

**Facility-Level 7-Day Hospital Visits after General Surgery Procedures  
Performed at Ambulatory Surgical Centers (Version 1.0)**

**Measure Technical Report**

**Submitted by:**

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# Table of Contents

1.	Executive Summary.....	9
1.1	Rationale for Assessing Hospital Visits after Ambulatory Surgery .....	9
1.2	Measure Development .....	10
1.3	Measure Specifications .....	10
1.4	Distribution of Measure Scores .....	11
1.5	Summary .....	11
2.	Introduction .....	12
2.1	Background .....	12
2.2	Definition of an Ambulatory Surgical Center (ASC) .....	12
2.3	Importance of Assessing Unplanned Hospital Visits after ASC Procedures .....	13
2.4	Related Risk-Adjusted Outpatient Outcome Measures of Hospital Visits.....	14
3.	Measure Development Methods.....	15
3.1	Overview of Measure Development Process .....	15
3.2	Data Sources .....	15
3.3	Cohort Definition .....	16
3.3.1.	Inclusion Criteria .....	16
3.3.2.	Exclusion Criteria.....	18
3.4	Outcome .....	18
3.4.1.	Definition of Outcome .....	18
3.4.2.	Outcome Timeframe.....	18
3.4.3.	Multiple Qualifying Procedures within a 7-Day Period .....	19
3.4.4.	All-Cause Hospital Visits.....	19
3.4.5.	Removal of Planned Admissions from the Outcome.....	20
3.5	Model Development .....	20
3.5.1.	Overview .....	20
3.5.2.	Candidate Risk Factors for Patient-Level Risk Adjustment.....	21
3.5.3.	Final Risk-Adjustment Variable Selection .....	22
3.5.4.	Model Performance and Validation.....	22
3.5.5.	Calculation of ASC-Level Measure Score Variation and Outlier Status .....	23
3.5.6.	ASC-Level Measure Score Reliability Testing .....	23
3.5.7.	Disparities Testing.....	23
3.5.8.	Face Validity Testing .....	24
3.5.9.	Statistical Software .....	24

4.	Results .....	25
4.1	Overall Summary.....	25
4.1.1.	Cohort .....	25
4.1.2.	Outcome Rates and Distribution .....	25
4.2	Risk-Adjustment Model .....	26
4.2.1.	Candidate and Final Variables.....	26
4.2.2.	Model Performance and Validation.....	26
4.3	ASC-Level Measure Score .....	26
4.3.1.	ASC-Level Measure Score Variation and Outlier Status .....	27
4.3.2.	ASC-Level Measure Score Reliability Testing .....	27
4.3.3.	ASC-Level Measure Score Disparities Testing.....	27
4.3.4.	Face Validity Testing .....	27
5.	Summary and Discussion .....	29
6.	References .....	30
7.	Tables .....	33
8.	Figures .....	57
9.	Appendices.....	60
	Appendix A: List of all Current Procedural Terminology (CPT®) Procedure Codes Included in the Measure Cohort.....	60
	Appendix B: Emergency Department Visits and Observation Stays Definition.....	76
	Appendix C: Planned Admission Algorithm .....	77
	Appendix D: Measure Score Calculation and Reporting.....	94
	D1. Risk-Standardized Measure Score Calculation .....	94
	D2. Outlier Evaluation .....	95
	D3. Bootstrapping Algorithm .....	95
	Appendix E: Risk-Adjustment Model Development .....	97

## List of Tables

Table 1. Frequency of risk model variables in the Medicare Development and Validation Samples (dataset: Medicare FFS CY 2015).....	33
Table 2. Top 20 procedures in the general surgery cohort (dataset: Medicare FFS CY 2015) .....	34
Table 4. Top diagnoses for any hospital visit within 7 days of general surgery ASC procedures (dataset: Medicare FFS CY 2015) .....	36
Table 5. Risk-adjustment model performance summaries in the Medicare Development and Validation Samples (dataset: Medicare FFS CY 2015) .....	54
Table 6. Model parameter estimates and odds ratios in the Medicare Development and Validation Samples (dataset: Medicare FFS CY 2015) .....	55
Table A1. List of procedures included in the measure cohort.....	60
Table B1. HCPCS codes or revenue center codes that define emergency department visits and observation stays .....	76
Table PA1. Procedure categories that are always planned (Planned Readmission Algorithm Version 4.0 – adapted for General Surgery ASC Measure Version 1.0) .....	80
Table PA2. Diagnosis categories that are always planned (Planned Readmission Algorithm Version 4.0 – adapted for General Surgery ASC Measure Version 1.0) .....	80
Table PA3. Procedure categories that are potentially planned (Planned Readmission Algorithm Version 4.0 – adapted for General Surgery ASC Measure Version 1.0) .....	80
Table PA4. Diagnosis categories that are acute (Planned Readmission Algorithm Version 4.0 – adapted for General Surgery ASC Measure Version 1.0).....	85
Table E1. Candidate variables considered for the risk-adjustment model .....	97
Table E2. Condition Categories (CCs) that are not risk adjusted for if they occur only at the time of the procedure .....	101

## List of Figures

Figure 1. Timing of hospital visits within 30 days of general surgery ASC procedures (event rate 1,000 in the 30 days post-discharge; dataset: Medicare FFS CY 2015) .....	57
Figure 2. Calibration plot of predicted versus observed outcomes across deciles of patient risk in the Development Sample (dataset: Medicare FFS CY 2015) .....	58
Figure 3. Calibration plot of predicted versus observed outcomes across deciles of patient risk in the Validation Sample (dataset: Medicare FFS CY 2015).....	58
Figure 4. Distribution of risk-standardized hospital visit ratios (RSHVRs) following general surgery procedures for ASCs with $\geq 25$ cases (dataset: Medicare FFS CYs 2014-2015).....	59
Figure PA1. Planned admission algorithm flowchart.....	79

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## **1. Executive Summary**

This report presents the development, testing, and specifications of a quality measure of general surgery procedures performed at ambulatory surgical centers (ASC). This ASC facility-level 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 procedure. Yale New Haven Health Services Corporation—Center for Outcomes Research and Evaluation (CORE) developed the measure for the Centers for Medicare & Medicaid Services (CMS). This measure will inform patient choice of ASC facilities and help providers and ASCs improve the quality of care.

This report presents the rationale for the measure, the specific technical approach to the measure, the measure specifications, and the national distribution of measure scores across ASC facilities.

### **1.1 Rationale for Assessing Hospital Visits after Ambulatory Surgery**

Ambulatory surgery is increasingly common in the United States. Nearly 70% of all surgeries in the United States are performed in an outpatient setting with an expanding number and variety of procedures being performed at stand-alone ASCs.<sup>1</sup> 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.<sup>2-9</sup> 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.<sup>6,10-17</sup>

We estimated the unadjusted rate of hospital visits as defined for this measure following general surgery procedures performed at ASCs. 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 25<sup>th</sup> and 75<sup>th</sup> percentiles were 0.0% and 3.7%, respectively). Of these hospital visits, 1.6% were 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.<sup>18</sup> 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.

## **1.2 Measure Development**

This measure was developed consistent with CMS's quality measure development guidance.<sup>19</sup> The CORE project team, a multidisciplinary team of clinicians, health services researchers and statisticians, was supported and informed by two surgical consultants and a national technical expert panel (TEP) consisting of patients, surgeons, methodologists, researchers, and providers. We also held a three-week public comment period, soliciting stakeholder input on the measure methodology, and publicly posted a summary of the comments received as well as our responses (available in the Downloads section at <https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/MMS/PC-Updates-on-Previous-Comment-Periods.html>).

## **1.3 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 ratio (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. 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. 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.

#### **1.4 Distribution of Measure Scores**

There was variation in risk-standardized scores across ASCs nationally. In a national Medicare FFS claims dataset for Calendar Years 2014 and 2015 that included 286,999 procedures at 1,642 ASCs performing at least 25 procedures, the facility measure scores, RSHVRs, ranged from 0.42 to 2.13, with a median RSHVR of 0.97 (the 25<sup>th</sup> and 75<sup>th</sup> percentiles were 0.90 and 1.10, respectively).

#### **1.5 Summary**

This report describes the measure specifications and 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.

## **2. Introduction**

### **2.1 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 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 United States, including the provision of many types of general surgical care.<sup>1</sup> 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.<sup>1</sup> In 2015 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.<sup>20</sup> Due to advances in surgical and anesthetic techniques, nearly 70% of all surgical procedures in the United States are performed in ambulatory settings, with many of these procedures taking place as same-day surgeries at ASCs.<sup>1</sup> 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.<sup>21,22</sup>

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, 3,251 ASCs performed 149,468 general surgery procedures of the types included in this measure (see [Section 3.3](#) for cohort definition); 1,157 (35.5%) of these ASCs performed at least 25 such procedures.

### **2.2 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). 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).

## **2.3 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.<sup>23</sup> 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 emergency department [ED] visits), and timeframe for measurement after surgery.<sup>2-9</sup> 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.

Centers for Medicare & Medicaid Services (CMS) developed 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.
3. General surgery procedures are performed at thousands of ASCs across the United States.

## **2.4 Related Risk-Adjusted Outpatient Outcome Measures of Hospital Visits**

We have developed four other risk-adjusted outpatient procedure measures that use the same 7-day unplanned hospital visit outcome to assess quality of care developed in the ASC or hospital outpatient department setting. Two of these measures have been endorsed by the National Quality Forum (NQF) and finalized for use in CMS quality reporting programs; the remaining two will be submitted to the NQF for endorsement review and have been proposed for use in CMS's Ambulatory Surgical Center Quality Reporting (ASCQR) program.

1. Hospital Visits after Hospital Outpatient Surgery (NQF status: endorsed, #2687; program status: finalized for use in the Hospital Outpatient Quality Reporting program).
2. Facility 7-Day Risk-Standardized Hospital Visit Rate after Outpatient Colonoscopy (NQF status: endorsed, #2539; program status: finalized for use in the ASCQR program).
3. Hospital Visits after ASC Orthopedic Procedures (NQF status: not yet submitted for endorsement review; program status: proposed for use in the ASCQR program).
4. Hospital Visits after ASC Urology Procedures (NQF status: not yet submitted for endorsement review; program status: proposed for use in the ASCQR program).

### **3. Measure Development Methods**

#### **3.1 Overview of Measure Development Process**

Yale New Haven Health Services Corporation—Center for Outcomes Research and Evaluation (CORE) led the development of the general surgery ASC measure under the guidance of the Centers for Medicare & Medicaid Services (CMS). The CORE Project Team consisted of a multidisciplinary group of clinicians, health services researchers, and statisticians with expertise in outcome measure development. We obtained clinical input from general surgery consultants and convened, through a public process, a national Technical Expert Panel (TEP) consisting of patients, clinicians, methodologists, researchers, and providers to provide input on the measure methodology.

Additionally, we held a three-week public comment period to solicit input on the measure's methodology and preliminary specifications. We revised the measure in response to public comment and posted a summary of the comments received as well as the updates made to the measure (available in the Downloads section at <https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/MMS/PC-Updates-on-Previous-Comment-Periods.html>). This report includes the measure's final specifications, inclusive of the revisions after consideration of the public comments.

