

# **2016 Measure Updates and Specifications Report**

## **Hospital Visits after Hospital Outpatient Surgery Measure**

### **(Risk-Standardized Hospital Visits within 7 Days After Hospital Outpatient Surgery Measure)**

**Version 1.1**

**Submitted by:**

Yale New Haven Health Services Corporation – Center for Outcomes Research and Evaluation  
(YNHHSC/CORE)

**Prepared for:**

Centers for Medicare & Medicaid Services (CMS)

**June 2016**

## **Surgery Measure Specifications Report Overview**

This report describes the Centers for Medicare & Medicaid Services' (CMS's) Hospital Visits after Hospital Outpatient Surgery measure. Please note that the Hospital Visits after Hospital Outpatient Surgery Measure is the original measure title. In CMS rulemaking documentation, the measure is referred to as the Risk-Standardized Hospital Visits within 7 Days after Hospital Outpatient Surgery Measure.

Part 1 of this report is the original technical report for the surgery measure completed in September 2014 and submitted to the National Quality Forum (NQF) with the NQF endorsement application. NQF subsequently endorsed the measure in December 2015.

Part 2 of this report is an addendum to the original report that presents CMS's updates to the measure since NQF endorsement and provides the measure specifications for the updated version of the measure, Version 1.1. Readers who are looking for the current measure specifications can skip directly to the Addendum, Part 2, Section 4 of this document.

**Hospital Visits after Hospital Outpatient Surgery:  
Measure Technical Report**

**Submitted by:**

Yale New Haven Health Services Corporation – Center for Outcomes Research and  
Evaluation (CORE)

**Prepared for:**

Centers for Medicare & Medicaid Services (CMS)

**September 29, 2014**

# Table of Contents

Table of Contents .....	2
List of Tables .....	4
List of Figures .....	4
Yale New Haven Health Services Corporation – Center for Outcomes Research and Evaluation (CORE) Project Team .....	5
Acknowledgements.....	6
1. Executive Summary.....	9
1.1. Rationale for Assessing Hospital Visits after Outpatient Surgery .....	9
1.2. Measure Development.....	9
1.3. Measure Specifications .....	10
1.4. Measure Testing and Results .....	10
1.5. Summary .....	11
2. Introduction .....	12
3. Methods.....	14
3.1. Measure Development Process .....	14
3.2. Data Sources.....	14
3.3. Study Cohort.....	15
3.3.1. Inclusion Criteria .....	15
3.3.2. Exclusion Criteria.....	18
3.4. Outcome.....	18
3.4.1. Outcome Timeframe.....	20
3.4.2. Removal of Planned Admissions from the Outcome.....	20
3.5. Model Development .....	20
3.5.1. Overview .....	20
3.5.2. Candidate Variables for Patient-Level Risk Adjustment .....	21
3.5.3. Final Variable Selection.....	22
3.5.4. Model Performance .....	22
3.5.5. Model Validation.....	22
3.5.6. Calculation of Facility-Level Measure Score .....	23
3.5.7. Facility-Level Measure Score Reliability Testing.....	23
3.5.8. Facility-Level Measure Score Disparities Testing.....	23
3.5.9. Face Validity Testing .....	24
3.5.10. Statistical Software .....	24

4.	Results .....	25
4.1.	Development and Validation Samples .....	25
4.2.	Patient-Level Risk-Adjustment Model .....	25
4.2.1.	Candidate and Final Variables .....	25
4.2.2.	Model Performance .....	25
4.2.3.	Model Validation.....	26
4.3.	Facility-Level Measure Score.....	26
4.3.1.	Facility-Measure Score Variation .....	26
4.3.2.	Facility-Measure Score Reliability Testing .....	26
4.3.3.	Facility-Measure Score Disparities Testing .....	26
4.3.4.	Face Validity Testing .....	27
5.	Summary .....	28
6.	References .....	29
7.	Tables and Figures.....	31
8.	Appendices.....	45
	Appendix A: List of Included CPT Procedure Codes Defining Cystoscopy with Intervention...	46
	Appendix B: ED Visits and Observation Stays Definition .....	49
	Appendix C: Surgery Measure Planned Admission Algorithm .....	50
	Appendix D: Measure Score Calculation and Reporting.....	61
	Appendix E: Risk-Adjustment Model Development .....	64
	Appendix F: Top Surgeries per Body System and Top Discharge Diagnoses for Hospital Visits by Body System.....	68

