](#). The CCs that are not risk adjusted for if they occur only at the time of the procedure are in [Appendix D, Table D2](#).

7.5.3 Final Risk-Adjustment Variable Selection

To select the final set of variables for the risk-adjustment model, risk variables were entered into logistic regression analyses predicting the outcome of hospital visits within 7 days in the 2015 Development Sample. The Development Sample is a randomly selected 50% sample of our 2015 Medicare cohort. To develop a parsimonious risk model, non-significant variables were iteratively removed from the model using a stepwise purposeful selection approach described by Hosmer and Lemeshow.³⁰ All variables significant at $p < 0.05$ were retained in the final model.

In addition, we tested interaction terms and retained those that were both significant at $p < 0.05$ and demonstrated a clinically plausible relationship to the outcome.

7.5.4 Model Performance and Validation

To assess performance of the patient-level risk-adjustment model in the 2015 Development Sample, the area under the receiver operating characteristic curve as measured by the c-statistic was calculated. Observed hospital visit rates were compared to predicted hospital visit probabilities in the predicted risk deciles, and the range of predicted probabilities from lowest to highest risk decile was evaluated to examine model discrimination.

Several analyses to validate the patient-level risk-adjustment model were performed. First, we compared model performance in the 2015 Development Sample with its performance in the 2015 Validation Sample. The c-statistic and model discrimination (predictive ability) were compared.³¹ Second, we examined the stability of the risk variable frequencies and regression coefficients across the development and validation datasets. Third, we calculated over-fitting indices in the 2015 Validation Sample. Over-fitting refers to the phenomenon in which a model describes the relationship between predictive variables and outcome well in the development dataset but fails to provide valid predictions in a new sample of patients (in this case, our validation dataset). Estimated calibration values of γ_0 far from 0 and estimated values of γ_1 far from 1 provide evidence of over-fitting.

7.5.5 Selection of Random Effects Term Distribution

We examined different distributions (Normal, T, Exponential and Gamma distributions) of random effects in the hierarchical logistic regression model by evaluating model DIC (Deviance Information Criteria). The hierarchical model with normally distributed random effects had the lowest DIC and was used to calculate ASC-level measure scores.

7.5.6 Calculation of ASC-Level Measure Score Variation and Outlier Status

ASCs' measure scores were calculated using a combined Medicare FFS 2014-2015 Dataset. As noted above in [Section 7.5.1](#), we calculated the RSHVR for each ASC by computing the ratio of the number of predicted unplanned hospital visits to the number of expected unplanned hospital visits and then multiplying the ratio by the national outcome rate in the Medicare FFS 2014-2015 Dataset. Then, we evaluated variation in the risk-adjusted measure scores among ASCs in two ways. First, we described the distribution of the RSHVR. Second, we assigned ASCs to one of three performance categories: 'better than national rate', 'no different than national rate' and 'worse than national rate'. To do this, we computed a 95% interval estimate of the RSHVR for each ASC to characterize the level of uncertainty around the specific point estimate. ASCs with 95% interval estimates that did not include the national rate were deemed either worse than or better than national rate; ASCs with 95% interval estimates that include the national rate were deemed no different than the national rate.

7.5.7 ASC-Level Measure Score Reliability Testing

To calculate measure score reliability for a 2-year reporting period, we used split samples of four years of claims data from 2012-2015. Reliability of the ASC-level measure score was tested by calculating the intra-class correlation coefficient (ICC). To calculate the ICC, the 2012-2015 data were split into two samples. For ASCs with two or more general surgery procedures, these procedures were randomly split into the two samples within each facility. The ASCs with one procedure were randomly split into the two samples. The ICC evaluated the agreement between the RSHVR calculated in the two randomly selected samples.³²

7.5.8 Statistical Software

All statistical analyses were performed using Statistical Analysis System (SAS) version 9.4 (SAS Institute Inc., Cary, NC). We used both GLIMMIX and MCMC procedures in SAS for identifying the optimal model for this measure. The final hierarchical logistic regression model was estimated using the GLIMMIX procedure in SAS.

8. Results

8.1 Cohort Size and Unadjusted Outcome Rates in the 2015 Data

8.1.1 Cohort

After applying all inclusion and exclusion criteria, the 2015 100% FFS dataset included 149,932 outpatient general surgeries performed at 3,256 ASCs. The 2015 Development and Validation Samples consisted of 74,966 and 74,966 general surgery procedures performed at 2,989 and 2,951 ASCs, respectively. In both the Development and Validation Samples, the average age of patients was 76.3 years, and the comorbidity frequencies were similar ([Table 1](#)).

[Table 2](#) presents the top 20 most common surgeries included in the Medicare FFS CY 2015 Dataset (CY 2015 general surgery ASC measure cohort); they represent 57.6% of all surgeries in the cohort.

Across ASCs in the Medicare FFS 2015 dataset, the median volume of general surgery procedure cases in the cohort was 12 and ranged from 1 to 1,620 procedures per ASC (the 25th and 75th percentiles were 4 and 43 procedures, respectively). These results show that there were many ASCs with few cases in the Medicare FFS CY 2015 dataset; 1,157 ASCs had more than 25 cases.

8.1.2 Outcome Rates and Distribution

In the 2015 100% FFS dataset, the overall national 7-day unplanned hospital visit rate was 2.2%. Of these hospital visits, 1.6% were ED or observation stay visits and 0.6% were unplanned inpatient admissions ([Table 3](#)).

The distribution of unadjusted outcome rates was skewed, suggesting variation in quality. Among the 1,157 ASCs with at least 25 cases in the Medicare FFS CY 2015 dataset, the unadjusted rate of unplanned hospital visits ranged from 0% to 13.2%. Among these ASCs with 25 or more cases, 25.2% had a rate of 0%; however, the top 10% had rates exceeding 5.7%. The results show important variation in performance across ASC facilities. While many achieve very low rates, there is a wide range of outcome rates, suggesting room for improvement.

Hospital visits after general surgery ASC procedures were for a diverse array of reasons. Potentially preventable causes, such as urinary retention, pain, nausea, vomiting, syncope, and other surgery-related complications, were common diagnoses associated with unplanned hospital visits across the AHRQ clinical categories included in the measure cohort ([Table 4](#)).

8.2 Patient-Level Risk-Adjustment Model

8.2.1 Candidate and Final Variables

Candidate variables for risk adjustment included patient demographic, clinical, and procedural-related characteristics ([see Appendix D, Table D1](#)). After performing the stepwise variable selection procedure described in [Section 7.5.3](#) above, the final risk-adjustment model included age, 20 comorbidities, work RVUs to adjust for surgical procedural complexity, number of qualifying procedures, procedure type (abdomen vs. alimentary tract vs. breast vs. skin/soft tissue vs. wound vs. varicose vein), and one interaction term. [Table 1](#) shows the frequency of the final risk-adjustment variables in the Development and Validation Samples.

8.2.2 Model Performance and Validation

As the results in [Table 5](#) show, the c-statistic in both the 2015 Development and Validation Sample final models was 0.702, which indicated good model discrimination. Additionally, the risk decile plots showed good discrimination; the model performed well in each of the risk deciles in both the Development Sample ([Figure 2](#)) and the Validation Sample ([Figure 3](#)). The mean observed unplanned hospital visit rate in the 2015 Development Sample ranged from 0.74% in the lowest decile of predicted general surgery hospital visit rate to 6.42% in the highest predicted risk decile, a range of 5.68%; the mean observed unplanned hospital visit rate in the 2015 Validation Sample ranged from 0.69% in the lowest predicted risk decile to 6.51% in the highest predicted risk decile, a range of 5.82% ([Table 5](#)).

The regression coefficients of the model variables were stable across the Development and Validation Samples ([Table 6](#)).

8.3 ASC-Level Measure Score

8.3.1 ASC-Level Measure Score Variation and Outlier Status

The risk-standardized measure scores estimated using two full years of Medicare FFS data (2014 and 2015) showed variation across ASCs. Among ASCs performing at least 25 procedures ([Figure 4](#)), the median RSHVR was 2.19%, ranging from 0.92% to 4.67% (the 25th and 75th percentiles were 2.02% and 3.07%, respectively). Using a bootstrapped 95% interval estimate, we found 30 significant outliers among 1,651 ASCs meeting the volume threshold of at least 25 cases; 14 were categorized as better than national rate, 1,621 as no different than national rate, and 16 as worse than the national rate.

8.3.2 ASC-Level Measure Score Reliability Testing

The results of reliability testing are consistent with existing measures of patient outcomes in the ambulatory surgery setting. The agreement between the two RSHVR values for each ASC was calculated for two years to be ICC [2,1] = 0.526, indicating moderate measure score reliability.³²

9. Summary and Discussion

Hospital visits following general surgery procedures performed at ASCs are unexpected by patients, currently largely invisible to providers, and costly to the healthcare system. The ASC general surgery measure, as specified, has the potential to illuminate these quality differences, inform patient choice, drive quality improvement, and enhance care coordination, with the ultimate goal of reducing unplanned hospital visits following general surgery procedures performed at ASCs.

Medicare beneficiaries commonly undergo outpatient general surgery procedures at ASCs. Using a national 100% Medicare FFS dataset, we estimated that approximately 149,932 outpatient general surgery procedures were performed in 2015 at 3,256 ASCs using the cohort definition for the measure. Our analysis suggests that 2.2% of general surgery procedures at ASCs among Medicare FFS patients aged 65 years and older are followed by unplanned hospital visits within 7 days. Hospital visits often occur due to potentially preventable adverse events, such as urinary retention, bleeding, postoperative pain, and nausea and vomiting. Our results also show significant variation in unplanned hospital visits among ASCs after adjusting for case mix, which suggests variation in quality of care.

The many small-volume ASCs make development and use of outcome measures to assess quality of care challenging. ASCs with few cases in a given year do not provide enough information about quality and limit our ability to estimate risk-adjusted facility-level measure scores. However, as mentioned above in [Section 7.2](#), for public reporting, CMS is considering using more than 1 year of data to ensure reliable estimates.

10. References

1. Cullen KA, Hall MJ, Golosinskiy A, Statistics NCfH. *Ambulatory surgery in the United States, 2006*. US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics; 2009.
2. Majholm BB. Is day surgery safe? A Danish multicentre study of morbidity after 57,709 day surgery procedures. *Acta anaesthesiologica Scandinavica*. 2012;56(3):323-331.
3. Whippley A, Kostandoff G, Paul J, Ma J, Thabane L, Ma HK. Predictors of unanticipated admission following ambulatory surgery: a retrospective case-control study. *Canadian Journal of Anesthesia/Journal canadien d'anesthésie*. 2013;60(7):675-683.
4. Fleisher LA, Pasternak LR, Herbert R, Anderson GF. Inpatient hospital admission and death after outpatient surgery in elderly patients: importance of patient and system characteristics and location of care. *Arch Surg*. 2004;139(1):67-72.
5. Coley KC, Williams BA, DaPos SV, Chen C, Smith RB. Retrospective evaluation of unanticipated admissions and readmissions after same day surgery and associated costs. *Journal of clinical anesthesia*. 2002;14(5):349-353.
6. Hollingsworth JM. Surgical quality among Medicare beneficiaries undergoing outpatient urological surgery. *The Journal of urology*. 2012;188(4):1274-1278.
7. Bain J, Kelly H, Snadden D, Staines H. Day surgery in Scotland: patient satisfaction and outcomes. *Quality in Health Care*. 1999;8(2):86-91.
8. Fortier J, Chung F, Su J. Unanticipated admission after ambulatory surgery--a prospective study. *Canadian journal of anaesthesia = Journal canadien d'anesthésie*. 1998;45(7):612-619.
9. Aldwinckle R, Montgomery J. Unplanned admission rates and postdischarge complications in patients over the age of 70 following day case surgery. *Anaesthesia*. 2004;59(1):57-59.
10. Baugh RR. Safety of outpatient surgery for obstructive sleep apnea. *Otolaryngology--head and neck surgery*. 2013;148(5):867-872.
11. Bhattacharyya N. Ambulatory sinus and nasal surgery in the United States: Demographics and perioperative outcomes. *The Laryngoscope*. 2010;120(3):635-638.
12. Bhattacharyya NN. Unplanned revisits and readmissions after ambulatory sinonasal surgery. *The Laryngoscope*. 2014;124(9):1983-1987.
13. Bhattacharyya NN. Revisits and postoperative hemorrhage after adult tonsillectomy. *The Laryngoscope*. 2014;124(7):1554-1556.

14. Hansen DGDG. Variation in hospital-based acute care within 30 days of outpatient plastic surgery. *Plastic and reconstructive surgery (1963)*. 2014;134(3):370e-378e.
15. Mahboubi HH. Ambulatory laryngopharyngeal surgery: evaluation of the national survey of ambulatory surgery. *JAMA otolaryngology-- head & neck surgery*. 2013;139(1):28-31.
16. Menachemi. Quality of care differs by patient characteristics: outcome disparities after ambulatory surgical procedures. *American journal of medical quality*. 2007;22(6):395-401.
17. Orosco RKRK. Ambulatory thyroidectomy: a multistate study of revisits and complications. *Otolaryngology--head and neck surgery*. 2015;152(6):1017-1023.
18. Owens PLPL. Surgical site infections following ambulatory surgery procedures. *JAMA : the journal of the American Medical Association*. 2014;311(7):709-716.
19. Mezei G, Chung F. Return hospital visits and hospital readmissions after ambulatory surgery. *Ann Surg*. 1999;230(5):721-727.
20. Bettelli G. High risk patients in day surgery. *Minerva anesthesiologica*. 2009;75(5):259-268.
21. Fuchs K. Minimally invasive surgery. *Endoscopy*. 2002;34(2):154-159.
22. Centers for Medicare & Medicaid Services. Ambulatory Surgical Center Quality Reporting Specifications Manual Release Notes Version: 6.0. 2016;
http://qualitynet.org/dcs/BlobServer?blobkey=id&blobnocache=true&blobwhere=1228890589535&blobheader=multipart%2Foctet-stream&blobheadername1=Content-Disposition&blobheadervalue1=attachment%3Bfilename%3DASC_Full_Manual_V6.0.pdf&blobcol=urldata&blohtable=MungoBlobs Accessed July 13, 2016.
23. Mattila K, Toivonen J, Janhunen L, Rosenberg PH, Hynynen M. Postdischarge symptoms after ambulatory surgery: first-week incidence, intensity, and risk factors. *Anesthesia and analgesia*. 2005;101(6):1643-1650.
24. Normand S-LT, Shahian DM. Statistical and clinical aspects of hospital outcomes profiling. *Statistical Science*. 2007;22(2):206-226.
25. Krumholz HM, Brindis RG, Brush JE, et al. Standards for Statistical Models Used for Public Reporting of Health Outcomes An American Heart Association Scientific Statement From the Quality of Care and Outcomes Research Interdisciplinary Writing Group: Cosponsored by the Council on Epidemiology and Prevention and the Stroke Council Endorsed by the American College of Cardiology Foundation. *Circulation*. 2006;113(3):456-462.

26. National Quality Forum. Measure Evaluation Criteria and Guidance for Evaluating Measures for Endorsement. 2015;
http://www.qualityforum.org/Measuring_Performance/Submitting_Standards/2015_Measure_Evaluation_Criteria.aspx. Accessed July 26, 2016.
27. Raval MV, Cohen ME, Ingraham AM, et al. Improving American College of Surgeons National Surgical Quality Improvement Program risk adjustment: incorporation of a novel procedure risk score. *Journal of the American College of surgeons*. 2010;211(6):715-723.
28. Fleisher LA, Pasternak LR, Lyles A. A novel index of elevated risk of inpatient hospital admission immediately following outpatient surgery. *Arch Surg*. 2007;142(3):263-268.
29. Mioton LM, Buck DW, 2nd, Rambachan A, Ver Halen J, Dumanian GA, Kim JY. Predictors of readmission after outpatient plastic surgery. *Plast Reconstr Surg*. 2014;133(1):173-180.
30. Hosmer DW, Lemeshow S. Introduction to the logistic regression model. *Applied Logistic Regression, Second Edition*. 2000:1-30.
31. DeLong ER, DeLong DM, Clarke-Pearson DL. Comparing the areas under two or more correlated receiver operating characteristic curves: a nonparametric approach. *Biometrics*. 1988:837-845.
32. Landis JR, Koch GG. The Measurement of Observer Agreement for Categorical Data. *Biometrics*. 1977;33(1):159-174.
33. Horwitz LI, Grady JN, Cohen DB, et al. Development and Validation of an Algorithm to Identify Planned Readmissions From Claims Data. *Journal of hospital medicine*. 2015;10(10):670-677.