#### **3.2 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.<sup>24</sup> 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 to 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 emergency department (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 and disparities testing, we used 2 years of claims data from CYs 2014 and 2015 (January 1, 2014 – December 31, 2015; hereinafter, Medicare FFS CYs 2014-2015 Dataset). To calculate measure score reliability for a 2-year reporting period, we used split samples of 4 years of claims data from 2012-2015 (January 1, 2012 – December 31, 2015).

### **3.3 Cohort Definition**

The target population for this measure is Medicare FFS patients aged 65 years and older, undergoing outpatient general surgery procedures in ASCs 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.

#### ***3.3.1. 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 is 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. Moreover, the scope of general surgery overlaps with that of



other specialties (for example, vascular surgery, and plastic surgery).<sup>25</sup> For this measure, we targeted procedures that general surgeons are trained to perform with the understanding that other subspecialists may also be performing many of these procedures at ASCs; since the type of surgeon performing a particular procedure may vary across ASCs, the measure is neutral to surgeons' specialty 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](https://www.cms.gov/medicare/medicare-fee-for-service-payment/ascpayment/11_addenda_updates.html) (download January 2014 and January 2015 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.<sup>1</sup>
- 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 for CY 2014 at: <https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/PhysicianFeeSched/PFS-Federal-Regulation-Notices-Items/CMS-1600-FC.html> and for CY 2015 at: <https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/PhysicianFeeSched/PFS-Federal-Regulation-Notices-Items/CMS-1612-FC.html> (download 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 general surgery ASC procedures, we reviewed with consultants and TEP members the Clinical Classifications Software (CCS) categories of procedures developed by the Agency for Healthcare Research and Quality (AHRQ). We

identified and included CCS categories within the scope of general surgery, and only included individual procedures within the CCS categories at the procedure (CPT® code) level if they were within the scope of general surgery practice. We did not include in the measure 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.

### *3.3.2. 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.

## **3.4 Outcome**

### *3.4.1. 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 2.3](#)).

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

### *3.4.2. 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.<sup>4,26</sup> 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 concluded that 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.

### *3.4.3. Multiple Qualifying Procedures within a 7-Day Period*

In rare instances (3.8%), an index procedure is followed by another qualifying general surgery ASC procedure within 7 days. When there are two 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 two 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.

### *3.4.4. 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 may 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.

### *3.4.5. 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.

## **3.5 Model Development**

### *3.5.1. 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 ratio (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. 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, 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. 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.<sup>27-29</sup>

### *3.5.2. Candidate Risk Factors for Patient-Level Risk Adjustment*

The measure adjusts for differences in patient comorbidities, demographics, and 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 Relative Value Unit (work RVU), number of qualifying procedures, and procedure type. We used the 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).<sup>24</sup>

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 three 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 four studies, we identified two variables not already included: anesthesia type and operating time.<sup>30,31</sup> 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 (CCs) 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](#).

### *3.5.3. Final Risk-Adjustment Variable Selection*

For development and testing of the patient-level model, we randomly split the Medicare FFS CY 2015 Dataset into Development and Validation Samples. The Development and Validation Samples each included a random 50% sample contained in the CY 2015 data.

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 Development Sample. As noted above, the Development Sample was a randomly selected 50% sample of our CY 2015 Medicare cohort. To develop a parsimonious risk model, non-significant variables were iteratively removed from the model using a stepwise selection approach described by Hosmer and Lemeshow.<sup>32</sup> All variables significant at  $p < 0.05$  were retained in the final model. We also tested interaction terms and retained those that were both significant at  $p < 0.05$  and demonstrated a clinically plausible relationship to the outcome. Finally, we reviewed the statistically selected variables for face validity and finalized the model variables with TEP input.

### *3.5.4. Model Performance and Validation*

To assess performance of the patient-level risk-adjustment model in the 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 Development Sample with its performance in the Validation Sample. The c-statistic and model discrimination (predictive ability) were compared.<sup>33</sup> 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 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  $\gamma_0$  far from 0 and estimated values of  $\gamma_1$  far from 1 provide evidence of over-fitting.

### *3.5.5. Calculation of ASC-Level Measure Score Variation and Outlier Status*

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.

ASCs' measure scores were calculated using a combined Medicare FFS CYs 2014-2015 Dataset. As noted above in [Section 3.5.1](#), 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 in the Medicare FFS CYs 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: (1) "better than expected," (2) "no different than expected," and (3) "worse than expected." 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 1 were deemed either worse than or better than expected; ASCs with 95% interval estimates that include 1 were deemed no different than expected.

### *3.5.6. ASC-Level Measure Score Reliability Testing*

To calculate measure score reliability for a 2-year reporting period, we used split samples of 4 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.<sup>34</sup>

### *3.5.7. Disparities Testing*

Using the Medicare FFS CYs 2014-2015 Dataset, we evaluated the potential impact of race and socioeconomic status (SES) on the general surgery ASC measure score. We assessed the relationship of SES to hospital visits at the patient and facility levels.

First, at the patient level, we assessed whether risk adjustment for Medicaid dual-eligibility status, African-American race, or a composite measure of SES (AHRQ-validated SES index)<sup>35</sup> affected ASC measure scores by comparing the facility-specific measure score with and without adjustment for each of these variables.

Second, at the ASC-level, we assessed whether ASCs with a high proportion of dual-eligible patients, African-American patients, or low-SES patients (as identified by the AHRQ SES index) performed as well on the measure as ASCs with lower proportions of these patients. To perform this ASC-level analysis, we categorized ASCs into quartiles based on the proportions of Medicare-Medicaid dual-eligible patients, African-American patients, and low-SES patients, and then examined the distribution of measure scores across the lowest and highest quartiles.

These analyses were performed using the Medicare FFS CYs 2014-2015 Dataset and data from the Census Bureau's American Community Survey. Specifically, we used the 2009-2013 American Community Survey to calculate AHRQ SES index scores and mapped them to patients' nine-digit ZIP codes.

### *3.5.8. Face Validity Testing*

We systematically assessed the face validity of the measure score as an indicator of quality by confidentially soliciting the TEP members' agreement with the following statements (via an online survey):

- “The risk-standardized hospital visit rates obtained from the Hospital Visits after General Surgery Ambulatory Surgical Center Procedures ASC measure, as specified, are valid and useful measures of ASC general surgical quality of care.”
- “The risk-standardized hospital visit rates obtained from the Hospital Visits after General Surgery Ambulatory Surgical Center Procedures' measure, as specified, will provide ASCs with information that can be used to improve their quality of care.”

Response options ranged from “strongly disagree” to “strongly agree.”

### *3.5.9. 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.



## 4. Results

### 4.1 Overall Summary

#### 4.1.1. Cohort

After applying all inclusion and exclusion criteria, the Medicare FFS CY 2015 Dataset included 149,468 outpatient general surgeries performed at 3,251 ASCs. The Development and Validation Samples consisted of 74,734 and 74,734 general surgery procedures performed at 2,966 and 2,961 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 57.7% of all surgeries in the cohort.

Across ASCs in the Medicare FFS CY 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 25<sup>th</sup> and 75<sup>th</sup> percentiles were 3 and 43 procedures, respectively). These results show that there were many ASCs with few cases in the Medicare FFS CY 2015 dataset; 1,153 ASCs had more than 25 cases.

#### 4.1.2. 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 1,153 ASCs with at least 25 cases in the Medicare FFS CY 2015 dataset, the unadjusted rate of unplanned hospital visits ranged from 0.0% to 13.2%. Among these ASCs with 25 or more cases, 25.1% of ASCs had a rate of 0.0%; 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](#)).

## 4.2 Risk-Adjustment Model

### 4.2.1. Candidate and Final Variables

Candidate variables for risk adjustment included patient demographic, clinical, and procedure-related characteristics ([see Appendix E, Table E1](#)). The stepwise selection procedure described in [Section 3.5.3](#) above identified age, 17 comorbidities, work RVUs to adjust for surgical procedural complexity and procedure type (abdomen vs. alimentary tract vs. breast vs. skin/soft tissue vs. wound vs. varicose vein), and one interaction term. For the final model, we retained these variables and one variable (opioid use) that had a p-value of 0.0917 because experts advised it was an important risk predictor and expressed a strong preference for including it in the model.

[Table 1](#) shows the frequency of the final risk-adjustment variables in the Development and Validation Samples.

### 4.2.2. Model Performance and Validation

As the results in [Table 5](#) show, the c-statistics in the Development and Validation Sample final models were 0.699 and 0.700, respectively, 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 Development Sample ranged from 0.79% in the lowest decile of predicted general surgery hospital visit rate to 6.39% in the highest predicted risk decile, a range of 5.60%; the mean observed unplanned hospital visit rate in the Validation Sample ranged from 0.71% in the lowest predicted risk decile to 6.44% in the highest predicted risk decile, a range of 5.73% ([Table 5](#)).

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

## 4.3 ASC-Level Measure Score

### 4.3.1. ASC-Level Measure Score Variation and Outlier Status

The measure score is an ASC-level risk-standardized hospital visit ratio (RSHVR). The risk-standardized measure scores estimated using 2 full years of Medicare FFS data (CYs 2014 and 2015) showed variation across ASCs. Among ASCs performing at least 25 procedures ([Figure 4](#)), the median RSHVR was 0.97, ranging from 0.42 to 2.13 (the 25<sup>th</sup> and 75<sup>th</sup> percentiles were 0.90

and 1.10, respectively). Using a bootstrapped 95% interval estimate, we found 31 significant outliers among 1,642 ASCs meeting the volume threshold of at least 25 cases; 15 were categorized as better than expected, 1,611 as no different than expected, and 16 as worse than expected.

#### *4.3.2. 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 2 years to be ICC [2,1] = 0.530, indicating moderate measure score reliability.<sup>34</sup>

#### *4.3.3. ASC-Level Measure Score Disparities Testing*

The ASC-level risk-standardized scores were highly correlated (Spearman correlation coefficients of nearly 1.0) when calculated with and without the addition of the three SES variables. The correlation coefficients were 0.998, 1.000, and 0.999 for the risk-standardized scores with and without Medicaid dual-eligibility status, African-American race, and the AHRQ SES index, respectively.

In addition, the analyses of ASCs categorized into quartiles based on proportions of Medicare-Medicaid dual-eligible patients, of African-American patients, and of low-SES patients (as identified by the AHRQ SES index) showed limited differences in the distributions of the RSHVRs by quartile. Also, the median RSHVR was 1.0 for all three variables, except for low % dual-eligible patients with a median RSHVR of 0.9 ([Table 7](#)).

#### *4.3.4. Face Validity Testing*

Fourteen out of the 15 TEP members responded to the face validity survey. Of the 14 respondents, 12 respondents indicated that they somewhat, moderately, or strongly agreed; and 2 respondents moderately disagreed with the following statements:

- “The risk-standardized hospital visit rates obtained from the Hospital Visits after General Surgery Ambulatory Surgical Center Procedures ASC measure, as specified, are valid and useful measures of ASC general surgical quality of care.”
- “The risk-standardized hospital visit rates obtained from the Hospital Visits after General Surgery Ambulatory Surgical Center Procedures’ measure, as specified, will provide ASCs with information that can be used to improve their quality of care.”

These validity testing results demonstrate TEP agreement with the overall face validity of the measure.

## 5. 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. While these procedures are diverse and are performed by multiple types of physicians, they share common reasons for near-term hospital visits and can be combined for quality assessment. The general surgery ASC measure, as specified, has the potential to illuminate quality differences among general surgery procedures across ASCs, 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.