## List of Tables

Table 1. Frequency of Risk Model Variables in the Medicare Development and Validation Datasets.....	31
Table 2. Crude HOPD Unplanned Hospital Visit Rate, Overall and by Body System .....	33
Table 3. Top Hospital Visit Diagnoses Following HOPD Same-Day Surgery .....	34
Table 4. Model Parameter Estimates and Odds Ratios in the Medicare Development and Validation Samples.....	35
Table 5. Risk-Adjustment Model Performance Summaries in the Medicare Development and Validation Samples.....	37
Table 6. Validation of the Measure’s Risk-Adjustment Model against Generic Claims-Based Comorbidity Indices .....	37

## List of Figures

Figure 1. Timing of Unplanned Hospital Visits Following Same-Day Surgery at HOPDs (Event Rate per Day Post-discharge for 0-30 Day Period).....	38
Figure 2. Timing of Unplanned Hospital Visits Following Same-Day Surgery at HOPDs by Body System (Event Rate per Day Post-discharge for 0-30 Day Period) .....	38
Figure 3. Calibration Plot of Predicted versus Observed Outcomes across Deciles of Patient Risk in the 2010 Development Split Sample .....	39
Figure 4. Calibration Plot of Predicted versus Observed Outcomes across Deciles of Patient Risk in the 2010 Validation Split Sample .....	39
Figure 5. Calibration Plot of Predicted versus Observed Outcomes across Deciles of Patient Risk in the 2011 Validation Sample .....	40
Figure 6. Distribution of RSHVRs Following Same-Day Surgery at HOPDs .....	41
Figure 7. Plot of HOPD Measure Score (RSHVRs) with and without Adjustment for Medicaid Dual Eligibility Status .....	42
Figure 8. Plot of HOPD Measure Score (RSHVRs) with and without Adjustment for the African-American Race .....	42
Figure 9. Boxplots of RSHVRs Comparing HOPDs with Varying Proportions of Dual-Eligible (Low SES) Patients (Quartile 1: HOPDs with Few Dual-Eligible Patients; Quartile 4: HOPDs with Many Dual-Eligible Patients).....	43
Figure 10. Boxplots of RSHVRs Comparing HOPDs with Varying Proportions of African-American Patients (Quartile 1: HOPDs with Few African-American Patients; Quartile 4: HOPDs with many African-American Patients) .....	44

## **Yale New Haven Health Services Corporation – Center for Outcomes Research and Evaluation (CORE) Project Team**

<b>Isuru Ranasinghe</b> , MBChB, MMed, PhD	Project Lead, CORE
<b>Craig S. Parzynski</b> , MS	Lead Analyst, CORE
<b>Rana Searfoss</b> , BA	Research Associate, CORE
<b>Julia Montague</b> , MPH	Research Project Coordinator II, CORE
<b>Zhenqiu Lin</b> , PhD	Supporting Analyst, CORE
<b>Kanchana Bhat</b> , MPH	Senior Project Manager, CORE
<b>Tasce Bongiovanni</b> , MD, MPP	Clinical Investigator, CORE
<b>Joseph S. Ross</b> , MD, MHS	Clinical Investigator, CORE
<b>Susannah Bernheim</b> , MD, MHS	Director of CMS Projects; Clinical Investigator, CORE
<b>Harlan M. Krumholz</b> , MD, SM	Director, CORE
<b>Elizabeth Drye</b> , MD, SM	Project Director, CORE