11.Tables

Table 1. Frequency of risk model variables in the Medicare Development and Validation Samples (dataset: Medicare FFS CY 2015)

Variable (definition)	2015 Development Sample (50%)		2015 Validation Sample (50%)	
	#	%	#	%
N	74,966		74,966	
Age: mean (standard deviation [SD])	76.3	7.2%	76.3	7.2%
Number of qualifying procedures: 1	56,840	75.8%	57,228	76.3%
Number of qualifying procedures: 2	13,910	18.6%	13,839	18.5%
Number of qualifying procedures: ≥3	4,216	5.6%	3,899	5.2%
Procedure Type: Abdomen and its contents	9,512	12.7%	9,468	12.6%
Procedure Type: Alimentary tract	4,990	6.7%	5,094	6.8%
Procedure Type: Breast	5,082	6.8%	5,101	6.8%
Procedure Type: Skin/soft tissue	41,554	55.4%	41,570	55.5%
Procedure Type: Wound	13,243	17.7%	13,152	17.5%
Procedure Type: Vascular	585	0.8%	581	0.8%
Work Relative Value Units: mean (SD)	7.0	3.9%	7.0	3.9%
Comorbidities				
Other benign tumors (CC 15, 16)	60,004	80.0%	59,966	80.0%
Liver or biliary disease (CC 27, 28, 29, 30, 31)	6,621	8.8%	6,676	8.9%
Disorders of immunity (CC 47)	1,648	2.2%	1,765	2.4%
Dementia or senility (CC 51, 52, 53)	5,697	7.6%	5,661	7.6%
Psychiatric disorders (CC 57, 58, 59, 60, 61, 62, 63)	16,007	21.4%	15,925	21.2%
Other significant central nervous system (CNS) disease (CC 77, 78, 79, 80)	2,716	3.6%	2,795	3.7%
Ischemic heart disease (CC 86, 87, 88, 89)	21,595	28.8%	21,504	28.7%
Other and unspecified heart diseases (CC 90, 92, 93, 98)	8,805	11.7%	8,936	11.9%
Specified arrhythmias and other heart rhythm disorders (CC 96, 97)	21,064	28.1%	21,143	28.2%
Vascular or circulatory disease (CC 106, 107, 108, 109)	24,136	32.2%	24,282	32.4%
Chronic lung disease (CC 110, 111, 112, 113)	15,216	20.3%	15,048	20.1%
Pneumonia (CC 114, 115, 116)	4,898	6.5%	4,851	6.5%
Dialysis or sever chronic kidney disease (CC 134, 136, 137)	2,077	2.8%	2,046	2.7%
Urinary tract infection and other urinary tract disorders (CC 144, 145)	21,166	28.2%	21,293	28.4%
Benign prostatic hyperplasia (ICD-9 codes: 60000, 60001, 60020, 60021, 60090, 6091;	14,733	19.7%	14,672	19.6%

Variable (definition)	2015 Development Sample (50%)		2015 Validation Sample (50%)	
	#	%	#	%
ICD-10 codes: N40.0, N40.1, N40.2, N40.3)				
Cellulitis, local skin infection (CC 164)	10,497	14.0%	10,471	14.0%
Other dermatological disorders (CC 165)	57,448	76.6%	57,567	76.8%
Major traumatic fracture or internal injury (CC 169, 170, 171, 172, 173, 174)	25,326	33.8%	25,601	34.2%
Chronic anticoagulant use (ICD-9 code: V5861; ICD-10 code: Z7901 [long-term ¹⁹ use of anticoagulants])	7,653	10.2%	7,712	10.3%
Opioid abuse (ICD-9 codes: 30400, 30401, 30402, 30403, 30470, 30471, 30472, 30403, 30550, 30551, 30552, 30553; ICD-10: codes: F11.10, F11.120, F11.121, F11.122, F11.129, F11.14, F11.150, F11.151, F11.159, F11.181, F11.182, F11.188, F11.19, F11.20, F11.21, F11.220, F11.221, F11.222, F11.229, F11.23, F11.24, F11.250, F11.251, F11.259, F11.281, F11.282, F11.288, F11.29)	377	0.5%	357	0.5%

Table 2. Top 20 procedures in the general surgery cohort (dataset: Medicare FFS CY 2015)

CPT® code	CPT® code short description	Number of procedures	% of all surgeries
14060	Skin tissue rearrangement	11409	7.6%
13132	Repair of wound or lesion	11207	7.5%
15260	Skin full graft een & lips	7996	5.3%
14040	Skin tissue rearrangement	7212	4.8%
49505	Prp i/hern init reduc >5 yr	7072	4.7%
46221	Ligation of hemorrhoid(s)	4485	3.0%
13121	Repair of wound or lesion	3941	2.6%
14041	Skin tissue rearrangement	3910	2.6%
19301	Partical mastectomy	3521	2.3%
14301	Skin tissue rearrangement	3353	2.2%
14061	Skin tissue rearrangement	3240	2.2%
13101	Repair of wound or lesion	2735	1.8%
15732	Muscle-skin graft head/neck	2707	1.8%
47562	Laparoscopic choletectomy	2357	1.6%
49650	Lap ing hernia repair init	2348	1.6%
14020	Skin tissue rearrangement	2186	1.5%
14021	Skin tissue rearrangement	1670	1.1%
11606	Exc tr-ext mal+marg > 4 cm	1668	1.1%
12032	Intmd wnd repair s/a/t/ext	1647	1.1%

CPT® code	CPT® code short description	Number of procedures	% of all surgeries
19125	Excision breast lesion	1625	1.1%

Table 3. Number and frequency of emergency department visits, observation stays, and unplanned inpatient admissions (dataset: Medicare FFS CY 2015)

Number of general surgery procedures	Number with unplanned hospital visits outcome	Overall 7-day unplanned hospital visit rate
149,932	3,299	2.2
Outcome type	#	%
Emergency department or observation stay visit	2,445	1.6
Unplanned inpatient admission	854	0.6

Table 4. Top hospital visit diagnoses for any hospital visit within 7 days of general surgery procedures (dataset: Medicare FFS CY 2015)

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary ICD-9 hospital diagnoses	ICD-9 diagnosis description	Frequency of ICD-9 diagnosis	Top 10 primary ICD-10 hospital diagnoses	ICD-10 diagnosis description	Frequency of ICD-10 diagnosis
53 – Varicose vein stripping, lower limb	1,166	21	1.8%	99811	Hemorrhage complic proc	3	M79651	Pain in right thigh	1
				78659	Chest pain NEC	2	T426X2A	Poisoning by other antiepileptic and sedative-hypnotic drugs, intentional self-harm, initial encounter	1
				99832	Disrup-external op wound	1	-	-	-
				9162	Blister hip & leg	1	-	-	-
				87342	Open wound of forehead	1	-	-	-
				78829	Oth spcf retention urine	1	-	-	-
				78060	Fever NOS	1	-	-	-
				59080	Pyelonephritis NOS	1	-	-	-
				5770	Acute pancreatitis	1	-	-	-
				99859	Other postop infection	1	-	-	-
67 – Other therapeutic procedures, hemic and lymphatic system	1,876	54	2.9%	99811	Hemorrhage complic proc	4	L7621	Postprocedural hemorrhage and hematoma of skin and subcutaneous tissue following a dermatologic procedure	3

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary ICD-9 hospital diagnoses	ICD-9 diagnosis description	Frequency of ICD-9 diagnosis	Top 10 primary ICD-10 hospital diagnoses	ICD-10 diagnosis description	Frequency of ICD-10 diagnosis
				43491	Crbl art ocl NOS w infrc	3	A419	Sepsis, unspecified organism	2
				99859	Other postop infection	2	A408	Other streptococcal sepsis	1
				7231	Cervicalgia	2	C8387	Other non-follicular lymphoma, spleen	1
				20281	Lymphomas NEC head	2	C8510	Unspecified B-cell lymphoma, unspecified site	1
				56400	Constipation NOS	1	C8593	Non-Hodgkin lymphoma, unspecified, intra-abdominal lymph nodes	1
				56089	Intestinal obstruct NEC	1	N952	Postmenopausal atrophic vaginitis	1
				490	Bronchitis NOS	1	R339	Retention of urine, unspecified	1
				42833	Ac on chr diast hrt fail	1	R55	Syncope and collapse	1
				42731	Atrial fibrillation	1	Z4889	Encounter for other specified surgical aftercare	1
71 – Gastrostomy, temporary and permanent	5	0	0.0%	-	-	-	-	-	-
72 – Colostomy, temporary and permanent	11	0	0.0%	-	-	-	-	-	-
73 – Ileostomy and	4	0	0.0%	-	-	-	-	-	-

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary ICD-9 hospital diagnoses	ICD-9 diagnosis description	Frequency of ICD-9 diagnosis	Top 10 primary ICD-10 hospital diagnoses	ICD-10 diagnosis description	Frequency of ICD-10 diagnosis
other enterostomy									
76 – Colonoscopy and biopsy	49	5	10.2%	78820	Retention urine NOS	2	D649	Anemia, unspecified	1
				8409	Sprain shoulder/arm NOS	1			
				78079	Malaise and fatigue NEC	1			
77 – Proctoscopy and anorectal biopsy	120	1	0.8%	-	-	-	J189	Pneumonia, unspecified organism	1
78 – Colorectal resection	442	20	4.5%	5693	Rectal & anal hemorrhage	3	I5043	Acute on chronic combined systolic (congestive) and diastolic (congestive) heart failure	1
				99811	Hemorrhage complic proc	2	N179	Acute kidney failure, unspecified	1
				78820	Retention urine NOS	2	-	-	-
				8021	Nasal bone fx-open	1	-	-	-
				7823	Edema	1	-	-	-
				605	Redun prepuce & phimosis	1	-	-	-
				5849	Acute kidney failure NOS	1	-	-	-
				78760	Full incontinence-feces	1	-	-	-
				56400	Constipation NOS	1	-	-	-
				4558	Hemorrhoid NOS w comp NEC	1	-	-	-
81 – Hemorrhoid procedures	7,784	244	2.9%	78820	Retention urine NOS	46	R339	Retention of urine, unspecified	14

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary ICD-9 hospital diagnoses	ICD-9 diagnosis description	Frequency of ICD-9 diagnosis	Top 10 primary ICD-10 hospital diagnoses	ICD-10 diagnosis description	Frequency of ICD-10 diagnosis
				99811	Hemorrhage complic proc	6	K5900	Constipation, unspecified	2
				9975	Surg compl-urinary tract	6	K644	Residual hemorrhoidal skin tags	2
				78659	Chest pain NEC	6	I4891	Unspecified atrial fibrillation	1
				5693	Rectal & anal hemorrhage	5	I639	Cerebral infarction, unspecified	1
				7802	Syncope and collapse	4	J189	Pneumonia, unspecified organism	1
				56942	Anal or rectal pain	4	J205	Acute bronchitis due to respiratory syncytial virus	1
				56400	Constipation NOS	4	J690	Pneumonitis due to inhalation of food and vomit	1
				78900	Abdmnal pain unspcf site	3	K626	Ulcer of anus and rectum	1
				78701	Nausea with vomiting	3	K8000	Calculus of gallbladder with acute choletitis without obstruction	1
84 – Cholectomy and common duct exploration	3,472	223	6.4%	78820	Retention urine NOS	18	R339	Retention of urine, unspecified	11
				33818	Acute postop pain NEC	11	G8918	Other acute postprocedural pain	5
				99749	Oth digestv system comp	9	K9189	Other postprocedural complications and disorders of digestive system	4

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary ICD-9 hospital diagnoses	ICD-9 diagnosis description	Frequency of ICD-9 diagnosis	Top 10 primary ICD-10 hospital diagnoses	ICD-10 diagnosis description	Frequency of ICD-10 diagnosis
				99859	Other postop infection	5	K91840	Postprocedural hemorrhage and hematoma of a digestive system organ or structure following a digestive system procedure	3
				0389	Septicemia NOS	5	J189	Pneumonia, unspecified organism	2
				78900	Abdmnal pain unspcf site	4	J95821	Acute postprocedural respiratory failure	2
				78829	Oth spcf retention urine	4	K913	Postprocedural intestinal obstruction	2
				78701	Nausea with vomiting	4	R109	Unspecified abdominal pain	2
				9975	Surg compl-urinary tract	3	A09	Infectious gastroenteritis and colitis, unspecified	1
				78901	Abdmnal pain rt upr quad	3	A4151	Sepsis due to Escherichia coli [E. coli]	1
85 – Inguinal and femoral hernia repair	11,441	498	4.4%	78820	Retention urine NOS	84	R339	Retention of urine, unspecified	25
				9975	Surg compl-urinary tract	13	G8918	Other acute postprocedural pain	6
				56400	Constipation NOS	13	K5900	Constipation, unspecified	5
				99812	Hematoma complic proc	11	R55	Syncope and collapse	5
				99811	Hemorrhage complic	8	R338	Other retention of	4

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary ICD-9 hospital diagnoses	ICD-9 diagnosis description	Frequency of ICD-9 diagnosis	Top 10 primary ICD-10 hospital diagnoses	ICD-10 diagnosis description	Frequency of ICD-10 diagnosis
					proc			urine	
				33818	Acute postop pain NEC	8	K91841	Postprocedural hemorrhage and hematoma of a digestive system organ or structure following other procedure	3
				99749	Oth digestv system comp	7	R319	Hematuria, unspecified	3
				78900	Abdmnal pain unspcf site	7	A419	Sepsis, unspecified organism	2
				60886	Edema, male genital orgn	6	H8110	Benign paroxysmal vertigo, unspecified ear	2
				60001	BPH w urinary obs/LUTS	6	I9789	Other postprocedural complications and disorders of the circulatory system, not elsewhere classified	2
86 – Other hernia repair	3,797	147	3.9%	78820	Retention urine NOS	13	R339	Retention of urine, unspecified	6
				99749	Oth digestv system comp	11	K5900	Constipation, unspecified	2
				56400	Constipation NOS	6	K913	Postprocedural intestinal obstruction	2
				9975	Surg compl-urinary tract	5	L7622	Postprocedural hemorrhage and hematoma of skin and subcutaneous tissue	2

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary ICD-9 hospital diagnoses	ICD-9 diagnosis description	Frequency of ICD-9 diagnosis	Top 10 primary ICD-10 hospital diagnoses	ICD-10 diagnosis description	Frequency of ICD-10 diagnosis
								following other procedure	
				78900	Abdmnal pain unspcf site	5	G8918	Other acute postprocedural pain	1
				99811	Hemorrhage complic proc	3	I481	Persistent atrial fibrillation	1
				5609	Intestinal obstruct NOS	3	I4891	Unspecified atrial fibrillation	1
				33818	Acute postop pain NEC	3	I890	Lymphedema, not elsewhere classified	1
				99859	Other postop infection	2	J180	Bronchopneumonia, unspecified organism	1
				9982	Accidental op laceration	2	J440	Chronic obstructive pulmonary disease with acute lower respiratory infection	1
87 – Laparoscopy	184	18	9.8%	99673	Comp-ren dialys dev/grft	2	C801	Malignant (primary) neoplasm, unspecified	1
				78820	Retention urine NOS	2	K659	Peritonitis, unspecified	1
				9982	Accidental op laceration	1	R072	Precordial pain	1
				78900	Abdmnal pain unspcf site	1	T8241XA	Breakdown (mechanical) of vascular dialysis catheter, initial encounter	1
				78951	Malignant ascites	1	-	-	-
				7861	Stridor	1	-	-	-

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary ICD-9 hospital diagnoses	ICD-9 diagnosis description	Frequency of ICD-9 diagnosis	Top 10 primary ICD-10 hospital diagnoses	ICD-10 diagnosis description	Frequency of ICD-10 diagnosis
				56400	Constipation NOS	1	-	-	-
				51189	Effusion NEC exc tb	1	-	-	-
				45341	Ac DVT/emb prox low ext	1	-	-	-
				41071	Subendo infarct, initial	1	-	-	-
94 – Other OR upper GI therapeutic procedures	11	2	18.2%	42789	Cardiac dysrhythmias NEC	1	-	-	-
				42731	Atrial fibrillation	1	-	-	-
95 – Other non-OR lower GI therapeutic procedures	346	7	2.0%	78060	Fever NOS	2	G40409	Other generalized epilepsy and epileptic syndromes, not intractable, without status epilepticus	1
				78659	Chest pain NEC	1	-	-	-
				7820	Skin sensation disturb	1	-	-	-
				7089	Urticaria NOS	1	-	-	-
				5693	Rectal & anal hemorrhage	1	-	-	-
96 – Other OR lower GI therapeutic procedures	1,309	39	3.0%	78820	Retention urine NOS	4	J45901	Unspecified asthma with (acute) exacerbation	1
				56942	Anal or rectal pain	2	K5641	Fecal impaction	1
				566	Anal & rectal abscess	2	K5900	Constipation, unspecified	1
				78652	Painful respiration	1	K603	Anal fistula	1
				78605	Shortness of breath	1	K611	Rectal abscess	1
				78097	Altered mental status	1	K625	Hemorrhage of anus	1