General surgery ASC procedures and unplanned hospital visits following these procedures are common among Medicare beneficiaries. Using a national 100% Medicare FFS dataset, we estimated that approximately 149,468 outpatient general surgery procedures were performed in 2015 at 3,251 ASCs using the cohort definition for the measure. Our analysis shows 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 3.2](#), for public reporting, CMS is considering using more than 1 year of data to ensure reliable estimates.

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## 7. Tables

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

Variable (definition)	Development Sample		Validation Sample	
	Number	Percentage (%)	Number	Percentage (%)
<b>N</b>	-	-	-	-
Age: mean (standard deviation [SD])	76.3	7.2	76.3	7.2
Procedure type: Abdomen and its contents	9,506	12.7%	9,474	12.7%
Procedure type: Alimentary tract	4,941	6.6%	5,143	6.9%
Procedure type: Breast	5,089	6.8%	5,094	6.8%
Procedure type: Skin/soft tissue	41,334	55.3%	41,357	55.3%
Procedure type: Wound	13,277	17.8%	13,087	17.5%
Procedure type: Vascular	587	0.8%	579	0.8%
Work Relative Value Unit (work RVU): mean (SD)	7	3.9	7	3.9
<b>Comorbidities</b>	-	-	-	-
Other benign tumors (CC 15, 16)	59,878	80.1%	59,906	80.2%
Liver or biliary disease (CC 27, 28, 29, 30, 31, 32)	6,621	8.9%	6,650	8.9%
Intestinal obstruction or perforation (CC 33)	1,482	2.0%	1,446	1.9%
Dementia or senility (CC 51, 52, 53)	5,611	7.5%	5,697	7.6%
Psychiatric disorders (CC 57, 58, 59, 60, 61, 62, 63)	15,913	21.3%	15,877	21.2%
Other significant central nervous system (CNS) disease (CC 77, 78, 79, 80)	2,698	3.6%	2,745	3.7%
Ischemic heart disease (CC 86, 87, 88, 89)	21,613	28.9%	21,373	28.6%
Specified arrhythmias and other heart rhythm disorders (CC 96, 97)	21,055	28.2%	21,047	28.2%
Stroke (CC 99, 100)	3,215	4.3%	3,273	4.4%
Chronic lung disease (CC 110, 111, 112, 113)	15,192	20.3%	14,976	20.0%
Pneumonia (CC 114, 115, 116)	4,910	6.6%	4,816	6.4%
Dialysis or sever chronic kidney disease (CC 134, 136, 137)	2,122	2.8%	1,990	2.7%
Benign prostatic hyperplasia (ICD-9 codes: 60000, 60001, 60020, 60021, 60090, 6091; ICD-10 codes: N40.0, N40.1, N40.2, N40.3)	14,499	19.4%	14,846	19.9%
Cellulitis, local skin infection (CC 164)	10,371	13.9%	10,541	14.1%
Major traumatic fracture or internal injury (CC 169, 170, 171, 172, 173, 174)	25,337	33.9%	25,389	34.0%
Complications of care (CC 176, 177)	6,083	8.1%	6,179	8.3%

Variable (definition)	Development Sample		Validation Sample	
	Number	Percentage (%)	Number	Percentage (%)
Chronic anticoagulant use (ICD-9 code: V5861; ICD-10 code: Z7901 [long-term <sup>18</sup> use of anticoagulants])	7,671	10.3%	7,653	10.2%
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)	386	0.5%	345	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	Percentage of all surgeries (%)
14060	Skin tissue rearrangement	11,409	7.6%
13132	Repair of wound or lesion	11,208	7.5%
15260	Skin full graft een & lips	7,996	5.3%
14040	Skin tissue rearrangement	7,214	4.8%
49505	Prp i/hern init reduc >5 yr	7,072	4.7%
46221	Ligation of hemorrhoid(s)	4,485	3.0%
13121	Repair of wound or lesion	3,941	2.6%
14041	Skin tissue rearrangement	3,911	2.6%
19301	Partical mastectomy	3,521	2.4%
14301	Skin tissue rearrangement	3,353	2.2%
14061	Skin tissue rearrangement	3,240	2.2%
13101	Repair of wound or lesion	2,736	1.8%
15732	Muscle-skin graft head/neck	2,707	1.8%
47562	Laparoscopic cholectectomy	2,357	1.6%
49650	Lap ing hernia repair init	2,348	1.6%
14020	Skin tissue rearrangement	2,186	1.5%
14021	Skin tissue rearrangement	1,670	1.1%
11606	Exc tr-ext mal+marg > 4 cm	1,668	1.1%
12032	Intmd wnd repair s/a/t/ext	1,647	1.1%
19125	Excision breast lesion	1,625	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	7-day unplanned hospital visit rate (%)
149,468	3,289	2.2%
Outcome type	#	%
Emergency department or observation stay visit	2,440	1.6%
Unplanned inpatient admission	849	0.6%

**Table 4. Top diagnoses for any hospital visit within 7 days of general surgery ASC 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 diagnoses per AHRQ clinical category (ICD-9 code)			Top 10 primary diagnoses per AHRQ clinical category (ICD-10 codes)		
				ICD-9 diagnosis code	ICD-9 diagnosis short description	Frequency of ICD-9 diagnosis	ICD-10 diagnosis code	ICD-10 diagnosis short 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 diagnoses per AHRQ clinical category (ICD-9 code)			Top 10 primary diagnoses per AHRQ clinical category (ICD-10 codes)		
				ICD-9 diagnosis code	ICD-9 diagnosis short description	Frequency of ICD-9 diagnosis	ICD-10 diagnosis code	ICD-10 diagnosis short 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%	-	-	-	-	-	-

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary diagnoses per AHRQ clinical category (ICD-9 code)			Top 10 primary diagnoses per AHRQ clinical category (ICD-10 codes)		
				ICD-9 diagnosis code	ICD-9 diagnosis short description	Frequency of ICD-9 diagnosis	ICD-10 diagnosis code	ICD-10 diagnosis short description	Frequency of ICD-10 diagnosis
72 – Colostomy, temporary and permanent	11	0	0.0%	-	-	-	-	-	-
73 – Ileostomy and other enterostomy	4	0	0.0%	-	-	-	-	-	-
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	-	-	-

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary diagnoses per AHRQ clinical category (ICD-9 code)			Top 10 primary diagnoses per AHRQ clinical category (ICD-10 codes)		
				ICD-9 diagnosis code	ICD-9 diagnosis short description	Frequency of ICD-9 diagnosis	ICD-10 diagnosis code	ICD-10 diagnosis short description	Frequency of ICD-10 diagnosis
				5849	Acute kidney failure NOS	1	-	-	-
				78760	Full incontinence-feces	1	-	-	-
				56400	Constipation NOS	1	-	-	-
				4558	Hemrrhoid NOS w comp NEC	1	-	-	-
81 – Hemorrhoid procedures	7,784	244	2.9%	78820	Retention urine NOS	46	R339	Retention of urine, unspecified	14
				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

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary diagnoses per AHRQ clinical category (ICD-9 code)			Top 10 primary diagnoses per AHRQ clinical category (ICD-10 codes)		
				ICD-9 diagnosis code	ICD-9 diagnosis short description	Frequency of ICD-9 diagnosis	ICD-10 diagnosis code	ICD-10 diagnosis short description	Frequency of ICD-10 diagnosis
				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
				99859	Other postop infection	5	K91840	Postprocedural hemorrhage and hematoma of a digestive system organ or structure following a digestive system procedure	3
				389	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



AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary diagnoses per AHRQ clinical category (ICD-9 code)			Top 10 primary diagnoses per AHRQ clinical category (ICD-10 codes)		
				ICD-9 diagnosis code	ICD-9 diagnosis short description	Frequency of ICD-9 diagnosis	ICD-10 diagnosis code	ICD-10 diagnosis short description	Frequency of ICD-10 diagnosis
				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 proc	8	R338	Other retention of urine	4
				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

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary diagnoses per AHRQ clinical category (ICD-9 code)			Top 10 primary diagnoses per AHRQ clinical category (ICD-10 codes)		
				ICD-9 diagnosis code	ICD-9 diagnosis short description	Frequency of ICD-9 diagnosis	ICD-10 diagnosis code	ICD-10 diagnosis short description	Frequency of ICD-10 diagnosis
				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 following other procedure	2
				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

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary diagnoses per AHRQ clinical category (ICD-9 code)			Top 10 primary diagnoses per AHRQ clinical category (ICD-10 codes)		
				ICD-9 diagnosis code	ICD-9 diagnosis short description	Frequency of ICD-9 diagnosis	ICD-10 diagnosis code	ICD-10 diagnosis short description	Frequency of ICD-10 diagnosis
				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	-	-	-
				56400	Constipation NOS	1	-	-	-
				51189	Effusion NEC exc tb	1	-	-	-
				45341	Ac DVT/emb prox low ext	1	-	-	-
				41071	Subendo infarct, initial	1	-	-	-

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary diagnoses per AHRQ clinical category (ICD-9 code)			Top 10 primary diagnoses per AHRQ clinical category (ICD-10 codes)		
				ICD-9 diagnosis code	ICD-9 diagnosis short description	Frequency of ICD-9 diagnosis	ICD-10 diagnosis code	ICD-10 diagnosis short description	Frequency of ICD-10 diagnosis
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 and rectum	1
				7242	Lumbago	1	K6289	Other specified diseases of anus and rectum	1

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary diagnoses per AHRQ clinical category (ICD-9 code)			Top 10 primary diagnoses per AHRQ clinical category (ICD-10 codes)		
				ICD-9 diagnosis code	ICD-9 diagnosis short description	Frequency of ICD-9 diagnosis	ICD-10 diagnosis code	ICD-10 diagnosis short description	Frequency of ICD-10 diagnosis
				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 procedures on breast	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 diagnoses per AHRQ clinical category (ICD-9 code)			Top 10 primary diagnoses per AHRQ clinical category (ICD-10 codes)		
				ICD-9 diagnosis code	ICD-9 diagnosis short description	Frequency of ICD-9 diagnosis	ICD-10 diagnosis code	ICD-10 diagnosis short description	Frequency of ICD-10 diagnosis
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

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary diagnoses per AHRQ clinical category (ICD-9 code)			Top 10 primary diagnoses per AHRQ clinical category (ICD-10 codes)		
				ICD-9 diagnosis code	ICD-9 diagnosis short description	Frequency of ICD-9 diagnosis	ICD-10 diagnosis code	ICD-10 diagnosis short description	Frequency of ICD-10 diagnosis
				41071	Subendo infarct, initial	2	K559	Vascular disorder of intestine, unspecified	1
				42789	Cardiac dysrhythmias NEC	2	L259	Unspecified contact dermatitis, unspecified cause	1
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

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary diagnoses per AHRQ clinical category (ICD-9 code)			Top 10 primary diagnoses per AHRQ clinical category (ICD-10 codes)		
				ICD-9 diagnosis code	ICD-9 diagnosis short description	Frequency of ICD-9 diagnosis	ICD-10 diagnosis code	ICD-10 diagnosis short description	Frequency of ICD-10 diagnosis
				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 infrct	1	L03114	Cellulitis of left upper limb	1
				4275	Cardiac arrest	1	L03116	Cellulitis of left lower limb	1
169 – Debridement of wound, infection or burn	38	4	10.5%	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	26,913	431	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



AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary diagnoses per AHRQ clinical category (ICD-9 code)			Top 10 primary diagnoses per AHRQ clinical category (ICD-10 codes)		
				ICD-9 diagnosis code	ICD-9 diagnosis short description	Frequency of ICD-9 diagnosis	ICD-10 diagnosis code	ICD-10 diagnosis short description	Frequency of ICD-10 diagnosis
				99832	Disrup-external op wound	8	T814XXA	Infection following a procedure, initial encounter	5
				7802	Syncope and collapse	7	N390	Urinary tract infection, site not specified	4
				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 mastoid process following other procedure	2
				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

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary diagnoses per AHRQ clinical category (ICD-9 code)			Top 10 primary diagnoses per AHRQ clinical category (ICD-10 codes)		
				ICD-9 diagnosis code	ICD-9 diagnosis short description	Frequency of ICD-9 diagnosis	ICD-10 diagnosis code	ICD-10 diagnosis short description	Frequency of ICD-10 diagnosis
171 – Suture of skin and subcutaneous tissue	24,868	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, unspecified organism	2
				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

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary diagnoses per AHRQ clinical category (ICD-9 code)			Top 10 primary diagnoses per AHRQ clinical category (ICD-10 codes)		
				ICD-9 diagnosis code	ICD-9 diagnosis short description	Frequency of ICD-9 diagnosis	ICD-10 diagnosis code	ICD-10 diagnosis short description	Frequency of ICD-10 diagnosis
172 – Skin graft	51,163	962	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
				4019	Hypertension NOS	14	A419	Sepsis, unspecified organism	5
				99859	Other postop infection	12	E871	Hypo-osmolality and hyponatremia	5
				389	Septicemia NOS	9	G459	Transient cerebral ischemic attack, unspecified	4

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary diagnoses per AHRQ clinical category (ICD-9 code)			Top 10 primary diagnoses per AHRQ clinical category (ICD-10 codes)		
				ICD-9 diagnosis code	ICD-9 diagnosis short description	Frequency of ICD-9 diagnosis	ICD-10 diagnosis code	ICD-10 diagnosis short description	Frequency of ICD-10 diagnosis
174 – Other non-OR therapeutic procedures on skin and breast	2,119	32	1.5%	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
				389	Septicemia NOS	2	L03115	Cellulitis of right lower limb	1
				7804	Dizziness and giddiness	1	R51	Headache	1
				7242	Lumbago	1	R55	Syncope and collapse	1
				71104	Pyogen arthritis-hand	1	S9032XA	Contusion of left foot, initial encounter	1
				5609	Intestinal obstruct NOS	1	T814XXA	Infection following a procedure, initial encounter	1
				5589	Noninf gastroenterit NEC	1	-	-	-
				5070	Food/vomit pneumonitis	1	-	-	-
				38611	Benign paroxysmal vertigo	1	-	-	-
175 – Other OR therapeutic	3,830	75	2.0%	99749	Oth digestv system comp	3	T814XXA	Infection following a procedure, initial encounter	2

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary diagnoses per AHRQ clinical category (ICD-9 code)			Top 10 primary diagnoses per AHRQ clinical category (ICD-10 codes)		
				ICD-9 diagnosis code	ICD-9 diagnosis short description	Frequency of ICD-9 diagnosis	ICD-10 diagnosis code	ICD-10 diagnosis short description	Frequency of ICD-10 diagnosis
procedures on skin and breast				9953	Allergy, unspecified	3	A419	Sepsis, unspecified organism	1
				78609	Respiratory abnorm NEC	2	C50911	Malignant neoplasm of unspecified site of right female breast	1
				78097	Altered mental status	2	J189	Pneumonia, unspecified organism	1
				99812	Hematoma complic proc	2	K565	Intestinal adhesions [bands] with obstruction (postprocedural) (postinfection)	1
				7804	Dizziness and giddiness	2	K859	Acute pancreatitis, unspecified	1
				486	Pneumonia, organism NOS	2	L03221	Cellulitis of neck	1
				43491	Crbl art ocl NOS w infrc	2	M797	Fibromyalgia	1
				29281	Drug-induced delirium	2	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	Development Sample	Validation Sample
Number of procedures	74,734 (50%)	74,734 (50%)
Number of hospital visits in 7 days	1,645 (2.2%)	1,644 (2.2%)
Calibration ( $\gamma_0$ , $\gamma_1$ )	(0,1)	(-0.08, 0.98)
c-statistic	0.699	0.700
Predictive ability (lowest-highest risk decile)	0.79%-6.39%	0.71%-6.44%

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

-	Development Sample		Validation Sample	
-	Estimate	Odds ratio (95% CI)	Estimate	Odds ratio (95% CI)
Intercept	-3.776	-	-3.886	-
Age	0.026	1.03 (1.02-1.03)	0.033	1.03 (1.03-1.04)
Procedure type: Abdomen and its contents (reference)	-	-	-	-
Procedure type: Alimentary tract	-0.878	-	-1.007	-
Procedure type: Breast	-1.379	-	-0.735	-
Procedure type: Skin/soft tissue	-1.031	-	-1.048	-
Procedure type: Wound	-1.010	-	-1.186	-
Procedure type: Varicose vein procedures	1.189	-	-0.356	-
Work Relative Value Unit (work RVU)	0.020	-	0.017	-
Other benign tumors	-0.295	0.75 (0.66-0.85)	-0.252	0.78 (0.68-0.89)
Liver or biliary disease	0.263	1.30 (1.12-1.51)	0.326	1.39 (1.20-1.60)
Intestinal obstruction/perforation	0.294	1.34 (1.04-1.73)	0.213	1.24 (0.95-1.61)
Dementia or senility	0.215	1.24 (1.05-1.46)	0.136	1.15 (0.97-1.35)
Psychiatric disorders	0.184	1.20 (1.07-1.35)	0.227	1.25 (1.12-1.41)
Other significant central nervous system (CNS) disease	0.283	1.33 (1.07-1.65)	0.255	1.29 (1.03-1.61)
Ischemic heart disease	0.163	1.18 (1.05-1.32)	0.176	1.19 (1.07-1.33)
Specified arrhythmias and other heart rhythm disorders	0.205	1.23 (1.09-1.38)	0.227	1.26 (1.12-1.41)
Stroke	0.309	1.36 (1.12-1.65)	-0.065	0.94 (0.75-1.17)
Chronic lung disease	0.182	1.20 (1.07-1.35)	0.273	1.31 (1.17-1.48)
Pneumonia	0.195	1.22 (1.03-1.44)	0.198	1.22 (1.03-1.44)
Dialysis or severe chronic kidney disease	0.553	1.74 (1.41-2.15)	0.527	1.69 (1.36-2.11)
Benign prostatic hyperplasia	0.232	1.26 (1.12-1.42)	0.118	1.13 (1.00-1.27)
Cellulitis, local skin infection	0.156	1.17 (1.02-1.34)	0.162	1.18 (1.03-1.34)
Major traumatic fracture or internal injury	0.160	1.17 (1.06-1.30)	0.255	1.29 (1.16-1.43)
Complications of care	0.195	1.22 (1.04-1.43)	0.123	1.13 (0.96-1.33)
Chronic anticoagulant use	0.204	1.23 (1.06-1.42)	0.205	1.23 (1.06-1.42)
Opioid abuse	-0.037	0.96 (0.54-1.74)	0.848	2.34 (1.51-3.62)

-	Development Sample		Validation Sample	
-	Estimate	Odds ratio (95% CI)	Estimate	Odds ratio (95% CI)
Interaction: Alimentary tract and RVU	0.132	-	0.135	-
Interaction: Breast and RVU	0.055	-	-0.008	-
Interaction: Skin/soft tissue and RVU	-0.005	-	0.003	-
Interaction: Wound and RVU	-0.011	-	-0.026	-
Interaction: Varicose vein procedures and RVU	-0.241	-	-0.076	-
Odds ratios: Work RVU in abdomen and its contents	0.020	1.02 (0.98-1.07)	0.017	1.02 (0.97-1.06)
Odds ratios: Work RVU in alimentary tract	0.152	1.16 (1.11-1.22)	0.152	1.16 (1.11-1.22)
Odds ratios: Work RVU in breast	0.075	1.08 (1.02-1.14)	0.009	1.01 (0.95-1.07)
Odds ratios: Work RVU in skin/soft tissue	0.016	1.02 (1.00-1.04)	0.020	1.02 (1.00-1.04)
Odds ratios: Work RVU in wound	0.009	1.01 (0.95-1.07)	-0.009	0.99 (0.93-1.06)
Odds ratios: Work RVU in varicose vein procedures	-0.220	0.80 (0.62-1.04)	-0.059	0.94 (0.63-1.42)

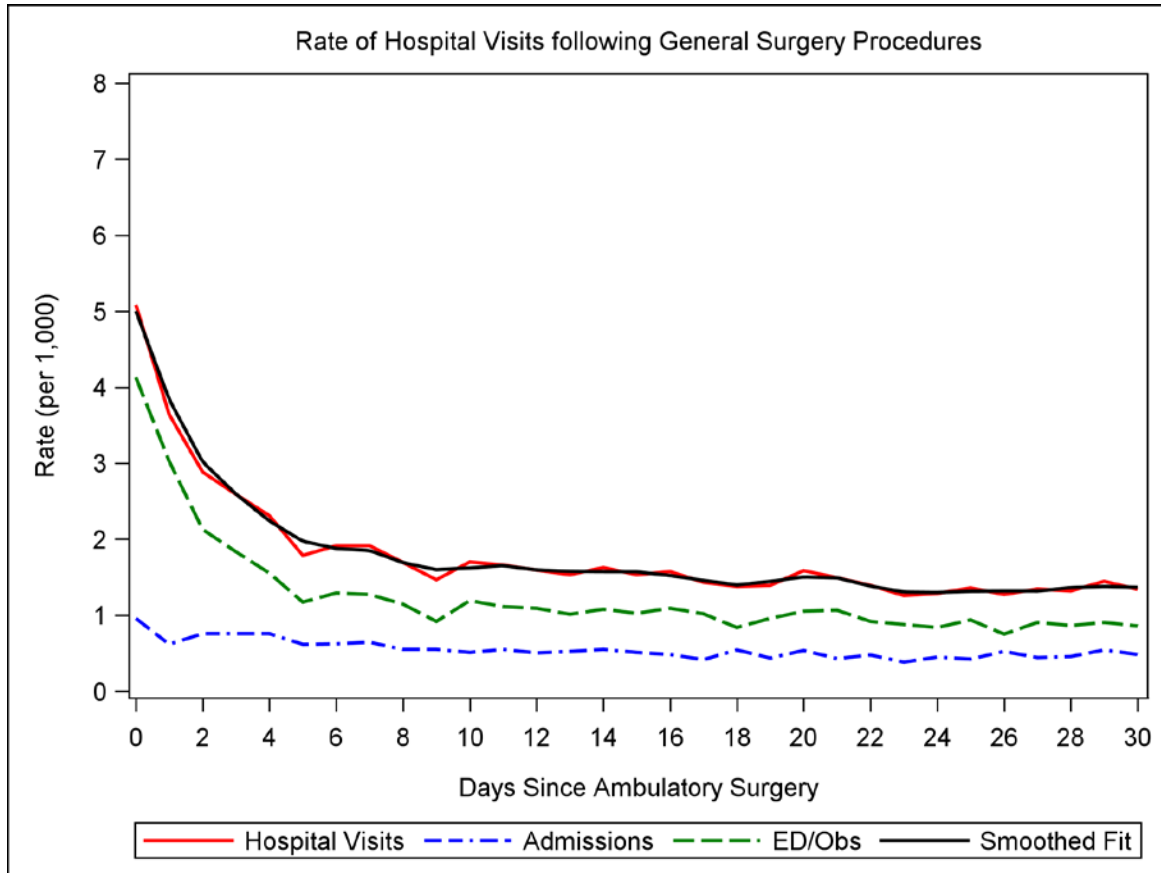
**Table 7. Variation in RSHVRs across ASCs by proportion of Medicaid dual-eligible, African-American, and low-SES patients (data source: Medicare FFS CYs 2014-2015)**