## Acknowledgements

This work is a collaborative effort, and the authors gratefully acknowledge and thank the ongoing support of the project’s surgical consultants and the participants of the project’s national technical expert panel (TEP). These individuals provided guidance on key clinical and methodological decisions. In addition, the authors would like to acknowledge and thank staff of the Centers for Medicare & Medicaid Services (CMS) and others for their contribution to this work. These individuals are listed below:

### ***Surgical Consultants***

Kevin Bozic, MD, MBA	William R. Murray Professor, M.D. Endowed Chair in Orthopaedic Surgery, and Professor and Vice Chair of the Department of Orthopaedic Surgery; University of California, San Francisco
Simon Kim, MD, MPH	Assistant Professor, Urological Institute, University Hospitals Case Medical Center; Center for Outcomes and Public Policy Effectiveness Research (COPPER) Center, Yale University
Sharon Sutherland, MD, MPH	Clinical Assistant Professor of Surgery, Case Western Reserve University Cleveland Clinic Lerner College of Medicine; Quality Improvement Officer, Cleveland Clinic

### ***TEP Members***

Name	Organization (Title)	Location
David Chang, PhD, MPH, MBA	Massachusetts General Hospital (Associate Professor of Surgery, Department of Surgery; Director of Healthcare Research and Policy Development, Codman Center for Clinical Effectiveness in Surgery)	Boston, MA
Gary Culbertson, MD	Iris Surgery Center (Plastic Surgeon; Medical Director)	Sumter, SC
Martha Deed, PhD	Member of the Public	North Tonawanda, NY
Richard Dutton, MD, MBA	Anesthesia Quality Institute (Executive Director)	Park Ridge, IL
Nestor Esnaola, MD, MPH, MBA	Temple University School of Medicine (Professor of Surgery; Chief, Surgical Oncology)	Philadelphia, PA

Charles Goldfarb, MD	Washington University School of Medicine (Associate Professor of Orthopaedic Surgery)	St Louis, MO
Lisa Ishii, MD, MHS	Johns Hopkins School of Medicine (Associate Professor, Department of Otolaryngology-Head & Neck Surgery)	Baltimore, MD
Sandra Koch, MD	Carson Medical Group (OB/GYN surgery)	Carson City, NV
Tricia Meyer, PharmD, MS	Scott & White Memorial Hospital (Associate Vice-President, Department of Pharmacy); Texas A&M University College of Medicine (Associate Professor, Department of Anesthesiology); Texas A&M Rangel College of Pharmacy (Adjunct Associate Professor, Department of Anesthesiology)	Temple, TX
Linda Radach, BA	Member of the Public	Lake Forest Park, WA
Danny Robinette, MD	Surgery Center of Fairbanks (General Surgeon; Medical Director)	Fairbanks, AK
Suketu Sanghvi, MD	The Permanente Medical Group, Kaiser Permanente (Ophthalmologist; Associate Executive Director)	Oakland, CA
Christopher Tessier, MD	Manchester Urology Associates (Urologist)	Manchester, NH
Thomas Tsai, MD, MPH	Brigham and Women's Hospital (General Surgery Resident; Administrative Chief Resident for Research); Harvard School of Public Health (Postdoctoral Fellow, Department of Health Policy and Management)	Boston, MA
Katherine Wilson, RN, MHA	AmSurg Corp (Vice President, Quality)	Nashville, TN

### ***CMS Staff***

Sungsoo Oh, MS	Government Task Leader, CMS
Felicia Diggs, RN, BSN, MSN	Nurse Consultant, Quality Measurement and Health Assessment Group, CMS
Daniel Duvall, MD	Medical Officer, Hospital and Ambulatory Policy Group, CMS

Marc Hartstein, MPP                      Group Director, Hospital and Ambulatory Policy Group, CMS