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary ICD-9 hospital diagnoses	ICD-9 diagnosis description	Frequency of ICD-9 diagnosis	Top 10 primary ICD-10 hospital diagnoses	ICD-10 diagnosis description	Frequency of ICD-10 diagnosis
								and rectum	
				7242	Lumbago	1	K6289	Other specified diseases of anus and rectum	1
				6826	Cellulitis of leg	1	L0231	Cutaneous abscess of buttock	1
				5990	Urin tract infection NOS	1	R109	Unspecified abdominal pain	1
				5849	Acute kidney failure NOS	1	-	-	-
99 – Other OR gastrointestinal therapeutic procedures	86	10	11.6%	V5831	Attn rem surg dressing	1	L7622	Postprocedural hemorrhage and hematoma of skin and subcutaneous tissue following other procedure	1
				99932	Blood inf dt cen ven cth	1	R109	Unspecified abdominal pain	1
				99812	Hematoma complic proc	1	-	-	-
				79902	Hypoxemia	1	-	-	-
				78605	Shortness of breath	1	-	-	-
				7821	Nonspecif skin erupt NEC	1	-	-	-
				42831	Ac diastolic hrt failure	1	-	-	-
				25080	DMII oth nt st uncntrld	1	-	-	-
165 – Breast biopsy and other diagnostic	94	4	4.3%	56400	Constipation NOS	2	R110	Nausea	1
				-	-	-	R531	Weakness	1

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary ICD-9 hospital diagnoses	ICD-9 diagnosis description	Frequency of ICD-9 diagnosis	Top 10 primary ICD-10 hospital diagnoses	ICD-10 diagnosis description	Frequency of ICD-10 diagnosis
procedures on breast									
166 – Lumpectomy, quadrantectomy of breast	6,792	112	1.6%	99812	Hematoma complic proc	11	I639	Cerebral infarction, unspecified	2
				78659	Chest pain NEC	3	C50911	Malignant neoplasm of unspecified site of right female breast	1
				56400	Constipation NOS	3	C50912	Malignant neoplasm of unspecified site of left female breast	1
				5589	Noninf gastroenterit NEC	3	G453	Amaurosis fugax	1
				1749	Malign neopl breast NOS	3	I9789	Other postprocedural complications and disorders of the circulatory system, not elsewhere classified	1
				4019	Hypertension NOS	2	J069	Acute upper respiratory infection, unspecified	1
				78650	Chest pain NOS	2	J9621	Acute and chronic respiratory failure with hypoxia	1
				78079	Malaise and fatigue NEC	2	J9622	Acute and chronic respiratory failure with hypercapnia	1
				41071	Subendo infarct, initial	2	K559	Vascular disorder of intestine, unspecified	1
				42789	Cardiac dysrhythmias NEC	2	L259	Unspecified contact dermatitis, unspecified	1

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary ICD-9 hospital diagnoses	ICD-9 diagnosis description	Frequency of ICD-9 diagnosis	Top 10 primary ICD-10 hospital diagnoses	ICD-10 diagnosis description	Frequency of ICD-10 diagnosis
								cause	
167 – Mastectomy	294	10	3.4%	V5831	Attn rem surg dressing	2	K5641	Fecal impaction	1
				V4571	Acq absnce breast/nipple	1	K5900	Constipation, unspecified	1
				99811	Hemorrhage complic proc	1	K9419	Other complications of enterostomy	1
				99679	Comp-int prost devic NEC	1	M7989	Other specified soft tissue disorders	1
				9221	Contusion of chest wall	1			
168 – Incision and drainage, skin and subcutaneous tissue	1,251	76	6.1%	99859	Other postop infection	6	L02512	Cutaneous abscess of left hand	2
				99811	Hemorrhage complic proc	5	A419	Sepsis, unspecified organism	1
				6110	Inflam disease of breast	2	G8918	Other acute postprocedural pain	1
				4019	Hypertension NOS	2	I63422	Cerebral infarction due to embolism of left anterior cerebral artery	1
				5990	Urin tract infection NOS	2	I959	Hypotension, unspecified	1
				78659	Chest pain NEC	2	K5900	Constipation, unspecified	1
				68100	Cellulitis, finger NOS	2	L02511	Cutaneous abscess of right hand	1
				99666	React-inter joint prost	2	L03011	Cellulitis of right finger	1
				43301	Ocl bslr art w infrc	1	L03114	Cellulitis of left upper limb	1

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary ICD-9 hospital diagnoses	ICD-9 diagnosis description	Frequency of ICD-9 diagnosis	Top 10 primary ICD-10 hospital diagnoses	ICD-10 diagnosis description	Frequency of ICD-10 diagnosis
				4275	Cardiac arrest	1	L03116	Cellulitis of left lower limb	1
169 – Debridement of wound, infection or burn	72	4	5.6%	83400	Disl finger NOS-closed	1	-	-	-
				81612	Fx distal phal, hand-opn	1	-	-	-
				81611	Fx mid/prx phal, hand-op	1	-	-	-
				79029	Abnormal glucose NEC	1	-	-	-
170 – Excision of skin lesion	27,276	434	1.6%	99811	Hemorrhage complic proc	27	L7621	Postprocedural hemorrhage and hematoma of skin and subcutaneous tissue following a dermatologic procedure	7
				99859	Other postop infection	12	R55	Syncope and collapse	6
				99832	Disrup-external op wound	8	N390	Urinary tract infection, site not specified	5
				7802	Syncope and collapse	7	T814XXA	Infection following a procedure, initial encounter	5
				78820	Retention urine NOS	6	A419	Sepsis, unspecified organism	2
				78097	Altered mental status	6	G8918	Other acute postprocedural pain	2
				7804	Dizziness and giddiness	6	H9542	Postprocedural hemorrhage and hematoma of ear and	2

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary ICD-9 hospital diagnoses	ICD-9 diagnosis description	Frequency of ICD-9 diagnosis	Top 10 primary ICD-10 hospital diagnoses	ICD-10 diagnosis description	Frequency of ICD-10 diagnosis
								mastoid process following other procedure	
				56400	Constipation NOS	6	J441	Chronic obstructive pulmonary disease with (acute) exacerbation	2
				5589	Noninf gastroenterit NEC	5	K529	Noninfective gastroenteritis and colitis, unspecified	2
				0389	Septicemia NOS	5	K5792	Diverticulitis of intestine, part unspecified, without perforation or abscess without bleeding	2
171 – Suture of skin and subcutaneous tissue	24,865	313	1.3%	99811	Hemorrhage complic proc	17	L7621	Postprocedural hemorrhage and hematoma of skin and subcutaneous tissue following a dermatologic procedure	6
				99859	Other postop infection	10	R42	Dizziness and giddiness	4
				99832	Disrup-external op wound	7	A419	Sepsis, unspecified organism	3
				486	Pneumonia, organism NOS	6	R0789	Other chest pain	3
				42731	Atrial fibrillation	5	R55	Syncope and collapse	3
				0389	Septicemia NOS	5	J189	Pneumonia,	2

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary ICD-9 hospital diagnoses	ICD-9 diagnosis description	Frequency of ICD-9 diagnosis	Top 10 primary ICD-10 hospital diagnoses	ICD-10 diagnosis description	Frequency of ICD-10 diagnosis
								unspecified organism	
				95901	Head injury NOS	4	K5900	Constipation, unspecified	2
				920	Contusion face/scalp/nck	4	M549	Dorsalgia, unspecified	2
				41071	Subendo infarct, initial	4	R112	Nausea with vomiting, unspecified	2
				8910	Open wnd knee/leg/ankle	3	T814XXA	Infection following a procedure, initial encounter	2
172 – Skin graft	51,165	963	1.9%	99811	Hemorrhage complic proc	96	L7621	Postprocedural hemorrhage and hematoma of skin and subcutaneous tissue following a dermatologic procedure	22
				42731	Atrial fibrillation	18	N390	Urinary tract infection, site not specified	8
				78820	Retention urine NOS	17	J189	Pneumonia, unspecified organism	6
				7802	Syncope and collapse	17	R0789	Other chest pain	6
				78659	Chest pain NEC	15	R339	Retention of urine, unspecified	6
				78079	Malaise and fatigue NEC	14	R55	Syncope and collapse	6
				5990	Urin tract infection NOS	14	S0990XA	Unspecified injury of head, initial encounter	6

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary ICD-9 hospital diagnoses	ICD-9 diagnosis description	Frequency of ICD-9 diagnosis	Top 10 primary ICD-10 hospital diagnoses	ICD-10 diagnosis description	Frequency of ICD-10 diagnosis
				4019	Hypertension NOS	14	A419	Sepsis, unspecified organism	5
				99859	Other postop infection	12	E871	Hypo-osmolality and hyponatremia	5
				0389	Septicemia NOS	9	G459	Transient cerebral ischemic attack, unspecified	4
174 – Other non-OR therapeutic procedures on skin and breast	2,203	39	1.8%	7802	Syncope and collapse	2	A419	Sepsis, unspecified organism	1
				4019	Hypertension NOS	2	K5720	Diverticulitis of large intestine with perforation and abscess without bleeding	1
				0389	Septicemia NOS	2	L03115	Cellulitis of right lower limb	1
				51881	Acute respiratory failure	1	R51	Headache	1
				5070	Food/vomit pneumonitis	1	R55	Syncope and collapse	1
				486	Pneumonia, organism NOS	1	S9032XA	Contusion of left foot, initial encounter	1
				45111	Femoral vein phlebitis	1	T814XXA	Infection following a procedure, initial encounter	1
				4271	Parox ventric tachycard	1	-	-	-
				3549	Mononeuritis arm NOS	1	-	-	-
				33818	Acute postop pain NEC	1	-	-	-

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary ICD-9 hospital diagnoses	ICD-9 diagnosis description	Frequency of ICD-9 diagnosis	Top 10 primary ICD-10 hospital diagnoses	ICD-10 diagnosis description	Frequency of ICD-10 diagnosis
175 – Other OR therapeutic procedures on skin and breast	3,814	74	1.9%	99749	Oth digestv system comp	3	T814XXA	Infection following a procedure, initial encounter	2
				9953	Allergy, unspecified	3	A419	Sepsis, unspecified organism	1
				99812	Hematoma complic proc	2	C50911	Malignant neoplasm of unspecified site of right female breast	1
				78097	Altered mental status	2	J189	Pneumonia, unspecified organism	1
				7804	Dizziness and giddiness	2	K565	Intestinal adhesions [bands] with obstruction (postprocedural) (postinfection)	1
				486	Pneumonia, organism NOS	2	K859	Acute pancreatitis, unspecified	1
				43491	Crbl art ocl NOS w infrc	2	L03221	Cellulitis of neck	1
				29281	Drug-induced delirium	2	M797	Fibromyalgia	1
				4870	Influenza with pneumonia	1	M7989	Other specified soft tissue disorders	1
				4359	Trans cereb ischemia NOS	1	R0600	Dyspnea, unspecified	1
244 – Gastric bypass and volume reduction	3	1	33.3%	53909	Oth cmp gastrc band proc	1	-	-	-

Table 5. Risk-adjustment model performance summaries in the Medicare Development and Validation Samples (dataset: Medicare FFS CY 2015)

Characteristic	2015 Development Sample	2015 Validation Sample
N	74,966 (50%)	74,966 (50%)
# of hospital visits in 7 days	1,650 (2.2%)	1,649 (2.2%)
Calibration (γ_0 , γ_1)	(0, 1)	(-0.09, 0.97)
c-statistic	0.702	0.702
Predictive ability (lowest-highest risk decile)	0.74%-6.42%	0.69%-6.51%

Table 6. Model parameter estimates and odds ratios in the Medicare Development and Validation Samples (dataset: Medicare FFS CY 2015)

	2015 Development Sample		2015 Validation Sample	
	Estimate	Odds ratio (95% CI)	Estimate	Odds ratio (95% CI)
Intercept	-3.728	-	-3.871	-
Age	0.029	1.03 (1.02-1.04)	0.028	1.03 (1.02-1.04)
Number of qualifying procedures: 1 (reference)	-	-	-	-
Number of qualifying procedures: 2	0.118	1.13 (0.98-1.29)	0.125	1.13 (0.99-1.30)
Number of qualifying procedures: ≥ 3	0.252	1.29 (1.04-1.60)	0.094	1.10 (0.87-1.39)
Procedure type: Abdomen and its content (reference)	-	-	-	-
Procedure type: Alimentary tract	-0.853	-	-1.009	-
Procedure type: Breast	-0.708	-	-1.368	-
Procedure type: Skin/Soft Tissue	-1.092	-	-1.023	-
Procedure type: Wound	-0.889	-	-1.345	-
Procedure type: Varicose vein procedures	0.707	-	0.481	-
Work RVU	0.013	-	0.021	-
Other benign tumors	-0.275	0.76 (0.66-0.87)	-0.209	0.81 (0.71-0.93)
Liver or biliary disease	0.201	1.22 (1.05-1.42)	0.340	1.41 (1.22-1.62)
Disorders of immunity	0.338	1.40 (1.08-1.82)	-0.049	0.95 (0.71-1.29)
Dementia or senility	0.177	1.19 (1.07-1.33)	0.171	1.19 (1.10-1.40)
Psychiatric disorders	0.120	1.13 (1.00-1.27)	0.272	1.31 (1.17-1.47)
Other significant central nervous system (CNS) disease	0.407	1.50 (1.22-1.85)	0.180	1.20 (0.96-1.50)
Ischemic heart disease	0.175	1.19 (1.07-1.33)	0.138	1.15 (1.03-1.28)
Other and unspecified heart disease	0.151	1.16 (1.01-1.34)	-0.017	0.98 (0.85-1.14)
Specified arrhythmias and other heart rhythm disorders	0.157	1.17 (1.04-1.32)	0.257	1.29 (1.15-1.45)
Vascular or circulatory disease	0.126	1.13 (1.02-1.27)	0.036	1.04 (0.93-1.16)
Chronic lung disease	0.162	1.18 (1.05-1.32)	0.255	1.29 (1.15-1.45)
Pneumonia	0.260	1.30 (1.10-1.53)	0.115	1.12 (0.94-1.33)
Dialysis or severe chronic kidney disease	0.524	1.69 (1.37-2.09)	0.496	1.64 (1.32-2.05)
Urinary tract infection and other urinary tract disorders	0.112	1.12 (1.00-1.25)	0.231	1.26 (1.13-1.40)
Benign prostatic hyperplasia	0.149	1.16 (1.03-1.30)	0.177	1.19 (1.06-1.34)

	2015 Development Sample		2015 Validation Sample	
	Estimate	Odds ratio (95% CI)	Estimate	Odds ratio (95% CI)
Cellulitis, local skin infection	0.202	1.22 (1.07-1.40)	0.160	1.17 (1.02-1.34)
Other dermatological disorders	-0.198	0.82 (0.73-0.93)	-0.106	0.90 (0.80-1.02)
Major traumatic fracture or internal injury	0.205	1.23 (1.10-1.36)	0.215	1.24 (1.12-1.38)
Chronic anticoagulant use	0.212	1.24 (1.07-1.43)	0.196	1.22 (1.05-1.41)
Opioid abuse	0.593	1.81 (1.14-2.88)	0.293	1.34 (0.79-2.28)
Interaction: Alimentary tract and RVU	0.119	-	0.137	-
Interaction: Breast and RVU	-0.024	-	0.055	-
Interaction: Skin/soft tissue and RVU	0.008	-	-0.005	-
Interaction: Wound and RVU	-0.048	-	0.019	-
Interaction: Varicose vein procedures and RVU	-0.175	-	-0.205	-
Odds ratios: Work RVU in abdomen and its contents	0.013	1.01 (0.97-1.06)	0.021	1.02 (0.98-1.07)
Odds ratios: Work RVU in alimentary tract	0.133	1.14 (1.09-1.20)	0.158	1.17 (1.12-1.23)
Odds ratios: Work RVU in breast	-0.011	0.99 (0.93-1.06)	0.076	1.08 (1.02-1.14)
Odds ratios: Work RVU in skin/soft tissue	0.021	1.02 (1.00-1.04)	0.016	1.02 (1.00-1.03)
Odds ratios: Work RVU in wound	-0.034	0.97 (0.91-1.03)	0.041	1.04 (0.98-1.11)
Odds ratios: Work RVU in varicose vein procedures	-0.161	0.85 (0.65-1.12)	-0.184	0.83 (0.58-1.20)

12.Figures

Figure 1. Timing of hospital visits within 30 days of general surgery ASC procedures (event rate per day post discharge for 0- through 30-day period; dataset: Medicare FFS CY 2015)