	Medicaid dual-eligible status		African-American race		Low-SES	
	Low % ( $\leq 1.82\%$ )	High % ( $\geq 7.06\%$ )	Low % (0.00%)	High % ( $\geq 3.95\%$ )	Low % ( $\leq 4.04\%$ )	High % ( $\geq 17.17\%$ )
Number of ASCs	409	822	599	633	410	822
Number of patients	83,214	154,890	79,947	158,734	71,841	151,213
Maximum RSHVR	1.6	1.9	1.9	2.1	1.8	1.9
90 <sup>th</sup>	1.2	1.3	1.2	1.3	1.2	1.3
75 <sup>th</sup>	1.1	1.1	1.1	1.1	1.1	1.1
Median	0.9	1.0	1.0	1.0	1.0	1.0
25 <sup>th</sup>	0.9	0.9	0.9	0.9	0.9	0.9
10 <sup>th</sup>	0.8	0.8	0.8	0.9	0.8	0.8
Minimum RSHVR	0.5	0.4	0.6	0.4	0.5	0.6

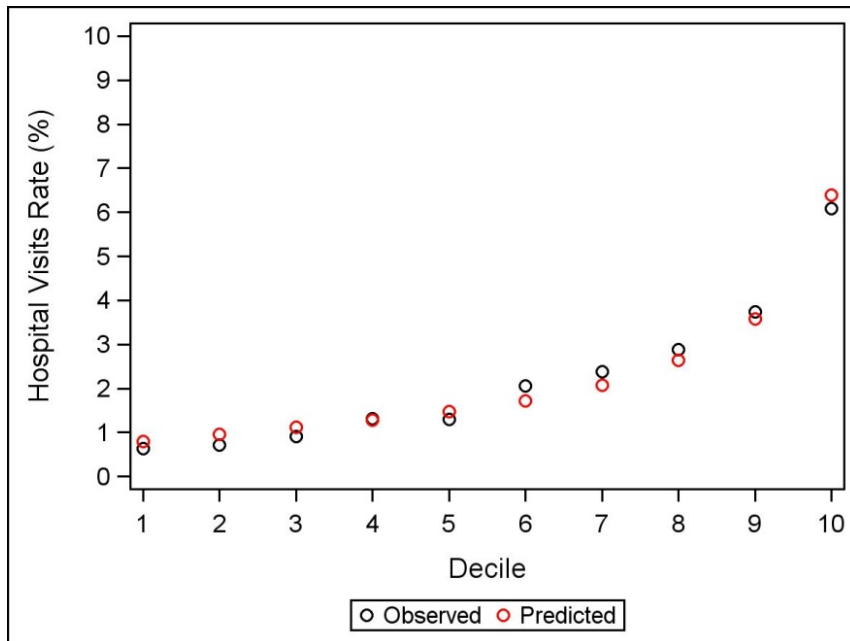


## 8. Figures

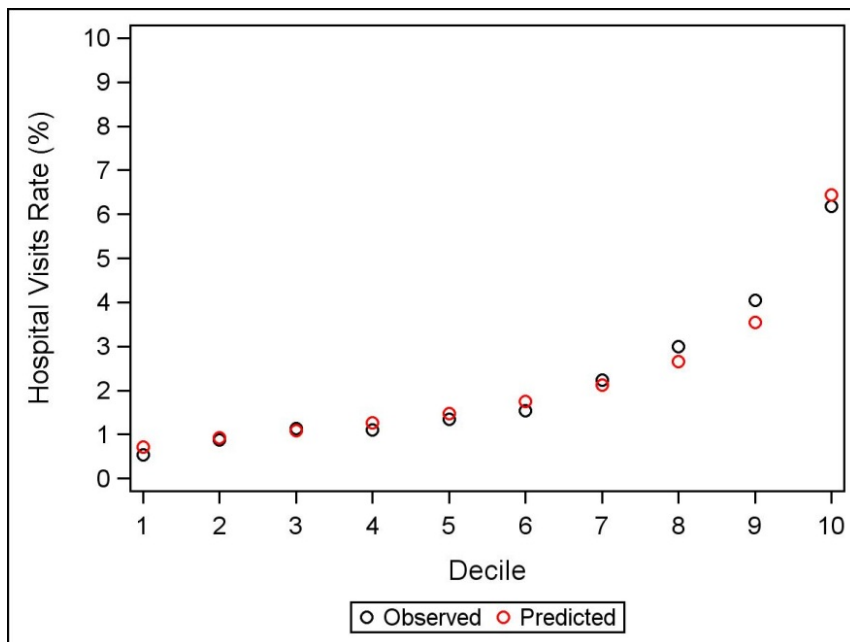
**Figure 1. Timing of hospital visits within 30 days of general surgery ASC procedures (event rate 1,000 in the 30 days post-discharge; dataset: Medicare FFS CY 2015)**



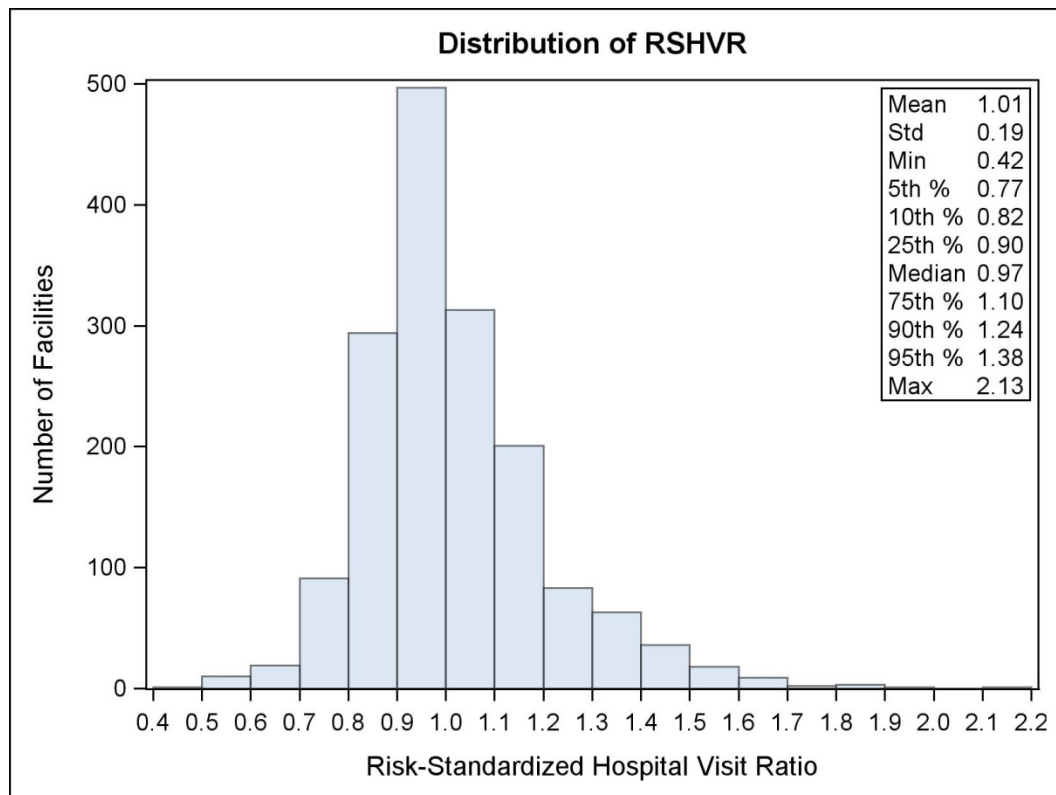
**Figure 2. Calibration plot of predicted versus observed outcomes across deciles of patient risk in the Development Sample (dataset: Medicare FFS CY 2015)**



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



**Figure 4. Distribution of risk-standardized hospital visit ratios (RSHVRs) following general surgery procedures for ASCs with  $\geq 25$  cases (dataset: Medicare FFS CYs 2014-2015)**



## 9. Appendices

### Appendix A: List of all Current Procedural Terminology (CPT®) Procedure Codes Included in the Measure Cohort

Table A1. List of procedures included in the measure cohort

AHRQ clinical category and 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)
Procedure type: Abdomen and its contents			
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	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
	49505	Prp i/hern init reduc >5 yr	090
	49507	Prp i/hern init block >5 yr	090
	49520	Rerepair ing hernia reduce	090
	49521	Rerepair ing hernia blocked	090
	49525	Repair ing hernia sliding	090
	49550	Rpr rem hernia init reduce	090
	49553	Rpr fem hernia init blocked	090
	49555	Rerepair fem hernia reduce	090
	49557	Rerepair fem hernia blocked	090
	49650	Lap ing hernia repair init	090
	49651	Lap ing hernia repair recur	090
86 – Other hernia repair	49540	Repair lumbar hernia	090

AHRQ clinical category and 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)
	49560	Rpr ventral hern init reduc	090
	49561	Rpr ventral hern init block	090
	49565	Rerepair ventrl hern reduce	090
	49566	Rerepair ventrl hern block	090
	49570	Rpr epigastric hern reduce	090
	49572	Rpr epigastric hern blocked	090
	49580	Rpr umbil hern reduc < 5 yr	090
	49582	Rpr umbil hern block < 5 yr	090
	49585	Rpr umbil hern reduc > 5 yr	090
	49587	Rpr umbil hern block > 5 yr	090
	49590	Repair spigelian hernia	090
	49600	Repair umbilical lesion	090
	49652	Lap vent/abd hernia repair	090
	49653	Lap vent/abd hern proc comp	090
	49654	Lap inc hernia repair	090
	49655	Lap inc hern repair comp	090
	49656	Lap inc hernia repair recur	090
	49657	Lap inc hern recur comp	090
	55540	Revise hernia & sperm veins	090
87 – Laparoscopy	49320	Diag laparo separate proc	010
	49321	Laparoscopy biopsy	010
	49322	Laparoscopy aspiration	010
	49324	Lap insert tunnel ip cath	010
	49325	Lap revision perm ip cath	010
97 – Other gastrointestinal diagnostic procedures	48102	Needle biopsy pancreas	010
98 – Other non-OR gastrointestinal therapeutic procedures	47530	Revise/reinsert bile tube	090