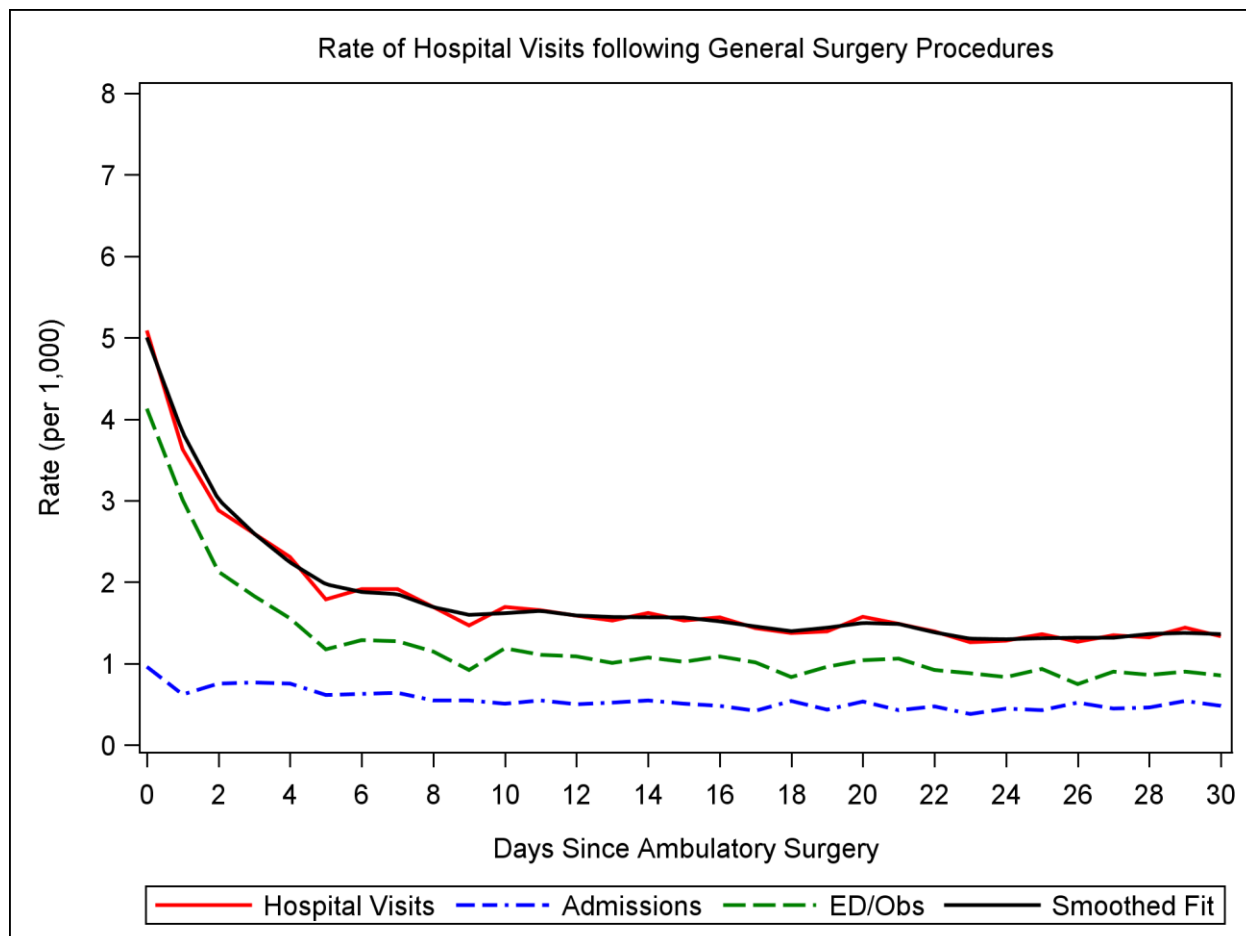


Figure 2. Calibration plot of predicted versus observed outcomes across deciles of patient risk in the CY 2015 Development Sample (dataset: Medicare FFS CY 2015)

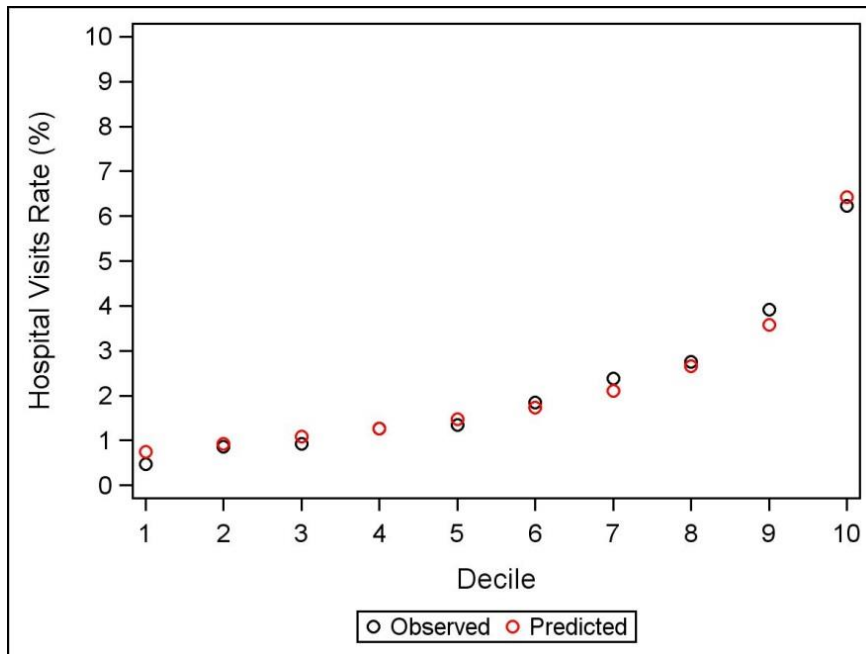


Figure 3. Calibration plot of predicted versus observed outcomes across deciles of patient risk in the CY 2015 Validation Sample (dataset: Medicare FFS CY 2015)

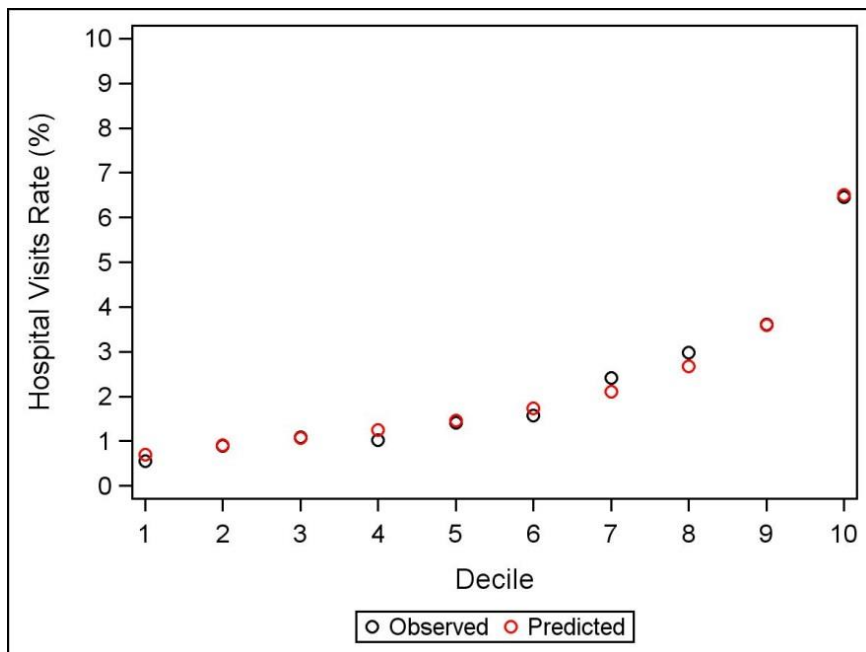
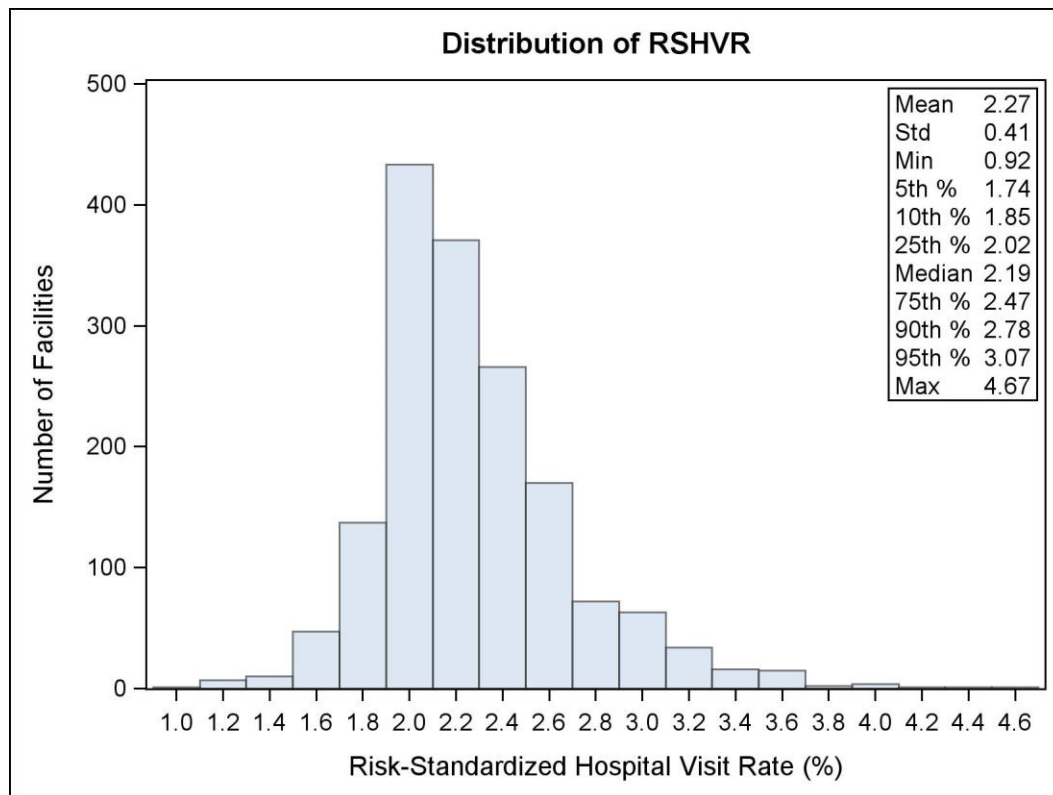


Figure 4. Distribution of risk-standardized hospital visit rates (RSHVRs) following general surgery ASC procedures (dataset: Medicare FFS 2014-2015) for ASCs with ≥ 25 cases



13. Appendices

13.1 Appendix A: List of all CPT® Procedure Codes Included in the Measure Cohort

Table A1. List of included Current Procedural Terminology (CPT®) codes defining general surgery procedures (codes used to define the general surgery measure cohort)

AHRQ clinical category	AHRQ clinical category description	Current Procedural Terminology (CPT®) code	Short description of CPT® code	Global Surgical Package Status
				090 = major procedure (90-day post-operative period) 010 = minor procedure (10-day post-operative period) 000 = minor procedure (0-day post-operative period)
53	Varicose vein stripping, lower limb	37766	Phleb veins - extrem 20+	090
		37765	Stab phleb veins xtr 10-20	090
		37785	Ligate/divide/excise vein	090
		37722	Ligate/strip long leg vein	090
		37700	Revise leg vein	090
		37761	Ligate leg veins open	090
		37718	Ligate/strip short leg vein	090
		37760	Ligate leg veins radical	090
		37735	Removal of leg veins/lesion	090
		37780	Revision of leg vein	090
67	Other therapeutic procedures, hemic and lymphatic system	38525	Biopsy/removal lymph nodes	090
		38500	Biopsy/removal lymph nodes	010
		38510	Biopsy/removal lymph nodes	010
		38745	Remove armpit lymph nodes	090
		38740	Remove armpit lymph nodes	090
		38760	Remove groin lymph nodes	090
		38542	Explore deep node(s) neck	090
		38520	Biopsy/removal lymph nodes	090

AHRQ clinical category	AHRQ clinical category description	Current Procedural Terminology (CPT®) code	Short description of CPT® code	Global Surgical Package Status
				090 = major procedure (90-day post-operative period) 010 = minor procedure (10-day post-operative period) 000 = minor procedure (0-day post-operative period)
		38700	Removal of lymph nodes neck	090
		38570	Laparoscopy lymph node biop	010
		38308	Incision of lymph channels	090
		38300	Drainage lymph node lesion	010
		38305	Drainage lymph node lesion	090
		38530	Biopsy/removal lymph nodes	090
		38550	Removal neck/armpit lesion	090
		38571	Laparoscopy lymphadenectomy	010
		38555	Removal neck/armpit lesion	090
		38572	Laparoscopy lymphadenectomy	010
		38794	Access thoracic lymph duct	090
71	Gastrostomy, temporary and permanent	49440	Place gastrostomy tube perc	010
		43653	Laparoscopy gastrostomy	090
72	Colostomy, temporary and permanent	44340	Revision of colostomy	090
73	Ileostomy and other enterostomy	44312	Revision of ileostomy	090
		49441	Place duod/jej tube perc	010
		49442	Place cecostomy tube perc	010
76	Colonoscopy and biopsy	45500	Repair of rectum	090
		45505	Repair of rectum	090
77	Proctoscopy and anorectal biopsy	45100	Biopsy of rectum	090
78	Colorectal resection	45171	Exc rect tum transanal part	090
		45172	Exc rect tum transanal full	090
		45160	Excision of rectal lesion	090

AHRQ clinical category	AHRQ clinical category description	Current Procedural Terminology (CPT®) code	Short description of CPT® code	Global Surgical Package Status
				090 = major procedure (90-day post-operative period) 010 = minor procedure (10-day post-operative period) 000 = minor procedure (0-day post-operative period)
81	Hemorrhoid procedures	46221	Ligation of hemorrhoid(s)	010
		46930	Destroy internal hemorrhoids	090
		46260	Remove in/ex hem groups 2+	090
		46946	Remove by ligat int hem grps	090
		46255	Remove int/ext hem 1 group	090
		46947	Hemorrhoidopexy by stapling	090
		46230	Removal of anal tags	010
		46250	Remove ext hem groups 2+	090
		46945	Remove by ligat int hem grp	090
		46320	Removal of hemorrhoid clot	010
		46500	Injection into hemorrhoid(s)	010
		46261	Remove in/ex hem grps & fiss	090
		46083	Incise external hemorrhoid	010
		46257	Remove in/ex hem grp & fiss	090
		46262	Remove in/ex hem grps w/fist	090
		46258	Remove in/ex hem grp w/fistu	090
84	Cholecystectomy and common duct exploration	47562	Laparoscopic cholecystectomy	090
		47563	Laparo cholecystectomy/graph	090
		47564	Laparo cholecystectomy/explr	090
		47630	Remove bile duct stone	090
85	Inguinal and femoral hernia repair	49505	Prp i/hern init reduc >5 yr	090
		49650	Lap ing hernia repair init	090
		49520	Rerepair ing hernia reduce	090
		49507	Prp i/hern init block >5 yr	090
		49651	Lap ing hernia repair recur	090

AHRQ clinical category	AHRQ clinical category description	Current Procedural Terminology (CPT®) code	Short description of CPT® code	Global Surgical Package Status <i>090 = major procedure (90-day post-operative period)</i> <i>010 = minor procedure (10-day post-operative period)</i> <i>000 = minor procedure (0-day post-operative period)</i>
		49525	Repair ing hernia sliding	090
		49521	Rerepair ing hernia blocked	090
		49550	Rpr rem hernia init reduce	090
		49553	Rpr fem hernia init blocked	090
		49557	Rerepair fem hernia blocked	090
		49555	Rerepair fem hernia reduce	090
		49495	Rpr ing hernia baby reduc	090
		49496	Rpr ing hernia baby blocked	090
		49500	Rpr ing hernia init reduce	090
		49501	Rpr ing hernia init blocked	090
86	Other hernia repair	49585	Rpr umbil hern reduc > 5 yr	090
		49560	Rpr ventral hern init reduc	090
		49587	Rpr umbil hern block > 5 yr	090
		49561	Rpr ventral hern init block	090
		49652	Lap vent/abd hernia repair	090
		49565	Rerepair ventrl hern reduce	090
		49653	Lap vent/abd hern proc comp	090
		49570	Rpr epigastric hern reduce	090
		49654	Lap inc hernia repair	090
		49655	Lap inc hern repair comp	090
		49590	Repair spigelian hernia	090
		49566	Rerepair ventrl hern block	090
		49572	Rpr epigastric hern blocked	090
		49656	Lap inc hernia repair recur	090

AHRQ clinical category	AHRQ clinical category description	Current Procedural Terminology (CPT®) code	Short description of CPT® code	Global Surgical Package Status <i>090 = major procedure (90-day post-operative period)</i> <i>010 = minor procedure (10-day post-operative period)</i> <i>000 = minor procedure (0-day post-operative period)</i>
		49657	Lap inc hern recur comp	090
		55540	Revise hernia & sperm veins	090
		49540	Repair lumbar hernia	090
		49580	Rpr umbil hern reduc < 5 yr	090
		49582	Rpr umbil hern block < 5 yr	090
		49600	Repair umbilical lesion	090
87	Laparoscopy	49320	Diag laparo separate proc	010
		49324	Lap insert tunnel ip cath	010
		49321	Laparoscopy biopsy	010
		49325	Lap revision perm ip cath	010
		49322	Laparoscopy aspiration	010
94	Other OR upper GI therapeutic procedures	43870	Repair stomach opening	090
		43130	Removal of esophagus pouch	090
95	Other non-OR lower GI therapeutic procedures	46922	Excision of anal lesion(s)	010
		46924	Destruction anal lesion(s)	010
		46220	Excise anal ext tag/papilla	010
		46910	Destruction anal lesion(s)	010
		45190	Destruction rectal tumor	090
		46940	Treatment of anal fissure	010
		46917	Laser surgery anal lesions	010
		46900	Destruction anal lesion(s)	010
		46916	Cryosurgery anal lesion(s)	010
		46942	Treatment of anal fissure	010
96	Other OR lower GI therapeutic procedures	46200	Removal of anal fissure	090
		46270	Remove anal fist subq	090

AHRQ clinical category	AHRQ clinical category description	Current Procedural Terminology (CPT®) code	Short description of CPT® code	Global Surgical Package Status
				<i>090 = major procedure (90-day post-operative period)</i> <i>010 = minor procedure (10-day post-operative period)</i> <i>000 = minor procedure (0-day post-operative period)</i>
		46275	Remove anal fist inter	090
		46080	Incision of anal sphincter	010
		46280	Remove anal fist complex	090
		45541	Correct rectal prolapse	090
		46040	Incision of rectal abscess	090
		46020	Placement of seton	010
		45910	Dilation of rectal narrowing	010
		45905	Dilation of anal sphincter	010
		46060	Incision of rectal abscess	090
		46505	Chemodenervation anal musc	010
		46700	Repair of anal stricture	090
		45915	Remove rectal obstruction	010
		46050	Incision of anal abscess	010
		46288	Repair anal fistula	090
		46285	Remove anal fist 2 stage	090
		46045	Incision of rectal abscess	090
		46030	Removal of rectal marker	010
		46707	Repair anorectal fist w/plug	090
		46750	Repair of anal sphincter	090
		45000	Drainage of pelvic abscess	090
		45005	Drainage of rectal abscess	010
		45020	Drainage of rectal abscess	090
		45150	Excision of rectal stricture	090
		46706	Repr of anal fistula w/glue	010
		46753	Reconstruction of anus	090

AHRQ clinical category	AHRQ clinical category description	Current Procedural Terminology (CPT®) code	Short description of CPT® code	Global Surgical Package Status <i>090 = major procedure (90-day post-operative period)</i> <i>010 = minor procedure (10-day post-operative period)</i> <i>000 = minor procedure (0-day post-operative period)</i>
		45108	Removal of anorectal lesion	090
		45900	Reduction of rectal prolapse	010
		46070	Incision of anal septum	090
		46754	Removal of suture from anus	010
		46760	Repair of anal sphincter	090
		46761	Repair of anal sphincter	090
		46762	Implant artificial sphincter	090
97	Other gastrointestinal diagnostic procedures	48102	Needle biopsy pancreas	010
98	Other non-OR gastrointestinal therapeutic procedures	47530	Revise/reinsert bile tube	090
99	Other OR gastrointestinal therapeutic procedures	49422	Remove tunneled ip cath	010
		49250	Excision of umbilicus	090
		49436	Embedded ip cath exit-site	010
		49402	Remove foreign body abdomen	090
		47382	Percut ablate liver rf	010
		47383	Perq abltj lvr cryoablation	010
		47510	Insert catheter bile duct	090
		47511	Insert bile duct drain	090
		49419	Insert tun ip cath w/port	090
		49426	Revise abdomen-venous shunt	090
		49429	Removal of shunt	010
165	Breast biopsy and other diagnostic procedures on breast	19101	Biopsy of breast open	010
166	Lumpectomy, quadrantectomy	19301	Partial mastectomy	090

AHRQ clinical category	AHRQ clinical category description	Current Procedural Terminology (CPT®) code	Short description of CPT® code	Global Surgical Package Status <i>090 = major procedure (90-day post-operative period)</i> <i>010 = minor procedure (10-day post-operative period)</i> <i>000 = minor procedure (0-day post-operative period)</i>
	of breast	19125	Excision breast lesion	090
		19120	Removal of breast lesion	090
		19302	P-mastectomy w/ln removal	090
167	Mastectomy	19303	Mast simple complete	090
		19300	Removal of breast tissue	090
		19304	Mast subq	090
168	Incision and drainage, skin and subcutaneous tissue	10140	Drainage of hematoma/fluid	010
		10060	Drainage of skin abscess	010
		10061	Drainage of skin abscess	010
		10180	Complex drainage wound	010
		26011	Drainage of finger abscess	010
		26010	Drainage of finger abscess	010
		21501	Drain neck/chest lesion	090
		10040	Acne surgery	010
169	Debridement of wound, infection or burn	11010	Debride skin at fx site	010
		69222	Clean out mastoid cavity	010
170	Excision of skin lesion	11642	Exc f/e/e/n/l mal+mrg 1.1-2	010
		11602	Exc tr-ext mal+marg 1.1-2 cm	010
		11603	Exc tr-ext mal+marg 2.1-3 cm	010
		11643	Exc f/e/e/n/l mal+mrg 2.1-3	010
		11606	Exc tr-ext mal+marg > 4 cm	010
		11402	Exc tr-ext b9+marg 1.1-2 cm	010
		11442	Exc face-mm b9+marg 1.1-2 cm	010
		11604	Exc tr-ext mal+marg 3.1-4 cm	010
		11440	Exc face-mm b9+marg 0.5 < cm	010

AHRQ clinical category	AHRQ clinical category description	Current Procedural Terminology (CPT®) code	Short description of CPT® code	Global Surgical Package Status
				<i>090 = major procedure (90-day post-operative period)</i> <i>010 = minor procedure (10-day post-operative period)</i> <i>000 = minor procedure (0-day post-operative period)</i>
		11644	Exc f/e/e/n/l mal+mrg 3.1-4	010
		11403	Exc tr-ext b9+marg 2.1-3 cm	010
		11641	Exc f/e/e/n/l mal+mrg 0.6-1	010
		11441	Exc face-mm b9+marg 0.6-1 cm	010
		11406	Exc tr-ext b9+marg > 4.0 cm	010
		11422	Exc h-f-nk-sp b9+marg 1.1-2	010
		26115	Exc hand les sc < 1.5 cm	090
		11622	Exc s/n/h/f/g mal+mrg 1.1-2	010
		11623	Exc s/n/h/f/g mal+mrg 2.1-3	010
		11646	Exc f/e/e/n/l mal+mrg > 4 cm	010
		11404	Exc tr-ext b9+marg 3.1-4 cm	010
		11624	Exc s/n/h/f/g mal+mrg 3.1-4	010
		11626	Exc s/n/h/f/g mal+mrg > 4 cm	010
		17000	Destruct premalg lesion	010
		11423	Exc h-f-nk-sp b9+marg 2.1-3	010
		11401	Exc tr-ext b9+marg 0.6-1 cm	010
		21931	Exc back les sc 3 cm/>	090
		11421	Exc h-f-nk-sp b9+marg 0.6-1	010
		11443	Exc face-mm b9+marg 2.1-3 cm	010
		21552	Exc neck les sc 3 cm/>	090
		11420	Exc h-f-nk-sp b9+marg 0.5 <	010
		21555	Exc neck les sc < 3 cm	090
		25075	Exc forearm les sc < 3 cm	090
		26111	Exc hand les sc 1.5 cm/>	090
		28043	Exc foot/toe tum sc < 1.5 cm	090

AHRQ clinical category	AHRQ clinical category description	Current Procedural Terminology (CPT®) code	Short description of CPT® code	Global Surgical Package Status
				<i>090 = major procedure (90-day post-operative period)</i> <i>010 = minor procedure (10-day post-operative period)</i> <i>000 = minor procedure (0-day post-operative period)</i>
		11640	Exc f/e/e/n/l mal+mrg 0.5cm<	010
		11400	Exc tr-ext b9+marg 0.5 < cm	010
		11424	Exc h-f-nk-sp b9+marg 3.1-4	010
		11426	Exc h-f-nk-sp b9+marg > 4 cm	010
		29893	Scope plantar fasciotomy	090
		24071	Exc arm/elbow les sc 3 cm/>	090
		28039	Exc foot/toe tum sc 1.5 cm/>	090
		24075	Exc arm/elbow les sc < 3 cm	090
		23071	Exc shoulder les sc 3 cm/>	090
		11444	Exc face-mm b9+marg 3.1-4 cm	010
		21012	Exc face les sbq 2 cm/>	090
		25071	Exc forearm les sc 3 cm/>	090
		11601	Exc tr-ext mal+marg 0.6-1 cm	010
		27337	Exc thigh/knee les sc 3 cm/>	090
		11200	Removal of skin tags	010
		11621	Exc s/n/h/f/g mal+mrg 0.6-1	010
		21011	Exc face les sc < 2 cm	090
		11446	Exc face-mm b9+marg > 4 cm	010
		27327	Exc thigh/knee les sc < 3 cm	090
		17110	Destruct b9 lesion 1-14	010
		22903	Exc abd les sc 3 cm/>	090
		27618	Exc leg/ankle tum < 3 cm	090
		27043	Exc hip pelvis les sc 3 cm/>	090
		17262	Destruction of skin lesions	010
		27632	Exc leg/ankle les sc 3 cm/>	090

AHRQ clinical category	AHRQ clinical category description	Current Procedural Terminology (CPT®) code	Short description of CPT® code	Global Surgical Package Status
				<i>090 = major procedure (90-day post-operative period)</i> <i>010 = minor procedure (10-day post-operative period)</i> <i>000 = minor procedure (0-day post-operative period)</i>
		11600	Exc tr-ext mal+marg 0.5 < cm	010
		17004	Destroy premal lesions 15/>	010
		23075	Exc shoulder les sc < 3 cm	090
		11620	Exc h-f-nk-sp mal+marg 0.5 <	010
		17272	Destruction of skin lesions	010
		22902	Exc abd les sc < 3 cm	090
		17281	Destruction of skin lesions	010
		27047	Exc hip/pelvis les sc < 3 cm	090
		17282	Destruction of skin lesions	010
		10160	Puncture drainage of lesion	010
		17271	Destruction of skin lesions	010
		17261	Destruction of skin lesions	010
		17263	Destruction of skin lesions	010
		17106	Destruction of skin lesions	090
		17111	Destruct lesion 15 or more	010
		17273	Destruction of skin lesions	010
		11450	Removal sweat gland lesion	090
		11470	Removal sweat gland lesion	090
		17280	Destruction of skin lesions	010
		17283	Destruction of skin lesions	010
		17276	Destruction of skin lesions	010
		11462	Removal sweat gland lesion	090
		17286	Destruction of skin lesions	010
		15936	Remove sacrum pressure sore	090
		17264	Destruction of skin lesions	010

AHRQ clinical category	AHRQ clinical category description	Current Procedural Terminology (CPT®) code	Short description of CPT® code	Global Surgical Package Status <i>090 = major procedure (90-day post-operative period)</i> <i>010 = minor procedure (10-day post-operative period)</i> <i>000 = minor procedure (0-day post-operative period)</i>
		17266	Destruction of skin lesions	010
		17274	Destruction of skin lesions	010
		11451	Removal sweat gland lesion	090
		11463	Removal sweat gland lesion	090
		11471	Removal sweat gland lesion	090
		15931	Remove sacrum pressure sore	090
		17107	Destruction of skin lesions	090
		17270	Destruction of skin lesions	010
		17284	Destruction of skin lesions	010
		17340	Cryotherapy of skin	010
		15944	Remove hip pressure sore	090
		15950	Remove thigh pressure sore	090
		15934	Remove sacrum pressure sore	090
		15940	Remove hip pressure sore	090
		17108	Destruction of skin lesions	090
		17260	Destruction of skin lesions	010
		31830	Revise windpipe scar	090
		15952	Remove thigh pressure sore	090
		15956	Remove thigh pressure sore	090
		17360	Skin peel therapy	010
171	Suture of skin and subcutaneous tissue	13132	Repair of wound or lesion	010
		13121	Repair of wound or lesion	010
		13101	Repair of wound or lesion	010
		12032	Intmd wnd repair s/a/t/ext	010
		12051	Intmd wnd repair face/mm	010

AHRQ clinical category	AHRQ clinical category description	Current Procedural Terminology (CPT®) code	Short description of CPT® code	Global Surgical Package Status
				<i>090 = major procedure (90-day post-operative period)</i> <i>010 = minor procedure (10-day post-operative period)</i> <i>000 = minor procedure (0-day post-operative period)</i>
		13131	Repair of wound or lesion	010
		12052	Intmd wnd repair face/mm	010
		12031	Intmd wnd repair s/a/t/ext	010
		12042	Intmd wnd repair n-hf/genit	010
		12034	Intmd wnd repair s/tr/ext	010
		13160	Late closure of wound	090
		13120	Repair of wound or lesion	010
		12041	Intmd wnd repair n-hf/genit	010
		12053	Intmd wnd repair face/mm	010
		13100	Repair of wound or lesion	010
		12035	Intmd wnd repair s/a/t/ext	010
		12020	Closure of split wound	010
		12054	Intmd wnd repair face/mm	010
		12044	Intmd wnd repair n-hf/genit	010
		12036	Intmd wnd repair s/a/t/ext	010
		12021	Closure of split wound	010
		12055	Intmd wnd repair face/mm	010
		12045	Intmd wnd repair n-hf/genit	010
		12037	Intmd wnd repair s/tr/ext	010
		12046	Intmd wnd repair n-hf/genit	010
		12047	Intmd wnd repair n-hf/genit	010
		12056	Intmd wnd repair face/mm	010
		12057	Intmd rpr face/mm >30.0 cm	010
172	Skin graft	14060	Skin tissue rearrangement	090
		15260	Skin full graft een & lips	090

AHRQ clinical category	AHRQ clinical category description	Current Procedural Terminology (CPT®) code	Short description of CPT® code	Global Surgical Package Status
				<i>090 = major procedure (90-day post-operative period)</i> <i>010 = minor procedure (10-day post-operative period)</i> <i>000 = minor procedure (0-day post-operative period)</i>
		14040	Skin tissue rearrangement	090
		14041	Skin tissue rearrangement	090
		14301	Skin tissue rearrangement	090
		14061	Skin tissue rearrangement	090
		15732	Muscle-skin graft head/neck	090
		14020	Skin tissue rearrangement	090
		14021	Skin tissue rearrangement	090
		15240	Skin full grft face/genit/hf	090
		15220	Skin full graft sclp/arm/leg	090
		14000	Skin tissue rearrangement	090
		15576	Form skin pedicle flap	090
		15630	Skin graft	090
		15120	Skn splt a-grft fac/nck/hf/g	090
		14001	Skin tissue rearrangement	090
		15100	Skin splt grft trnk/arm/leg	090
		15731	Forehead flap w/vasc pedicle	090
		15574	Form skin pedicle flap	090
		15736	Muscle-skin graft arm	090
		15734	Muscle-skin graft trunk	090
		15770	Derma-fat-fascia graft	090
		15738	Muscle-skin graft leg	090
		15620	Skin graft	090
		15760	Composite skin graft	090
		15572	Form skin pedicle flap	090
		15570	Form skin pedicle flap	090

AHRQ clinical category	AHRQ clinical category description	Current Procedural Terminology (CPT®) code	Short description of CPT® code	Global Surgical Package Status
				<i>090 = major procedure (90-day post-operative period)</i> <i>010 = minor procedure (10-day post-operative period)</i> <i>000 = minor procedure (0-day post-operative period)</i>
		15200	Skin full graft trunk	090
		15115	Epidrm a-grft face/nck/hf/g	090
		40818	Excise oral mucosa for graft	090
		15135	Derm autograft face/nck/hf/g	090
		15845	Skin and muscle repair face	090
		15050	Skin pinch graft	090
		15110	Epidrm autogrft trnk/arm/leg	090
		15650	Transfer skin pedicle flap	090
		15840	Graft for face nerve palsy	090
		15610	Skin graft	090
		14350	Skin tissue rearrangement	090
		15600	Skin graft	090
		15150	Cult skin grft t/arm/leg	090
		15155	Cult skin graft f/n/hf/g	090
		15130	Derm autograft trnk/arm/leg	090
		15841	Graft for face nerve palsy	090
		15842	Nerve palsy microsurg graft	090
174	Other non-OR therapeutic procedures on skin and breast	11750	Removal of nail bed	010
		10120	Remove foreign body	010
		10121	Remove foreign body	010
		11752	Remove nail bed/finger tip	010
		19110	Nipple exploration	090
		61885	Insrt/redo neurostim 1 array	090
		11765	Excision of nail fold toe	010
		61886	Implant neurostim arrays	090