AHRQ clinical category and 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)
99 – Other OR gastrointestinal therapeutic procedures	47382	Percut ablate liver rf	010
	47383	Perq abltj lvr cryoablation	010
	47510	Insert catheter bile duct	090
	47511	Insert bile duct drain	090
	49250	Excision of umbilicus	090
	49402	Remove foreign body adbomen	090
	49419	Insert tun ip cath w/port	090
	49422	Remove tunneled ip cath	010
	49426	Revise abdomen-venous shunt	090
	49429	Removal of shunt	010
	49436	Embedded ip cath exit-site	010
Procedure type: Alimentary tract			
71 – Gastrostomy, temporary and permanent	43653	Laparoscopy gastrostomy	090
	49440	Place gastrostomy tube perc	010
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
94 – Other OR upper GI therapeutic procedures	43130	Removal of esophagus pouch	090
	43870	Repair stomach opening	090
95 – Other non-OR lower GI therapeutic procedures	45190	Destruction rectal tumor	090
	46220	Excise anal ext tag/papilla	010
	46900	Destruction anal lesion(s)	010
	46910	Destruction anal lesion(s)	010
	46916	Cryosurgery anal lesion(s)	010

AHRQ clinical category and description	Current Procedural Terminology (CPT®) code	Short description of CPT® code	Global Surgical Package Status <i>090 = major procedure (90-day post-operative period) 010 = minor procedure (10-day post-operative period) 000 = minor procedure (0-day post-operative period)</i>
	46917	Laser surgery anal lesions	010
	46922	Excision of anal lesion(s)	010
	46924	Destruction anal lesion(s)	010
	46940	Treatment of anal fissure	010
	46942	Treatment of anal fissure	010
96 – Other OR lower GI therapeutic procedures	45000	Drainage of pelvic abscess	090
	45005	Drainage of rectal abscess	010
	45020	Drainage of rectal abscess	090
	45108	Removal of anorectal lesion	090
	45150	Excision of rectal stricture	090
	45541	Correct rectal prolapse	090
	45900	Reduction of rectal prolapse	010
	45905	Dilation of anal sphincter	010
	45910	Dilation of rectal narrowing	010
	45915	Remove rectal obstruction	010
	46020	Placement of seton	010
	46030	Removal of rectal marker	010
	46040	Incision of rectal abscess	090
	46045	Incision of rectal abscess	090
	46050	Incision of anal abscess	010
	46060	Incision of rectal abscess	090
	46070	Incision of anal septum	090
	46080	Incision of anal sphincter	010
	46200	Removal of anal fissure	090
	46270	Remove anal fist subq	090
	46275	Remove anal fist inter	090
	46280	Remove anal fist complex	090

AHRQ clinical category and 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)
	46285	Remove anal fist 2 stage	090
	46288	Repair anal fistula	090
	46505	Chemodenervation anal musc	010
	46700	Repair of anal stricture	090
	46706	Repr of anal fistula w/glue	010
	46707	Repair anorectal fist w/plug	090
	46750	Repair of anal sphincter	090
	46753	Reconstruction of anus	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
244 – Gastric bypass and volume reduction	43886	Revise gastric port open	090
	43887	Remove gastric port open	090
	43888	Change gastric port open	090
77 – Proctoscopy and anorectal biopsy	45100	Biopsy of rectum	090
78 – Colorectal resection	45160	Excision of rectal lesion	090
	45171	Exc rect tum transanal part	090
	45172	Exc rect tum transanal full	090
81 – Hemorrhoid procedures	46083	Incise external hemorrhoid	010
	46221	Ligation of hemorrhoid(s)	010
	46230	Removal of anal tags	010
	46250	Remove ext hem groups 2+	090
	46255	Remove int/ext hem 1 group	090
	46257	Remove in/ex hem grp & fiss	090
	46258	Remove in/ex hem grp w/fistu	090
	46260	Remove in/ex hem groups 2+	090



AHRQ clinical category and 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)
	46261	Remove in/ex hem grps & fiss	090
	46262	Remove in/ex hem grps w/fist	090
	46320	Removal of hemorrhoid clot	010
	46500	Injection into hemorrhoid(s)	010
	46930	Destroy internal hemorrhoids	090
	46945	Remove by ligat int hem grp	090
	46946	Remove by ligat int hem grps	090
	46947	Hemorrhoidopexy by stapling	090
Procedure type: Breast			
165 – Breast biopsy and other diagnostic procedures on breast	19101	Biopsy of breast open	010
166 – Lumpectomy, quadrantectomy of breast	19120	Removal of breast lesion	090
	19125	Excision breast lesion	090
	19301	Partial mastectomy	090
	19302	P-mastectomy w/ln removal	090
167 – Mastectomy	19300	Removal of breast tissue	090
	19303	Mast simple complete	090
	19304	Mast subq	090
175 – Other OR therapeutic procedures on skin and breast	20926	Removal of tissue for graft	090
	11960	Insert tissue expander(s)	090
	11970	Replace tissue expander	090
	11971	Remove tissue expander(s)	090
	19020	Incision of breast lesion	090
	19112	Excise breast duct fistula	090
	19316	Suspension of breast	090
	19318	Reduction of large breast	090
	19324	Enlarge breast	090

AHRQ clinical category and 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)
	19325	Enlarge breast with implant	090
	19328	Removal of breast implant	090
	19330	Removal of implant material	090
	19340	Immediate breast prosthesis	090
	19342	Delayed breast prosthesis	090
	19350	Breast reconstruction	090
	19355	Correct inverted nipple(s)	090
	19357	Breast reconstruction	090
	19366	Breast reconstruction	090
	19370	Surgery of breast capsule	090
	19371	Removal of breast capsule	090
	19380	Revise breast reconstruction	090
Procedure type: Skin/soft tissue			
67 – Other therapeutic procedures, hemic and lymphatic system	38300	Drainage lymph node lesion	010
	38305	Drainage lymph node lesion	090
	38308	Incision of lymph channels	090
	38500	Biopsy/removal lymph nodes	010
	38510	Biopsy/removal lymph nodes	010
	38520	Biopsy/removal lymph nodes	090
	38525	Biopsy/removal lymph nodes	090
	38530	Biopsy/removal lymph nodes	090
	38542	Explore deep node(s) neck	090
	38550	Removal neck/armpit lesion	090
	38555	Removal neck/armpit lesion	090
	38570	Laparoscopy lymph node biop	010
	38571	Laparoscopy lymphadenectomy	010
	38572	Laparoscopy lymphadenectomy	010

AHRQ clinical category and 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
	38740	Remove armpit lymph nodes	090
	38745	Remove armpit lymph nodes	090
	38760	Remove groin lymph nodes	090
	38794	Access thoracic lymph duct	090
170 – Excision of skin lesion	10160	Puncture drainage of lesion	010
	11200	Removal of skin tags	010
	11400	Exc tr-ext b9+marg 0.5 < cm	010
	11401	Exc tr-ext b9+marg 0.6-1 cm	010
	11402	Exc tr-ext b9+marg 1.1-2 cm	010
	11403	Exc tr-ext b9+marg 2.1-3 cm	010
	11404	Exc tr-ext b9+marg 3.1-4 cm	010
	11406	Exc tr-ext b9+marg > 4.0 cm	010
	11420	Exc h-f-nk-sp b9+marg 0.5 <	010
	11421	Exc h-f-nk-sp b9+marg 0.6-1	010
	11422	Exc h-f-nk-sp b9+marg 1.1-2	010
	11423	Exc h-f-nk-sp b9+marg 2.1-3	010
	11424	Exc h-f-nk-sp b9+marg 3.1-4	010
	11426	Exc h-f-nk-sp b9+marg > 4 cm	010
	11440	Exc face-mm b9+marg 0.5 < cm	010
	11441	Exc face-mm b9+marg 0.6-1 cm	010
	11442	Exc face-mm b9+marg 1.1-2 cm	010
	11443	Exc face-mm b9+marg 2.1-3 cm	010
	11444	Exc face-mm b9+marg 3.1-4 cm	010
	11446	Exc face-mm b9+marg > 4 cm	010
	11450	Removal sweat gland lesion	090
	11451	Removal sweat gland lesion	090

AHRQ clinical category and description	Current Procedural Terminology (CPT®) code	Short description of CPT® code	<b>Global Surgical Package Status</b> <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>
	11462	Removal sweat gland lesion	090
	11463	Removal sweat gland lesion	090
	11470	Removal sweat gland lesion	090
	11471	Removal sweat gland lesion	090
	11600	Exc tr-ext mal+marg 0.5 < cm	010
	11601	Exc tr-ext mal+marg 0.6-1 cm	010
	11602	Exc tr-ext mal+marg 1.1-2 cm	010
	11603	Exc tr-ext mal+marg 2.1-3 cm	010
	11604	Exc tr-ext mal+marg 3.1-4 cm	010
	11606	Exc tr-ext mal+marg > 4 cm	010
	11620	Exc h-f-nk-sp mal+marg 0.5 <	010
	11621	Exc s/n/h/f/g mal+mrg 0.6-1	010
	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
	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
	11640	Exc f/e/e/n/l mal+mrg 0.5cm<	010
	11641	Exc f/e/e/n/l mal+mrg 0.6-1	010
	11642	Exc f/e/e/n/l mal+mrg 1.1-2	010
	11643	Exc f/e/e/n/l mal+mrg 2.1-3	010
	11644	Exc f/e/e/n/l mal+mrg 3.1-4	010
	11646	Exc f/e/e/n/l mal+mrg > 4 cm	010
	15931	Remove sacrum pressure sore	090
	15934	Remove sacrum pressure sore	090
	15936	Remove sacrum pressure sore	090
	15940	Remove hip pressure sore	090
	15944	Remove hip pressure sore	090

AHRQ clinical category and description	Current Procedural Terminology (CPT®) code	Short description of CPT® code	Global Surgical Package Status <i>090 = major procedure (90-day post-operative period) 010 = minor procedure (10-day post-operative period) 000 = minor procedure (0-day post-operative period)</i>
	15950	Remove thigh pressure sore	090
	15952	Remove thigh pressure sore	090
	15956	Remove thigh pressure sore	090
	17000	Destruct premalg lesion	010
	17004	Destroy premal lesions 15/>	010
	17106	Destruction of skin lesions	090
	17107	Destruction of skin lesions	090
	17108	Destruction of skin lesions	090
	17110	Destruct b9 lesion 1-14	010
	17111	Destruct lesion 15 or more	010
	17260	Destruction of skin lesions	010
	17261	Destruction of skin lesions	010
	17262	Destruction of skin lesions	010
	17263	Destruction of skin lesions	010
	17264	Destruction of skin lesions	010
	17266	Destruction of skin lesions	010
	17270	Destruction of skin lesions	010
	17271	Destruction of skin lesions	010
	17272	Destruction of skin lesions	010
	17273	Destruction of skin lesions	010
	17274	Destruction of skin lesions	010
	17276	Destruction of skin lesions	010
	17280	Destruction of skin lesions	010
	17281	Destruction of skin lesions	010
	17282	Destruction of skin lesions	010
	17283	Destruction of skin lesions	010
	17284	Destruction of skin lesions	010