AHRQ clinical category	AHRQ clinical category description	Current Procedural Terminology (CPT®) code	Short description of CPT® code	Global Surgical Package Status
				<i>090 = major procedure (90-day post-operative period)</i> <i>010 = minor procedure (10-day post-operative period)</i> <i>000 = minor procedure (0-day post-operative period)</i>
		61888	Revise/remove neuroreceiver	010
		23330	Remove shoulder foreign body	010
		24200	Removal of arm foreign body	010
		15788	Chemical peel face epiderm	090
		15789	Chemical peel face dermal	090
		10081	Drainage of pilonidal t	010
		10080	Drainage of pilonidal t	010
		15793	Chemical peel nonfacial	090
		15792	Chemical peel nonfacial	090
175	Other OR therapeutic procedures on skin and breast	20926	Removal of tissue for graft	090
		19380	Revise breast reconstruction	090
		19371	Removal of breast capsule	090
		19318	Reduction of large breast	090
		15740	Island pedicle flap graft	090
		11760	Repair of nail bed	010
		19340	Immediate breast prosthesis	090
		11970	Replace tissue expander	090
		19342	Delayed breast prosthesis	090
		19316	Suspension of breast	090
		19350	Breast reconstruction	090
		19328	Removal of breast implant	090
		19370	Surgery of breast capsule	090
		19330	Removal of implant material	090
		19366	Breast reconstruction	090
		11960	Insert tissue expander(s)	090

AHRQ clinical category	AHRQ clinical category description	Current Procedural Terminology (CPT®) code	Short description of CPT® code	Global Surgical Package Status
				<i>090 = major procedure (90-day post-operative period)</i> <i>010 = minor procedure (10-day post-operative period)</i> <i>000 = minor procedure (0-day post-operative period)</i>
		19357	Breast reconstruction	090
		28190	Removal of foot foreign body	010
		19325	Enlarge breast with implant	090
		11971	Remove tissue expander(s)	090
		20103	Explore wound extremity	010
		19020	Incision of breast lesion	090
		11762	Reconstruction of nail bed	010
		15830	Exc skin abd	090
		15839	Excise excessive skin tissue	090
		11771	Removal of pilonidal lesion	090
		15781	Abrasion treatment of skin	090
		11770	Removal of pilonidal lesion	010
		11772	Removal of pilonidal lesion	090
		19355	Correct inverted nipple(s)	090
		15780	Abrasion treatment of skin	090
		15836	Excise excessive skin tissue	090
		27086	Remove hip foreign body	010
		30124	Removal of nose lesion	090
		15786	Abrasion lesion single	010
		15837	Excise excessive skin tissue	090
		19112	Excise breast duct fistula	090
		15832	Excise excessive skin tissue	090
		15838	Excise excessive skin tissue	090
		19324	Enlarge breast	090
		26596	Excision constricting tissue	090

AHRQ clinical category	AHRQ clinical category description	Current Procedural Terminology (CPT®) code	Short description of CPT® code	Global Surgical Package Status
				090 = major procedure (90-day post-operative period) 010 = minor procedure (10-day post-operative period) 000 = minor procedure (0-day post-operative period)
		15819	Plastic surgery neck	090
		15783	Dermabrasion suprfl any site	090
		15782	Dermabrasion other than face	090
		15833	Excise excessive skin leg	090
		15834	Excise excessive skin hip	090
		15835	Excise excessive skin buttck	090
244	Gastric bypass and volume reduction	43888	Change gastric port open	090
		43886	Revise gastric port open	090
		43887	Remove gastric port open	090

13.2 Appendix B: Emergency Department Visits and Observation Stays Definition

Table B1. HCPCS codes or revenue center codes that define emergency department visits and observation stays

Billing (HCPCS) or Revenue Code*	Description
0450	Emergency Room
0451	Emergency Room: EM/EMTALA
0452	Emergency Room: ER/Beyond EMTALA
0456	Emergency Room: Urgent care
0459	Emergency Room: Other emergency room
0981	Professional fees (096x) Emergency room
G0378†	Hospital observation service, per hour

*Identified in Medicare Part B Outpatient hospital claims.

†Denotes HCPCS Codes, all other codes are revenue center codes.

13.3 Appendix C: Planned Admission Algorithm

C1. Planned Admission Algorithm Overview

The planned admission algorithm is adapted from the CMS Planned Readmission Algorithm Version 4.0. The algorithm is a set of criteria for classifying hospital inpatient admissions occurring after an ASC general surgery as planned or unplanned using Medicare claims. CMS seeks to count only unplanned admissions in the measure outcome because variation in planned admissions does not reflect quality differences. CORE developed the Planned Readmission Algorithm under contract to CMS based on a hospital-wide (not condition-specific) cohort of patients.³³

The algorithm classifies admissions as planned or unplanned using a flow chart ([Figure PA1](#)) and 4 tables of procedures and conditions ([Table PA1–Table PA4](#)). [Table PA1](#) identifies procedures that, if present in an admission, classify the admission as planned. [Table PA2](#) identifies principal discharge diagnoses that classify admissions as planned. [Table PA3](#) identifies procedures that, if present, classify an admission as planned as long as that admission does not have an acute (unplanned) principal discharge diagnosis. [Table PA4](#) lists the acute (unplanned) principal discharge diagnoses that disqualify admissions with a potentially planned procedure in [Table PA3](#) as planned.

The algorithm uses the Agency for Healthcare Research and Quality's (AHRQ's) Clinical Classifications Software (CCS) (<http://www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp>) codes

to group thousands of individual procedure and diagnosis ICD-9-CM codes into clinically coherent, mutually exclusive procedure CCS categories and mutually exclusive diagnosis CCS categories, respectively.

C2. Detailed Description of Planned Readmission Algorithm Version 4.0 – General Surgery ASC Measure

The planned admission algorithm uses the flow chart ([Figure PA1](#)) and [Table PA1–Table PA4](#), adapted for the general surgery ASC procedure population, to identify specific procedure categories and discharge diagnosis categories to classify admissions as planned or unplanned. As illustrated in the flow chart ([Figure PA1](#)), admissions that include certain procedures ([Table PA1](#)) or are for certain diagnoses [Table PA2](#) are always considered planned. If the admission does not include a procedure or diagnosis in [Table PA1](#) or [Table PA2](#) that is always considered planned, the algorithm checks whether the admission has at least 1 procedure that is considered potentially planned ([Table PA3](#)). If the admission has no procedures from [Table PA3](#), the admission is considered unplanned. [Table PA3](#) includes AHRQ procedure CCS categories and individual ICD-9-CM procedure codes. Examples of potentially planned procedures are total hip replacement (Procedure CCS 153) and hernia repair (Procedure CCS 85).

If the admission has at least 1 potentially planned procedure from [Table PA3](#), the algorithm checks for a principal discharge diagnosis that is considered acute ([Table PA4](#)). If the admission has an acute principal discharge diagnosis from [Table PA4](#), the admission is considered unplanned. Otherwise, it is considered planned. The list of acute principal discharge diagnoses includes diagnosis groups from AHRQ condition categories and groupings of individual ICD-9-CM diagnosis codes that represent cardiac diagnoses that would not be associated with a planned admission. Examples of acute principal discharge diagnoses that identify admissions with potentially planned procedures as unplanned are pneumonia (Diagnosis CCS 122) and cardiac arrest (Diagnosis CCS 107).

Figure PA1. Planned admission algorithm flowchart

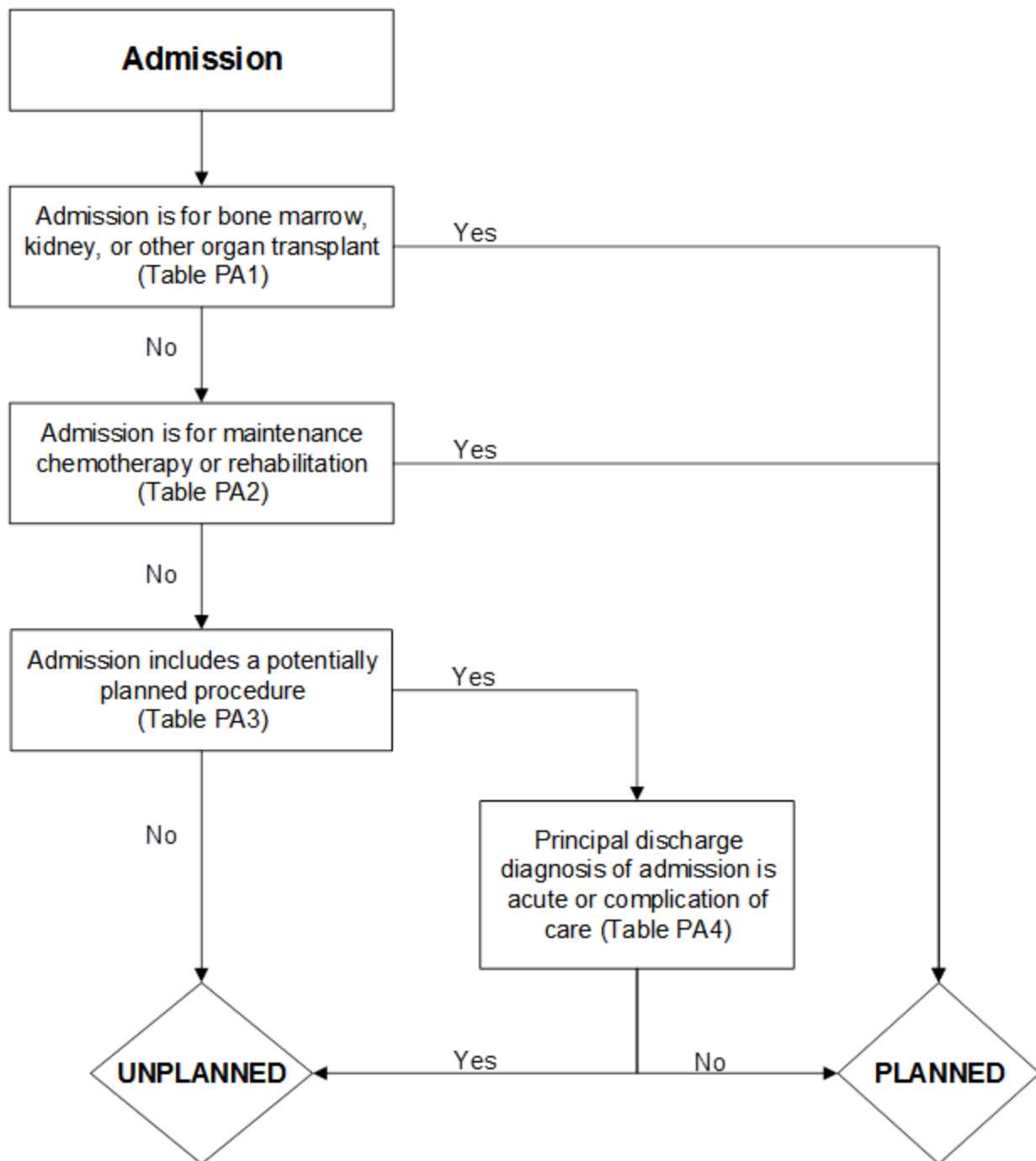


Table PA1. Procedure categories that are always planned (Planned Readmission Algorithm Version 4.0 – adapted for General Surgery ASC Measure Version 1.0)

Procedure CCS (ICD-9 & ICD-10)	Description
64	Bone marrow transplant
105	Kidney transplant
176	Other organ transplantation (in ICD-10 version, description adds: “[other than bone marrow corneal or kidney]”)

Table PA2. Diagnosis categories that are always planned (Planned Readmission Algorithm Version 4.0 – adapted for General Surgery ASC Measure Version 1.0)

Diagnosis CCS (ICD-9 & ICD-10)	Description
45	Maintenance chemotherapy
254	Rehabilitation

Table PA3. Procedure categories that are potentially planned (Planned Readmission Algorithm Version 4.0 – adapted for General Surgery ASC Measure Version 1.0)

Code	Description
Procedure CCS (ICD-9 & ICD-10)	
1	Incision and excision of central nervous system (CNS)
3	Laminectomy; excision intervertebral disc (in ICD-10 version, description is: “Excision, destruction or resection of intervertebral disc”)
5	Insertion of catheter or spinal stimulator and injection into spinal canal
9	Other OR therapeutic nervous system procedures
10	Thyroidectomy; partial or complete
12	Other therapeutic endocrine procedures (in ICD-10 version, description is: “Therapeutic endocrine procedures”)
33	Other OR therapeutic procedures on nose; mouth and pharynx
36	Lobectomy or pneumonectomy
38	Other diagnostic procedures on lung and bronchus
40	Other diagnostic procedures of respiratory tract and mediastinum
43	Heart valve procedures
44	Coronary artery bypass graft (CABG)
45	Percutaneous transluminal coronary angioplasty (PTCA) (in ICD-10 version, description adds: “with or without stent”)
49	Other OR heart procedures
51	Endarterectomy; vessel of head and neck
52	Aortic resection; replacement or anastomosis
53	Varicose vein stripping; lower limb
55	Peripheral vascular bypass
56	Other vascular bypass and shunt; not heart

Code	Description
59	Other OR procedures on vessels of head and neck
66	Procedures on spleen
67	Other therapeutic procedures; hemic and lymphatic system
74	Gastrectomy; partial and total
78	Colorectal resection
79	Local excision of large intestine lesion (not endoscopic)
84	Choletectomy and common duct exploration
85	Inguinal and femoral hernia repair
86	Other hernia repair
99	Other OR gastrointestinal therapeutic procedures
104	Nephrectomy; partial or complete
106	Genitourinary incontinence procedures
107	Extracorporeal lithotripsy; urinary
109	Procedures on the urethra
112	Other OR therapeutic procedures of urinary tract
113	Transurethral resection of prostate (TURP)
114	Open prostatectomy
119	Oophorectomy; unilateral and bilateral
120	Other operations on ovary
124	Hysterectomy; abdominal and vaginal
129	Repair of tocele and rectocele; obliteration of vaginal vault
132	Other OR therapeutic procedures; female organs
142	Partial excision bone
152	Arthroplasty knee
153	Hip replacement; total and partial
154	Arthroplasty other than hip or knee
158	Spinal fusion
159	Other diagnostic procedures on musculoskeletal system
166	Lumpectomy; quadrantectomy of breast
167	Mastectomy
170 (only in ICD-9 version of algorithm)	Excision of skin lesion
172	Skin graft
175 (only in ICD-10 version of algorithm)	Other OR therapeutic procedures on skin subcutaneous tissue fascia and breast
ICD-9-PCS Code	
30.1	Hemilaryngectomy
30.29	Other partial laryngectomy
30.3	Complete laryngectomy
30.4	Radical laryngectomy

Code	Description
31.74	Revision of tracheostomy
34.6	Scarification of pleura
38.18	Endarterectomy, lower limb arteries
55.03	Percutaneous nephrostomy without fragmentation
55.04	Percutaneous nephrostomy with fragmentation
94.26	Subconvulsive electroshock therapy
94.27	Other electroshock therapy
ICD-10-PCS Code	
0CBS0ZZ	Excision of Larynx, Open Approach
0CBS3ZZ	Excision of Larynx, Percutaneous Approach
0CBS4ZZ	Excision of Larynx, Percutaneous Endoscopic Approach
0CBS7ZZ	Excision of Larynx, Via Natural or Artificial Opening
0CBS8ZZ	Excision of Larynx, Via Natural or Artificial Opening Endoscopic
0CBS0ZZ	Excision of Larynx, Open Approach
0CBS3ZZ	Excision of Larynx, Percutaneous Approach
0CBS4ZZ	Excision of Larynx, Percutaneous Endoscopic Approach
0CBS7ZZ	Excision of Larynx, Via Natural or Artificial Opening
0CBS8ZZ	Excision of Larynx, Via Natural or Artificial Opening Endoscopic
0B110F4	Bypass Trachea to Cutaneous with Tracheostomy Device, Open Approach
0B110Z4	Bypass Trachea to Cutaneous, Open Approach
0B113F4	Bypass Trachea to Cutaneous with Tracheostomy Device, Percutaneous Approach
0B113Z4	Bypass Trachea to Cutaneous, Percutaneous Approach
0B114F4	Bypass Trachea to Cutaneous with Tracheostomy Device, Percutaneous Endoscopic Approach
0B114Z4	Bypass Trachea to Cutaneous, Percutaneous Endoscopic Approach
0CTS0ZZ	Resection of Larynx, Open Approach
0CTS4ZZ	Resection of Larynx, Percutaneous Endoscopic Approach
0CTS7ZZ	Resection of Larynx, Via Natural or Artificial Opening
0CTS8ZZ	Resection of Larynx, Via Natural or Artificial Opening Endoscopic
0B110F4	Bypass Trachea to Cutaneous with Tracheostomy Device, Open Approach
0B110Z4	Bypass Trachea to Cutaneous, Open Approach
0B113F4	Bypass Trachea to Cutaneous with Tracheostomy Device, Percutaneous Approach
0B113Z4	Bypass Trachea to Cutaneous, Percutaneous Approach
0B114F4	Bypass Trachea to Cutaneous with Tracheostomy Device, Percutaneous Endoscopic Approach
0B114Z4	Bypass Trachea to Cutaneous, Percutaneous Endoscopic Approach
0CTS0ZZ	Resection of Larynx, Open Approach

Code	Description
OCTS4ZZ	Resection of Larynx, Percutaneous Endoscopic Approach
OCTS7ZZ	Resection of Larynx, Via Natural or Artificial Opening
OCTS8ZZ	Resection of Larynx, Via Natural or Artificial Opening Endoscopic
0GTG0ZZ	Resection of Left Thyroid Gland Lobe, Open Approach
0GTG4ZZ	Resection of Left Thyroid Gland Lobe, Percutaneous Endoscopic Approach
0GTH0ZZ	Resection of Right Thyroid Gland Lobe, Open Approach
0GTH4ZZ	Resection of Right Thyroid Gland Lobe, Percutaneous Endoscopic Approach
0GTK0ZZ	Resection of Thyroid Gland, Open Approach
0GTK4ZZ	Resection of Thyroid Gland, Percutaneous Endoscopic Approach
0WB60ZZ	Excision of Neck, Open Approach
0WB63ZZ	Excision of Neck, Percutaneous Approach
0WB64ZZ	Excision of Neck, Percutaneous Endoscopic Approach
0WB6XZZ	Excision of Neck, External Approach
0BW10FZ	Revision of Tracheostomy Device in Trachea, Open Approach
0BW13FZ	Revision of Tracheostomy Device in Trachea, Percutaneous Approach
0BW14FZ	Revision of Tracheostomy Device in Trachea, Percutaneous Endoscopic Approach
0WB6XZ2	Excision of Neck, Stoma, External Approach
0WQ6XZ2	Repair Neck, Stoma, External Approach
0B5N0ZZ	Destruction of Right Pleura, Open Approach
0B5N3ZZ	Destruction of Right Pleura, Percutaneous Approach
0B5N4ZZ	Destruction of Right Pleura, Percutaneous Endoscopic Approach
0B5P0ZZ	Destruction of Left Pleura, Open Approach
0B5P3ZZ	Destruction of Left Pleura, Percutaneous Approach
0B5P4ZZ	Destruction of Left Pleura, Percutaneous Endoscopic Approach
04CK0ZZ	Extirpation of Matter from Right Femoral Artery, Open Approach
04CK3ZZ	Extirpation of Matter from Right Femoral Artery, Percutaneous Approach
04CK4ZZ	Extirpation of Matter from Right Femoral Artery, Percutaneous Endoscopic Approach
04CL0ZZ	Extirpation of Matter from Left Femoral Artery, Open Approach
04CL3ZZ	Extirpation of Matter from Left Femoral Artery, Percutaneous Approach
04CL4ZZ	Extirpation of Matter from Left Femoral Artery, Percutaneous Endoscopic Approach
04CM0ZZ	Extirpation of Matter from Right Popliteal Artery, Open Approach
04CM3ZZ	Extirpation of Matter from Right Popliteal Artery, Percutaneous Approach
04CM4ZZ	Extirpation of Matter from Right Popliteal Artery, Percutaneous Endoscopic Approach
04CN0ZZ	Extirpation of Matter from Left Popliteal Artery, Open Approach
04CN3ZZ	Extirpation of Matter from Left Popliteal Artery, Percutaneous Approach
04CN4ZZ	Extirpation of Matter from Left Popliteal Artery, Percutaneous Endoscopic Approach
04CP0ZZ	Extirpation of Matter from Right Anterior Tibial Artery, Open Approach

Code	Description
04CP3ZZ	Extirpation of Matter from Right Anterior Tibial Artery, Percutaneous Approach
04CP4ZZ	Extirpation of Matter from Right Anterior Tibial Artery, Percutaneous Endoscopic Approach
04CQ0ZZ	Extirpation of Matter from Left Anterior Tibial Artery, Open Approach
04CQ3ZZ	Extirpation of Matter from Left Anterior Tibial Artery, Percutaneous Approach
04CQ4ZZ	Extirpation of Matter from Left Anterior Tibial Artery, Percutaneous Endoscopic Approach
04CR0ZZ	Extirpation of Matter from Right Posterior Tibial Artery, Open Approach
04CR3ZZ	Extirpation of Matter from Right Posterior Tibial Artery, Percutaneous Approach
04CR4ZZ	Extirpation of Matter from Right Posterior Tibial Artery, Percutaneous Endoscopic Approach
04CS0ZZ	Extirpation of Matter from Left Posterior Tibial Artery, Open Approach
04CS3ZZ	Extirpation of Matter from Left Posterior Tibial Artery, Percutaneous Approach
04CS4ZZ	Extirpation of Matter from Left Posterior Tibial Artery, Percutaneous Endoscopic Approach
04CT0ZZ	Extirpation of Matter from Right Peroneal Artery, Open Approach
04CT3ZZ	Extirpation of Matter from Right Peroneal Artery, Percutaneous Approach
04CT4ZZ	Extirpation of Matter from Right Peroneal Artery, Percutaneous Endoscopic Approach
04CU0ZZ	Extirpation of Matter from Left Peroneal Artery, Open Approach
04CU3ZZ	Extirpation of Matter from Left Peroneal Artery, Percutaneous Approach
04CU4ZZ	Extirpation of Matter from Left Peroneal Artery, Percutaneous Endoscopic Approach
04CV0ZZ	Extirpation of Matter from Right Foot Artery, Open Approach
04CV3ZZ	Extirpation of Matter from Right Foot Artery, Percutaneous Approach
04CV4ZZ	Extirpation of Matter from Right Foot Artery, Percutaneous Endoscopic Approach
04CW0ZZ	Extirpation of Matter from Left Foot Artery, Open Approach
04CW3ZZ	Extirpation of Matter from Left Foot Artery, Percutaneous Approach
04CW4ZZ	Extirpation of Matter from Left Foot Artery, Percutaneous Endoscopic Approach
04CY0ZZ	Extirpation of Matter from Lower Artery, Open Approach
04CY3ZZ	Extirpation of Matter from Lower Artery, Percutaneous Approach
04CY4ZZ	Extirpation of Matter from Lower Artery, Percutaneous Endoscopic Approach
0T9030Z	Drainage of Right Kidney with Drainage Device, Percutaneous Approach
0T9040Z	Drainage of Right Kidney with Drainage Device, Percutaneous Endoscopic Approach
0T9130Z	Drainage of Left Kidney with Drainage Device, Percutaneous Approach
0T9140Z	Drainage of Left Kidney with Drainage Device, Percutaneous Endoscopic Approach
0TC03ZZ	Extirpation of Matter from Right Kidney, Percutaneous Approach
0TC04ZZ	Extirpation of Matter from Right Kidney, Percutaneous Endoscopic Approach
0TC13ZZ	Extirpation of Matter from Left Kidney, Percutaneous Approach
0TC14ZZ	Extirpation of Matter from Left Kidney, Percutaneous Endoscopic Approach

Code	Description
OTF33ZZ	Fragmentation in Right Kidney Pelvis, Percutaneous Approach
OTF34ZZ	Fragmentation in Right Kidney Pelvis, Percutaneous Endoscopic Approach
OTF43ZZ	Fragmentation in Left Kidney Pelvis, Percutaneous Approach
OTF44ZZ	Fragmentation in Left Kidney Pelvis, Percutaneous Endoscopic Approach
GZB4ZZZ	Other Electroconvulsive Therapy
GZB0ZZZ	Electroconvulsive Therapy, Unilateral-Single Seizure
GZB1ZZZ	Electroconvulsive Therapy, Unilateral-Multiple Seizure
GZB2ZZZ	Electroconvulsive Therapy, Bilateral-Single Seizure
GZB3ZZZ	Electroconvulsive Therapy, Bilateral-Multiple Seizure
GZB4ZZZ	Other Electroconvulsive Therapy

Table PA4. Diagnosis categories that are acute (Planned Readmission Algorithm Version 4.0 – adapted for General Surgery ASC Measure Version 1.0)

Code	Description
Diagnosis CCS (ICD-9 & ICD-10)	
1	Tuberculosis
2	Septicemia (except in labor)
3	Bacterial infection; unspecified site
4	Mycoses
5	HIV infection
7	Viral infection
8	Other infections; including parasitic
9	Sexually transmitted infections (not HIV or hepatitis)
54	Gout and other crystal arthropathies
55	Fluid and electrolyte disorders
60	Acute posthemorrhagic anemia
61	Sickle cell anemia
63	Diseases of white blood cells
76	Meningitis (except that caused by tuberculosis or sexually transmitted disease)
77	Encephalitis (except that caused by tuberculosis or sexually transmitted disease)
78	Other CNS infection and poliomyelitis
82	Paralysis
83	Epilepsy; convulsions
84	Headache; including migraine
85	Coma; stupor; and brain damage
87	Retinal detachments; defects; vascular occlusion; and retinopathy
89	Blindness and vision defects

Code	Description
90	Inflammation; infection of eye (except that caused by tuberculosis or sexually transmitted disease)
91	Other eye disorders
92	Otitis media and related conditions
93	Conditions associated with dizziness or vertigo
99	Hypertension with complications and secondary hypertension
100	Acute myocardial infarction (with the exception of ICD-9 codes 410.x2)
102	Nonspecific chest pain
104	Other and ill-defined heart disease
107	Cardiac arrest and ventricular fibrillation
109	Acute cerebrovascular disease
112	Transient cerebral ischemia
116	Aortic and peripheral arterial embolism or thrombosis
118	Phlebitis; thrombophlebitis and thromboembolism
120	Hemorrhoids
122	Pneumonia (except that caused by TB or sexually transmitted disease)
123	Influenza
124	Acute and chronic tonsillitis
125	Acute bronchitis
126	Other upper respiratory infections
127	Chronic obstructive pulmonary disease and bronchiectasis
128	Asthma
129	Aspiration pneumonitis; food/vomitus
130	Pleurisy; pneumothorax; pulmonary collapse
131	Respiratory failure; insufficiency; arrest (adult)
135	Intestinal infection
137	Diseases of mouth; excluding dental
139	Gastroduodenal ulcer (except hemorrhage)
140	Gastritis and duodenitis
142	Appendicitis and other appendiceal conditions
145	Intestinal obstruction without hernia
146	Diverticulosis and diverticulitis
148	Peritonitis and intestinal abscess
153	Gastrointestinal hemorrhage
154	Noninfectious gastroenteritis
157	Acute and unspecified renal failure
159	Urinary tract infections

Code	Description
165	Inflammatory conditions of male genital organs
168	Inflammatory diseases of female pelvic organs
172	Ovarian t
197	Skin and subcutaneous tissue infections
198	Other inflammatory condition of skin
225	Joint disorders and dislocations; trauma-related
226	Fracture of neck of femur (hip)
227	Spinal cord injury
228	Skull and face fractures
229	Fracture of upper limb
230	Fracture of lower limb
232	Sprains and strains
233	Intracranial injury
234	Crushing injury or internal injury
235	Open wounds of head; neck; and trunk
237	Complication of device; implant or graft
238	Complications of surgical procedures or medical care
239	Superficial injury; contusion
240	Burns
241	Poisoning by psychotropic agents
242	Poisoning by other medications and drugs
243	Poisoning by non-medicinal substances
244	Other injuries and conditions due to external causes
245	Syncope
246	Fever of unknown origin
247	Lymphadenitis
249	Shock
250	Nausea and vomiting
251	Abdominal pain
252	Malaise and fatigue
253	Allergic reactions
259	Residual codes; unclassified
650	Adjustment disorders
651	Anxiety disorders
652	Attention-deficit, conduct, and disruptive behavior disorders (in ICD-10 version, description is: "Attention-deficit")

Code	Description
653	Delirium, dementia, and amnestic and other cognitive disorders (in ICD-10 version, description is: "Delirium")
656	Impulse control disorders, NEC (in ICD-10 version, description is: "Impulse control disorders")
658	Personality disorders
660	Alcohol-related disorders
661	Substance-related disorders
662	Suicide and intentional self-inflicted injury
663	Screening and history of mental health and substance abuse codes
670	Miscellaneous disorders
Acute ICD-9 codes within Diagnosis CCS 97: Peri-; endo-; and myocarditis; cardiomyopathy	
3282	Diphtheritic myocarditis
3640	Meningococcal carditis NOS
3641	Meningococcal pericarditis
3642	Meningococcal endocarditis
3643	Meningococcal myocarditis
7420	Coxsackie carditis NOS
7421	Coxsackie pericarditis
7422	Coxsackie endocarditis
7423	Coxsackie myocarditis
11281	Candida endocarditis
11503	Histoplasma capsulatum pericarditis
11504	Histoplasma capsulatum endocarditis
11513	Histoplasma duboisii pericarditis
11514	Histoplasma duboisii endocarditis
11593	Histoplasmosis pericarditis
11594	Histoplasmosis endocarditis
1303	Toxoplasma myocarditis
3910	Acute rheumatic pericarditis
3911	Acute rheumatic endocarditis
3912	Acute rheumatic myocarditis
3918	Acute rheumatic heart disease NEC
3919	Acute rheumatic heart disease NOS
3920	Rheumatic chorea w heart involvement
3980	Rheumatic myocarditis
39890	Rheumatic heart disease NOS
39899	Rheumatic heart disease NEC

Code	Description
4200	Acute pericarditis in other disease
42090	Acute pericarditis NOS
42091	Acute idiopathic pericarditis
42099	Acute pericarditis NEC
4210	Acute/subacute bacterial endocarditis
4211	Acute endocarditis in other diseases
4219	Acute/subacute endocarditis NOS
4220	Acute myocarditis in other diseases
42290	Acute myocarditis NOS
42291	Idiopathic myocarditis
42292	Septic myocarditis
42293	Toxic myocarditis
42299	Acute myocarditis NEC
4230	Hemopericardium
4231	Adhesive pericarditis
4232	Constrictive pericarditis
4233	Cardiac tamponade
4290	Myocarditis NOS
Acute ICD-10 codes within Diagnosis CCS 97: Peri-; endo-; and myocarditis; cardiomyopathy	
A3681	Diphtheritic cardiomyopathy
A3950	Meningococcal carditis, unspecified
A3951	Meningococcal endocarditis
A3952	Meningococcal myocarditis
A3953	Meningococcal pericarditis
B3320	Viral carditis, unspecified
B3321	Viral endocarditis
B3322	Viral myocarditis
B3323	Viral pericarditis
B376	Candida endocarditis
B394	Histoplasmosis capsulati, unspecified
B395	Histoplasmosis duboisii
B399	Histoplasmosis, unspecified
B5881	Toxoplasma myocarditis
I010	Acute rheumatic pericarditis
I011	Acute rheumatic endocarditis
I012	Acute rheumatic myocarditis
I018	Other acute rheumatic heart disease

Code	Description
I019	Acute rheumatic heart disease, unspecified
I020	Rheumatic chorea with heart involvement
I090	Rheumatic myocarditis
I0989	Other specified rheumatic heart diseases
I099	Rheumatic heart disease, unspecified
I300	Acute nonspecific idiopathic pericarditis
I308	Other forms of acute pericarditis
I309	Acute pericarditis, unspecified
I310	Chronic adhesive pericarditis
I311	Chronic constrictive pericarditis
I312	Hemopericardium, not elsewhere classified
I314	Cardiac tamponade
I32	Pericarditis in diseases classified elsewhere
I330	Acute and subacute infective endocarditis
I339	Acute and subacute endocarditis, unspecified
I39	Endocarditis and heart valve disorders in diseases classified elsewhere
I400	Infective myocarditis
I401	Isolated myocarditis
I408	Other acute myocarditis
I409	Acute myocarditis, unspecified
I41	Myocarditis in diseases classified elsewhere
I514	Myocarditis, unspecified
Acute ICD-9 codes within Diagnosis CCS 105: Conduction disorders	
4260	Atrioventricular
42610	Atrioventricular block NOS
42611	Atrioventricular block-1st degree
42612	Atrioventricular block-Mobitz II
42613	Atrioventricular block-2nd degree NEC
4262	Left bundle branch hemiblock
4263	Left bundle branch block NEC
4264	Right bundle branch block
42650	Bundle branch block NOS
42651	Right bundle branch block/left posterior fascicular block
42652	Right bundle branch block/left ant fascicular block
42653	Bilateral bundle branch block NEC
42654	Trifascicular block
4266	Other heart block