AHRQ clinical category and description	Current Procedural Terminology (CPT®) code	Short description of CPT® code	<b>Global Surgical Package Status</b> <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>
	17286	Destruction of skin lesions	010
	17340	Cryotherapy of skin	010
	17360	Skin peel therapy	010
	21011	Exc face les sc < 2 cm	090
	21012	Exc face les sbq 2 cm/>	090
	21552	Exc neck les sc 3 cm/>	090
	21555	Exc neck les sc < 3 cm	090
	21931	Exc back les sc 3 cm/>	090
	22902	Exc abd les sc < 3 cm	090
	22903	Exc abd les sc 3 cm/>	090
	23071	Exc shoulder les sc 3 cm/>	090
	23075	Exc shoulder les sc < 3 cm	090
	24071	Exc arm/elbow les sc 3 cm/>	090
	24075	Exc arm/elbow les sc < 3 cm	090
	25071	Exc forearm les sc 3 cm/>	090
	25075	Exc forearm les sc < 3 cm	090
	26111	Exc hand les sc 1.5 cm/>	090
	26115	Exc hand les sc < 1.5 cm	090
	27043	Exc hip/pelvis les sc 3 cm/>	090
	27047	Exc hip/pelvis les sc < 3 cm	090
	27327	Exc thigh/knee les sc < 3 cm	090
	27337	Exc thigh/knee les sc 3 cm/>	090
	27618	Exc leg/ankle tum < 3 cm	090
	27632	Exc leg/ankle les sc 3 cm/>	090
	28039	Exc foot/toe tum sc 1.5 cm/>	090
	28043	Exc foot/toe tum sc < 1.5 cm	090
	31830	Revise windpipe scar	090

AHRQ clinical category and description	Current Procedural Terminology (CPT®) code	Short description of CPT® code	<b>Global Surgical Package Status</b> <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>
172 – Skin graft	14000	Skin tissue rearrangement	090
	14001	Skin tissue rearrangement	090
	14020	Skin tissue rearrangement	090
	14021	Skin tissue rearrangement	090
	14040	Skin tissue rearrangement	090
	14041	Skin tissue rearrangement	090
	14060	Skin tissue rearrangement	090
	14061	Skin tissue rearrangement	090
	14301	Skin tissue rearrangement	090
	14350	Skin tissue rearrangement	090
	15050	Skin pinch graft	090
	15100	Skin spl t grft trnk/arm/leg	090
	15110	Epidrm autogrft trnk/arm/leg	090
	15115	Epidrm a-grft face/nck/hf/g	090
	15120	Skn spl t a-grft fac/nck/hf/g	090
	15130	Derm autograft trnk/arm/leg	090
	15135	Derm autograft face/nck/hf/g	090
	15150	Cult skin grft t/arm/leg	090
	15155	Cult skin graft f/n/hf/g	090
	15200	Skin full graft trunk	090
	15220	Skin full graft sclp/arm/leg	090
	15240	Skin full grft face/genit/hf	090
	15260	Skin full graft een & lips	090
	15570	Form skin pedicle flap	090
	15572	Form skin pedicle flap	090
	15574	Form skin pedicle flap	090
	15576	Form skin pedicle flap	090

AHRQ clinical category and description	Current Procedural Terminology (CPT®) code	Short description of CPT® code	Global Surgical Package Status <i>090 = major procedure (90-day post-operative period) 010 = minor procedure (10-day post-operative period) 000 = minor procedure (0-day post-operative period)</i>
	15600	Skin graft	090
	15610	Skin graft	090
	15620	Skin graft	090
	15630	Skin graft	090
	15650	Transfer skin pedicle flap	090
	15731	Forehead flap w/vasc pedicle	090
	15732	Muscle-skin graft head/neck	090
	15734	Muscle-skin graft trunk	090
	15736	Muscle-skin graft arm	090
	15738	Muscle-skin graft leg	090
	15760	Composite skin graft	090
	15770	Derma-fat-fascia graft	090
	15845	Skin and muscle repair face	090
	40818	Excise oral mucosa for graft	090
174 – Other non-OR therapeutic procedures on skin and breast	10080	Drainage of pilonidal cyst	010
	10081	Drainage of pilonidal cyst	010
	10120	Remove foreign body	010
	10121	Remove foreign body	010
	11750	Removal of nail bed	010
	11752	Remove nail bed/finger tip	010
	11765	Excision of nail fold toe	010
	15792	Chemical peel nonfacial	090
	19110	Nipple exploration	090
	23330	Remove shoulder foreign body	010
175 – Other OR therapeutic procedures on skin and breast	24200	Removal of arm foreign body	010
	11760	Repair of nail bed	010
	11762	Reconstruction of nail bed	010



AHRQ clinical category and 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)
	15740	Island pedicle flap graft	090
	15782	Dermabrasion other than face	090
	15783	Dermabrasion suprfl any site	090
	15830	Exc skin abd	090
	15832	Excise excessive skin tissue	090
	15833	Excise excessive skin leg	090
	15834	Excise excessive skin hip	090
	15835	Excise excessive skin buttck	090
	15836	Excise excessive skin tissue	090
	15837	Excise excessive skin tissue	090
	15838	Excise excessive skin tissue	090
	15839	Excise excessive skin tissue	090
	26560	Repair of web finger	090
	26561	Repair of web finger	090
	26562	Repair of web finger	090
	26596	Excision constricting tissue	090
	30120	Revision of nose	090
Procedure type: Vascular			
53 – Varicose vein stripping, lower limb	37700	Revise leg vein	090
	37718	Ligate/strip short leg vein	090
	37722	Ligate/strip long leg vein	090
	37735	Removal of leg veins/lesion	090
	37760	Ligate leg veins radical	090
	37761	Ligate leg veins open	090
	37765	Stab phleb veins xtr 10-20	090
	37766	Phleb veins - extrem 20+	090
	37780	Revision of leg vein	090

AHRQ clinical category and 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)
	37785	Ligate/divide/excise vein	090
Procedure type: Wound			
168 – Incision and drainage, skin and subcutaneous tissue	10040	Acne surgery	010
	10060	Drainage of skin abscess	010
	10061	Drainage of skin abscess	010
	10140	Drainage of hematoma/fluid	010
	10180	Complex drainage wound	010
	21501	Drain neck/chest lesion	090
	26010	Drainage of finger abscess	010
	26011	Drainage of finger abscess	010
169 – Debridement of wound, infection or burn	11010	Debride skin at fx site	010
171 – Suture of skin and subcutaneous tissue	12020	Closure of split wound	010
	12021	Closure of split wound	010
	12031	Intmd wnd repair s/a/t/ext	010
	12032	Intmd wnd repair s/a/t/ext	010
	12034	Intmd wnd repair s/tr/ext	010
	12035	Intmd wnd repair s/a/t/ext	010
	12036	Intmd wnd repair s/a/t/ext	010
	12037	Intmd wnd repair s/tr/ext	010
	12041	Intmd wnd repair n-hf/genit	010
	12042	Intmd wnd repair n-hf/genit	010
	12044	Intmd wnd repair n-hf/genit	010
	12045	Intmd wnd repair n-hf/genit	010
	12046	Intmd wnd repair n-hf/genit	010
	12047	Intmd wnd repair n-hf/genit	010
	12051	Intmd wnd repair face/mm	010
	12052	Intmd wnd repair face/mm	010

AHRQ clinical category and description	Current Procedural Terminology (CPT®) code	Short description of CPT® code	<b>Global Surgical Package Status</b> <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>
	12053	Intmd wnd repair face/mm	010
	12054	Intmd wnd repair face/mm	010
	12055	Intmd wnd repair face/mm	010
	12056	Intmd wnd repair face/mm	010
	12057	Intmd rpr face/mm >30.0 cm	010
	13100	Repair of wound or lesion	010
	13101	Repair of wound or lesion	010
	13120	Repair of wound or lesion	010
	13121	Repair of wound or lesion	010
	13131	Repair of wound or lesion	010
	13132	Repair of wound or lesion	010
	13160	Late closure of wound	090
175 – Other OR therapeutic procedures on skin and breast	11770	Removal of pilonidal lesion	010
	11771	Removal of pilonidal lesion	090
	11772	Removal of pilonidal lesion	090
	15786	Abrasion lesion single	010
	20103	Explore wound extremity	010
	27086	Remove hip foreign body	010
	28190	Removal of foot foreign body	010
	30124	Removal of nose lesion	090

## 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 <sup>†</sup>	Hospital observation service, per hour

\*Identified in Medicare Part B Outpatient hospital claims.

<sup>†</sup>Denotes HCPCS Codes, all other codes are revenue center codes.

## 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 general surgery ASC procedure 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.<sup>36</sup>

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.

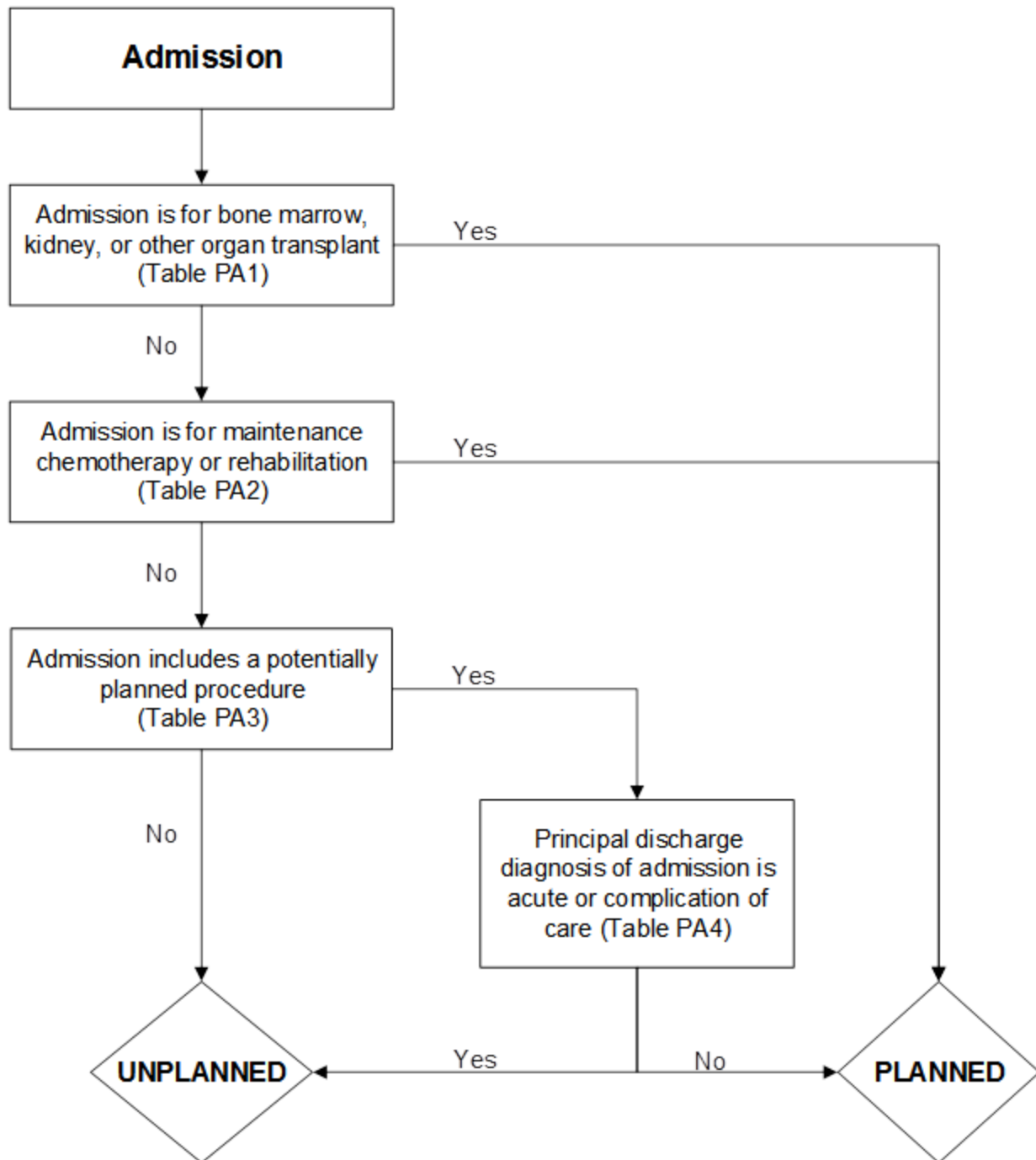
### *C2. Detailed Description of Planned Readmission Algorithm Version 4.0 – General Surgery ASC Measure*