Code	Description
4267	Anomalous atrioventricular excitation
42681	Lown-Ganong-Levine syndrome
42682	Long QT syndrome
4269	Conduction disorder NOS
Acute ICD-10 codes within Diagnosis CCS 105: Conduction disorders	
I442	Atrioventricular block, complete
I4430	Unspecified atrioventricular block
I440	Atrioventricular block, first degree
I441	Atrioventricular block, second degree
I4469	Other fascicular block
I444	Left anterior fascicular block
I445	Left posterior fascicular block
I4460	Unspecified fascicular block
I447	Left bundle-branch block, unspecified
I4510	Unspecified right bundle-branch block
I4430	Unspecified atrioventricular block
I4439	Other atrioventricular block
I454	Nonspecific intraventricular block
I452	Bifascicular block
I453	Trifascicular block
I455	Other specified heart block
I456	Pre-excitation syndrome
I4581	Long QT syndrome
I459	Conduction disorder, unspecified
Acute ICD-9 codes within Diagnosis CCS 106: Dysrhythmia	
4272	Paroxysmal tachycardia NOS
7850	Tachycardia NOS
42789	Cardiac dysrhythmias NEC
4279	Cardiac dysrhythmia NOS
42769	Premature beats NEC
Acute ICD-10 codes within Diagnosis CCS 106: Dysrhythmia	
I479	Paroxysmal tachycardia, unspecified
I4949	Other premature depolarization
I498	Other specified cardiac arrhythmias
I499	Cardiac arrhythmia, unspecified
R000	Tachycardia, unspecified
R001	Bradycardia, unspecified

Code	Description
Acute ICD-9 codes within Diagnosis CCS 108: Congestive heart failure; non-hypertensive	
39891	Rheumatic heart failure
4280	Congestive heart failure
4281	Left heart failure
42820	Unspecified systolic heart failure
42821	Acute systolic heart failure
42823	Acute on chronic systolic heart failure
42830	Unspecified diastolic heart failure
42831	Acute diastolic heart failure
42833	Acute on chronic diastolic heart failure
42840	Unspecified combined systolic & diastolic heart failure
42841	Acute combined systolic & diastolic heart failure
42843	Acute on chronic combined systolic & diastolic heart failure
4289	Heart failure NOS
Acute ICD-10 codes within Diagnosis CCS 108: Congestive heart failure; non-hypertensive	
I0981	Rheumatic heart failure
I509	Heart failure, unspecified
I501	Left ventricular failure
I5020	Unspecified systolic (congestive) heart failure
I5021	Acute systolic (congestive) heart failure
I5023	Acute on chronic systolic (congestive) heart failure
I5030	Unspecified diastolic (congestive) heart failure
I5031	Acute diastolic (congestive) heart failure
I5033	Acute on chronic diastolic (congestive) heart failure
I5040	Unspecified combined systolic and diastolic (congestive) heart failure
I5041	Acute combined systolic (congestive) and diastolic (congestive) heart failure
I5043	Acute on chronic combined systolic (congestive) and diastolic (congestive) heart failure
I509	Heart failure, unspecified
Acute ICD-9 codes within Diagnosis CCS 149: Biliary tract disease	
5740	Calculus of gallbladder with acute cholelitis
57400	Calculus of gallbladder with acute cholelitis without mention of obstruction
57401	Calculus of gallbladder with acute cholelitis with obstruction
5743	Calculus of bile duct with acute cholelitis
57430	Calculus of bile duct with acute cholelitis without mention of obstruction
57431	Calculus of bile duct with acute cholelitis with obstruction
5746	Calculus of gallbladder and bile duct with acute cholelitis

Code	Description
57460	Calculus of gallbladder and bile duct with acute choletitis without mention of obstruction
57461	Calculus of gallbladder and bile duct with acute choletitis with obstruction
5748	Calculus of gallbladder and bile duct with acute and chronic choletitis
57480	Calculus of gallbladder and bile duct with acute and chronic choletitis without mention of obstruction
57481	Calculus of gallbladder and bile duct with acute and chronic choletitis with obstruction
5750	Acute choletitis
57512	Acute and chronic choletitis
5761	Cholangitis
Acute ICD-10 codes within Diagnosis CCS 149: Biliary tract disease	
K8000	Calculus of gallbladder with acute choletitis w/o obstruction
K8001	Calculus of gallbladder with acute choletitis with obstruction
K8042	Calculus of bile duct with acute choletitis w/o obstruction
K8043	Calculus of bile duct with acute choletitis with obstruction
K8062	Calculus of GB and bile duct with acute choletitis w/o obstruction
K8063	Calculus of GB and bile duct with acute choletitis with obstruction
K8066	Calculus of GB and bile duct with acute and chronic choletitis w/o obstruction
K8067	Calculus of GB and bile duct with acute and chronic choletitis with obstruction
K810	Acute choletitis
K812	Acute choletitis with chronic choletitis
K830	Cholangitis
Acute ICD-9 codes with Diagnosis CCS 152: Pancreatic disorders	
5770	Acute Pancreatitis
Acute ICD-10 codes with Diagnosis CCS 152: Pancreatic disorders	
K859	Acute pancreatitis, unspecified

13.4 Appendix D: Measure Score Calculation and Reporting

D1. Risk-Standardized Measure Score Calculation Algorithm

We fit a hierarchical generalized linear model (HGLM), which accounts for the clustering of observations within ASCs. We assume that the outcome is a known exponential family distribution and that it is related linearly to the covariates via a known linked function, h . For our model, we assumed a binomial distribution and a logit link function. Further, we accounted for the clustering within ASC by estimating a facility-specific effect, α_i , which is assumed to follow a normal distribution with mean μ and variance τ^2 , the between-facility variance component. The HGLM is defined by the following equations:

$$h(Y_{ij}) = \alpha_i + \beta Z_{ij} \quad (1)$$

$$\alpha_i = \mu + \omega_i; \omega_i \sim N(0, \tau^2) \quad (2)$$

$$i = 1 \dots I; j = 1 \dots n_i$$

Where Y_{ij} denotes the outcome (equal to 1 if the patient has an eligible hospital visit within 7 days of a surgery procedure, 0 otherwise) for the j -th patient who had a procedure at the i -th ASC; $\mathbf{Z}_{ij} = (Z_{1ij}, Z_{2ij}, \dots, Z_{pij})$ is a set of p patient-specific covariates derived from the data; and I denotes the total number of ASCs and n_i the number of surgeries performed at ASC i . The facility-specific intercept of the i -th ASC, α_i , defined above, is comprised of μ , the adjusted average intercept over all ASCs in the sample and ω_i , the facility-specific intercept deviation from μ . A point estimate of ω_i , greater or less than 0, determines if ASC performance is worse or better compared to the adjusted average outcome.

The HGLM is estimated using the SAS software system (GLIMMIX procedure).

D2. Provider Performance Reporting

Using the HGLM defined by Equations (1) - (2), we estimate the parameters $\hat{\mu}$, $\{\hat{\alpha}_1, \hat{\alpha}_2, \dots, \hat{\alpha}_I\}$, $\hat{\beta}$, and $\hat{\tau}^2$. We calculate the measure score, s_i , for each ASC by computing the ratio of the number of predicted hospital visits to the number of expected hospital visits. Specifically, we calculate:

$$\text{Predicted} \quad \hat{y}_{ij}(Z) = h^{-1}(\hat{\alpha}_i + \hat{\beta} Z_{ij})$$

$$\text{Expected} \quad \hat{e}_{ij}(Z) = h^{-1}(\hat{\mu} + \hat{\beta} Z_{ij})$$

$$\text{Measure score} \quad \hat{s}_i(Z) = \frac{\sum_{j=1}^{n_i} \hat{y}_{ij}(Z)}{\sum_{j=1}^{n_i} \hat{e}_{ij}(Z)}$$

If the “predicted” \hat{s}_i number of hospital visits is higher (lower) than the “expected” number of hospital visits, then that ASC’s ratio will be higher (lower) than 1.0.

13.5 Appendix E: Risk-Adjustment Model Development

Table E1. Candidate variables considered for the risk-adjustment model

Patient demographic, comorbidity, and procedural complexity candidate variables for risk adjustment	
Variable category	Definition
Age	
Sex	
Number of qualifying procedures	Defined as 1, 2, or ≥ 3
Procedure type	Defined as abdominal (reference), alimentary tract, breast, skin/soft tissue, varicose vein, or wound procedures
Work Relative Value Units (work RVUs)	Work RVUs are assigned to each CPT® procedure code and approximate procedure complexity by incorporating elements of physician time and effort
Septicemia, sepsis, systemic inflammatory response syndrome/shock	CC 2
History of infection	CC 1, 3-7
Cancers	CC 8, 9, 10, 11, 12, 13, 14
Other benign tumors	CC 15, 16
Diabetes and diabetes mellitus complications	CC 17, 18, 19, 122, 123
Protein-calorie malnutrition	CC 21
Morbid Obesity	CC 22 (excluding ICD-9-CM code 27803)
Disorders of fluid/electrolyte/acid-base balance	CC 23, 24
Disorders of lipid metabolism	CC 25
Other endocrine/metabolic/nutritional disorders	CC 26
Liver or biliary disease	CC 27, 28, 29, 30, 31, 32
Intestinal obstruction/perforation	CC 33
Chronic pancreatitis; and peptic ulcer, hemorrhage, other specified gastrointestinal disorders	CC 34, 36
Inflammatory bowel disease	CC 35
Other gastrointestinal disorders	CC 38
Bone/joint/muscle infections/necrosis	CC 39
Rheumatoid and osteoarthritis	CC 40-42

Patient demographic, comorbidity, and procedural complexity candidate variables for risk adjustment	
Variable category	Definition
Osteoporosis and other bone/cartilage disorders	CC 43
Other Musculoskeletal and Connective Tissue Disorders	CC 44, 45
Hematological disorders including coagulation defects and iron deficiency	CC 46, 48, 49
Disorders of immunity	CC 47
Delirium and encephalopathy	CC 50
Dementia or senility	CC 51-53
Drug/alcohol abuse/dependence/psychosis	CC 54, 55, 56 (excluding ICD-9-CM codes 30400, 30401, 30402, 30403, 30470, 30471, 30472, 30403, 30550, 30551, 30552, 30553; ICD-10-CM codes F11.10, F11.120, F11.121, F11.122, F11.129, F11.14, F11.150, F11.151, F11.159, F11.181, F11.182, F11.188, F11.19, F11.20, F11.21, F11.220, F11.221, F11.222, F11.229, F11.23, F11.24, F11.250, F11.251, F11.259, F11.281, F11.282, F11.288, F11.29, F553)
Psychiatric disorders	CC 57, 58, 59, 60, 61, 62, 63
Hemiplegia, paraplegia, paralysis, functional disability	CC 70, 71, 73, 74, 103, 104
Spinal cord disorders/injuries	CC 72
Amputation status	CC 189, 190
Polyneuropathy	CC 75, 81
Muscular Dystrophy	CC 76
Other significant central nervous system (CNS) disease	CC 77, 78, 79, 80
Cardiorespiratory arrest, failure and respiratory dependence	CC 82, 83, 84
Congestive heart failure	CC 85
Ischemic heart disease	CC 86, 87, 88, 89
Valvular and rheumatic heart disease	CC 91
Other and unspecified heart disease	CC 90, 92, 93, 98
Hypertension and hypertensive disease	CC 94, 95
Specified arrhythmias and other heart rhythm disorders	CC 96, 97
Stroke	CC 99, 100
Pre-cerebral arterial occlusion and transient cerebral ischemia	CC 101
Cerebrovascular disease	CC 102, 105

Patient demographic, comorbidity, and procedural complexity candidate variables for risk adjustment	
Variable category	Definition
Vascular or circulatory disease	CC 106, 107, 108, 109
Chronic lung disease	CC 110, 111, 112, 113
Pneumonia	CC 114, 115, 116
Pleural effusion/pneumothorax	CC 117
Other respiratory disorders	CC 118 (excluding ICD-9-CM codes 78051, 78057, 3272, 32720, 32721, 32723, 32727, 32729; ICD-10-CM codes G4730, G4731, G4733, G4737, G4739)
Sleep apnea	ICD-9-CM codes 78051, 78057, 3272, 32720, 32721, 32723, 32727, 32729; ICD-10-CM codes: G4730, G4731, G4733, G4737, G4739
Other ENT and mouth disorders	CC 129, 131
Organ transplant	CC 132, 186, 187
Dialysis or severe chronic kidney disease	CC 134, 136, 137
Acute or unspecified renal failure	CC 135, 140
Mild to moderate chronic kidney disease	CC 138, 139
Nephritis	CC 141
Urinary obstruction and retention	CC 142
Urinary incontinence	CC 143
Urinary tract infection and other urinary tract disorders	CC 144, 145
Pelvic inflammatory disease and other specified female Genital Disorders	CC 147, 148
Male Genital Disorders (without Benign Prostatic hyperplasia [BPH])	CC 149 (excluding ICD-9-CM codes 60000, 60001, 60020, 60021, 60090, 6091; ICD-10-CM codes: N40.0, N40.1, N40.2, N40.3)
Benign prostatic hyperplasia	ICD-9-CM codes 60000, 60001, 60020, 60021, 60090, 6091; ICD-10-CM codes N40.0, N40.1, N40.2, N40.3
Pressure ulcer	CC 157, 158, 159, 160
Burns, non-pressure ulcers	CC 161, 162, 163

Patient demographic, comorbidity, and procedural complexity candidate variables for risk adjustment	
Variable category	Definition
Cellulitis, local skin infection	CC 164
Other dermatological disorders	CC 165
Head injury	CC 166, 167, 168
Major traumatic fracture or internal injury	CC 169, 170, 171, 172, 173, 174
Poisonings and allergic reactions	CC 175
Complications of care	CC 176, 177
Radiation therapy	CC 192
Chemotherapy	CC 193
Chronic anticoagulant use	ICD-9-CM code V5861; ICD-10-CM code Z7901
Failure to thrive	ICD-9 code: 7837; ICD-10 code: R627
History of falling	ICD-9-CM code V1588; ICD-10-CM codes Z9181, R296
Opioid abuse	ICD-9-CM codes 30400, 30401, 30402, 30403, 30470, 30471, 30472, 30403, 30550, 30551, 30552, 30553; ICD-10-CM codes F11.10, F11.120, F11.121, F11.122, F11.129, F11.14, F11.150, F11.151, F11.159, F11.181, F11.182, F11.188, F11.19, F11.20, F11.21, F11.220, F11.221, F11.222, F11.229, F11.23, F11.24, F11.250, F11.251, F11.259, F11.281, F11.282, F11.288, F11.29
Steroid use	ICD-9-CM codes V58.65, V87.44, V87.45; ICD-10-CM codes Z7951, Z7952, Z92240, Z92241, F553
Tobacco use disorder	ICD-9-CM diagnosis code 3051; ICD-10-CM code F17200

Table E2. Condition Categories (CCs) that are not risk adjusted for if they occur only at the time of the procedure

Condition Category (CC)	CC description
CC 2	Septicemia, sepsis, systemic inflammatory response syndrome/shock
CC 7	Other infectious diseases
CC 17	Diabetes with acute complications
CC 24	Disorders of fluid/electrolyte/acid-base
CC 30	Acute liver failure/disease
CC 33	Intestinal obstruction/perforation
CC 36	Peptic ulcer, hemorrhage, other specified gastrointestinal disorders
CC 50	Delirium and encephalopathy
CC 80	Coma, brain compression/anoxic damage
CC 82	Respirator dependence/tracheostomy status
CC 83	Respiratory arrest
CC 84	Cardio-respiratory failure and shock
CC 85	Congestive heart failure
CC 86	Acute myocardial infarction
CC 87	Unstable angina and other acute ischemic heart disease
CC 96	Specified heart arrhythmias
CC 97	Other heart rhythm and conduction disorders
CC 98	Other and unspecified heart disease
CC 99	Cerebral hemorrhage
CC 100	Ischemic or unspecified stroke
CC 101	Precerebral arterial occlusion and transient cerebral ischemia
CC 103	Hemiplegia/hemiparesis
CC 104	Monoplegia, other paralytic syndromes
CC 107	Vascular disease with complications
CC 114	Aspiration and specified bacterial pneumonias
CC 115	Pneumococcal pneumonia, emphysema, lung abscess
CC 117	Pleural effusion/pneumothorax
CC 135	Acute renal failure
CC 140	Unspecified renal failure
CC 141	Nephritis
CC 142	Urinary obstruction and retention
CC 144	Urinary tract infection
CC 164	Cellulitis, local skin infection
CC 168	Concussion or unspecified head injury
CC 175	Poisonings and allergic and inflammatory reactions
CC 176	Complications of specified implanted device or graft
CC 177	Other complications of medical care