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
<b>Procedure CCS (ICD-9 &amp; ICD-10)</b>	
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	Cholecystectomy 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
OGTG0ZZ	Resection of Left Thyroid Gland Lobe, Open Approach
OGTG4ZZ	Resection of Left Thyroid Gland Lobe, Percutaneous Endoscopic Approach
OGTH0ZZ	Resection of Right Thyroid Gland Lobe, Open Approach
OGTH4ZZ	Resection of Right Thyroid Gland Lobe, Percutaneous Endoscopic Approach
OGTK0ZZ	Resection of Thyroid Gland, Open Approach
OGTK4ZZ	Resection of Thyroid Gland, Percutaneous Endoscopic Approach
OWB60ZZ	Excision of Neck, Open Approach
OWB63ZZ	Excision of Neck, Percutaneous Approach
OWB64ZZ	Excision of Neck, Percutaneous Endoscopic Approach
OWB6XZZ	Excision of Neck, External Approach
OBW10FZ	Revision of Tracheostomy Device in Trachea, Open Approach
OBW13FZ	Revision of Tracheostomy Device in Trachea, Percutaneous Approach
OBW14FZ	Revision of Tracheostomy Device in Trachea, Percutaneous Endoscopic Approach
OWB6XZ2	Excision of Neck, Stoma, External Approach
OWQ6XZ2	Repair Neck, Stoma, External Approach
OB5N0ZZ	Destruction of Right Pleura, Open Approach
OB5N3ZZ	Destruction of Right Pleura, Percutaneous Approach
OB5N4ZZ	Destruction of Right Pleura, Percutaneous Endoscopic Approach
OB5P0ZZ	Destruction of Left Pleura, Open Approach
OB5P3ZZ	Destruction of Left Pleura, Percutaneous Approach
OB5P4ZZ	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
<b>Diagnosis CCS (ICD-9 &amp; ICD-10)</b>	
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
<b>Acute ICD-9 codes within Diagnosis CCS 97: Peri-; endo-; and myocarditis; cardiomyopathy</b>	
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
<b>Acute ICD-10 codes within Diagnosis CCS 97: Peri-; endo-; and myocarditis; cardiomyopathy</b>	
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
<b>Acute ICD-9 codes within Diagnosis CCS 105: Conduction disorders</b>	
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
<b>Acute ICD-10 codes within Diagnosis CCS 105: Conduction disorders</b>	
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
<b>Acute ICD-9 codes within Diagnosis CCS 106: Dysrhythmia</b>	
4272	Paroxysmal tachycardia NOS
7850	Tachycardia NOS
42789	Cardiac dysrhythmias NEC
4279	Cardiac dysrhythmia NOS
42769	Premature beats NEC
<b>Acute ICD-10 codes within Diagnosis CCS 106: Dysrhythmia</b>	
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
<b>Acute ICD-9 codes within Diagnosis CCS 108: Congestive heart failure; non-hypertensive</b>	
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
<b>Acute ICD-10 codes within Diagnosis CCS 108: Congestive heart failure; non-hypertensive</b>	
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
<b>Acute ICD-9 codes within Diagnosis CCS 149: Biliary tract disease</b>	
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
<b>Acute ICD-10 codes within Diagnosis CCS 149: Biliary tract disease</b>	
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
<b>Acute ICD-9 codes with Diagnosis CCS 152: Pancreatic disorders</b>	
5770	Acute Pancreatitis
<b>Acute ICD-10 codes with Diagnosis CCS 152: Pancreatic disorders</b>	
K859	Acute pancreatitis, unspecified

## Appendix D: Measure Score Calculation and Reporting

We fit a hierarchical generalized linear model (HGLM), which accounts for the clustering of observations within ASCs. We assume the outcome is a known exponential family distribution and relates linearly to the covariates via a known link function,  $h$ . For our model, we assumed a binomial distribution and a logit link function. Further, we accounted for the clustering within ASCs by estimating a facility-specific effect,  $\alpha_i$ , which we assume follows a normal distribution with mean  $\mu$  and variance  $\tau^2$ , the between-facility variance component. The following equations define the HGLM:

$$(1) h(\Pr(Y_{ij} = 1 | \mathbf{Z}_{ij}, \omega_i)) = \log\left(\frac{\Pr(Y_{ij}=1|\mathbf{Z}_{ij},\omega_i)}{1-\Pr(Y_{ij}=1|\mathbf{Z}_{ij},\omega_i)}\right) = \alpha_i + \boldsymbol{\beta}\mathbf{Z}_{ij}$$

$$\text{where } \alpha_i = \mu + \omega_i; \omega_i \sim N(0, \tau^2)$$

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

Where  $Y_{ij}$  denotes the outcome (equal to 1 if patient has one or more qualifying hospital visits within 7 days, 0 otherwise) for the  $j$ -th patient who had a general surgery 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,  $\alpha_i$ , defined above, comprises  $\mu$ , the adjusted average intercept over all ASCs in the sample, and  $\omega_i$ , the facility specific intercept deviation from  $\mu$ . A point estimate of  $\omega_i$ , greater or less than 0, determines whether ASC performance is worse or better compared to the adjusted average outcome.

We estimate the HGLM using the SAS software system (GLIMMIX procedure).

### D1. Risk-Standardized Measure Score Calculation

Using the HGLM defined by Equation (1), we obtain the parameters  $\hat{\mu}$ ,  $\{\hat{\alpha}_1, \hat{\alpha}_2, \dots, \hat{\alpha}_I\}$ ,

$\hat{\boldsymbol{\beta}}$ , and  $\hat{\tau}^2$ . We calculate a risk-standardized ratio  $s_i$  for each ASC by computing the ratio of the number of predicted hospital visits to the number of expected hospital visits. Specifically, we calculate:

$$(1) \text{ Predicted Value: } \hat{Y}_{ij} = h^{-1}(\hat{\alpha}_i + \hat{\boldsymbol{\beta}}\mathbf{Z}_{ij}) = \frac{\exp(\hat{\alpha}_i + \hat{\boldsymbol{\beta}}\mathbf{Z}_{ij})}{\exp(\hat{\alpha}_i + \hat{\boldsymbol{\beta}}\mathbf{Z}_{ij}) + 1}$$

$$(2) \text{ Expected Value: } \hat{e}_{ij} = h^{-1}(\hat{\mu} + \hat{\boldsymbol{\beta}}\mathbf{Z}_{ij}) = \frac{\exp(\hat{\mu} + \hat{\boldsymbol{\beta}}\mathbf{Z}_{ij})}{\exp(\hat{\mu} + \hat{\boldsymbol{\beta}}\mathbf{Z}_{ij}) + 1}$$

$$(3) \hat{s}_i = \frac{\sum_{j=1}^{n_i} \hat{y}_{ij}}{\sum_{j=1}^{n_i} \hat{e}_{ij}}$$

If the “predicted” number of hospital visits is higher (lower) than the “expected” number of hospital visits, then that ASCs  $\hat{s}_i$  will be higher (lower) than 1.

## D2. Outlier Evaluation

Because the measure score is a complex function of parameter estimates, we use re-sampling and simulation techniques to derive an interval estimate to determine if an ASC is performing better than, worse than, or no different than expected. An ASC is considered as better than expected if their entire confidence interval falls below 1, and considered worse if the entire confidence interval falls above 1. They are considered no different if the confidence interval overlaps 1.

More specifically, we use a bootstrapping procedures to compute confidence intervals. Because the theoretical-based standard errors are not easily derived, and to avoid making unnecessary assumptions, we use the bootstrap to empirically construct the sampling distribution for each facility level risk-standardized ratio. The bootstrapping algorithm is described below.

## D3. Bootstrapping Algorithm

Let  $I$  denote the total number of facilities in the sample. We repeat steps 1 – 4 below for  $b = 1, 2, \dots, B$  times:

1. Sample  $I$  facilities with replacement.
2. Fit the hierarchical logistic regression model using all patients within each sampled facility. We use as starting values the parameter estimates obtained by fitting the model to all facilities. If some facilities are selected more than once in a bootstrapped sample, we treat them as distinct so that we have  $I$  random effects to estimate the variance components. At the conclusion of Step 2, we have:
  - a.  $\hat{\beta}^{(b)}$  (the estimated regression coefficients of the risk factors).
  - b. The parameters governing the random effects, facility adjusted outcomes, distribution  $\hat{\mu}^{(b)}$  and  $\hat{\tau}^{2(b)}$ .
  - c. The set of facility-specific intercepts and corresponding variances,  $\{\hat{\alpha}_i^{(b)}, \hat{v}\hat{\alpha}_i^{(b)}; i = 1, 2, \dots, I\}$
3. We generate a facility random effect by sampling from the distribution of the facility-specific distribution obtained in Step 2c. We approximate the distribution for each random effect by a normal distribution. Thus, we draw  $\alpha_i^{(b*)} \sim N(\hat{\alpha}_i^{(b)}, \hat{v}\hat{\alpha}_i^{(b)})$  for the unique set of facilities sampled in Step 1.

4. Within each unique facility  $i$  sampled in Step 1, and for each case  $j$  in that facility, we calculate  $\hat{y}_{ij}^{(b)}$ ,  $\hat{e}_{ij}^{(b)}$ , and  $\hat{s}_i^{(b)}$  where  $\hat{\beta}^{(b)}$  and  $\hat{\mu}^{(b)}$  are obtained from Step 2 and  $\alpha_i^{(b*)}$  is obtained from Step 3.

Ninety-five percent interval estimates (or alternative interval estimates) for the facility-standardized outcome can be computed by identifying the 2.5<sup>th</sup> and 97.5<sup>th</sup> percentiles of randomly half of the B estimates (or the percentiles corresponding to the alternative desired intervals).



## 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 $\geq 3$
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, 4, 5, 6, 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, 41, 42
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, 52, 53

Patient demographic, comorbidity, and procedural complexity candidate variables for risk adjustment	
Variable category	Definition
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
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)

Patient demographic, comorbidity, and procedural complexity candidate variables for risk adjustment	
Variable category	Definition
Sleep apnea	ICD-9-CM codes 78051, 78057, 3272, 32720, 32721, 32723, 32727, 32729; ICD-10-CM codes: G4730, G4731, G4733, G4737, G4739
Other ear, nose, and throat (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
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

Patient demographic, comorbidity, and procedural complexity candidate variables for risk adjustment	
Variable category	Definition
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