Vinitha Meyyur, PhD                      Social Science Research Analyst, Quality Measurement and  
Health Assessment Group, CMS

Kate Goodrich, MD, MHS                      Director, Quality Measurement and Health Assessment Group,  
CMS

***Statistical Consultant***

Sharon-Lise Normand, MSc,                      Professor of Biostatistics, Department of Health Care  
PhD    Policy, Harvard University

# 1. Executive Summary

This report presents the development, testing, and final specifications of a measure of unplanned hospital visits following same-day surgery at hospital outpatient departments (HOPDs). The measure is designed to assess the quality of surgeries performed at HOPDs using a risk-adjusted outcome of post-surgical hospital visits (inpatient admissions directly after surgery and return visits to the hospital within 7 days after discharge home). Yale New Haven Health Services Corporation – Center for Outcomes Research and Evaluation (CORE) developed the measure for the Centers for Medicare & Medicaid Services (CMS) under a contract supporting the development of ambulatory care outcome measures. This facility-level measure will inform patient choice and help providers and HOPDs improve quality of care.

## 1.1. Rationale for Assessing Hospital Visits after Outpatient Surgery

Outpatient same-day surgery is exceedingly common in the United States (US). Nearly 70% of all surgeries in the US are now performed in the outpatient setting with most performed as same-day surgeries at HOPDs.<sup>1</sup> While most outpatient surgery is safe, there are well-described and potentially preventable adverse events that occur after outpatient surgery, such as uncontrolled pain, urinary retention, infection, bleeding, and venous thromboembolism, which can result in unanticipated hospital visits. Similarly, direct admissions after surgery that are primarily caused by non-clinical patient considerations, such as lack of transport home upon discharge, or facility logical issues, such as delayed start of surgery, are common causes of unanticipated yet preventable hospital admissions following same-day surgery.

Hospital utilization following same-day surgery is an important and accepted patient-centered outcome reported in the literature. National estimates of hospital visit rates following 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> Furthermore, hospital visit rates vary among HOPDs,<sup>7</sup> suggesting variation in surgical and discharge care quality. However, providers (HOPDs and surgeons) are often unaware of their patients' hospital visits after surgery since patients often present to the ED or to different hospitals.<sup>10</sup> Therefore, a quality measure of hospital visits following outpatient same-day surgery can improve transparency, inform patients and providers, and foster quality improvement.

## 1.2. Measure Development

CORE developed the measure consistent with CMS's measure development guidance. We assembled a multidisciplinary team of clinicians, health services researchers, and statisticians.

CORE also convened, through a public process, a national technical expert panel (TEP) consisting of patients, surgeons, methodologists, researchers, and providers. We also held a public comment period soliciting stakeholder input on the measure methodology.

### **1.3. Measure Specifications**

In brief, the measure includes Medicare fee-for-service (FFS) patients aged 65 years and older undergoing same-day surgery (except eye surgeries) in HOPDs. The measure outcome is any of the following hospital visits: 1) an inpatient admission directly after the surgery or 2) an unplanned hospital visit (inpatient admission, observation stay, or ED visit) occurring after discharge and within 7 days of the surgery.

The measure score is a ratio of the predicted to expected number of post-surgical hospital visits among the HOPD's patients. It is analogous to an observed/expected ratio, but accounts for the clustering of patients within HOPDs and sample size variation across HOPDs. The denominator is the expected number of hospital visits given the HOPD's case mix and surgical procedure mix. The numerator is the number of hospital visits predicted for the HOPD's patients accounting for its observed rate, the number of surgeries performed at the HOPD, the case mix, and the surgical procedure mix. A ratio of less than one indicates the HOPD's patients were estimated as having fewer post-surgical visits than expected compared to HOPDs with similar surgical procedures and patients, and a ratio of greater than one indicates the HOPD's patients were estimated as having more visits than expected.

To calculate a facility-specific, post-surgical risk-standardized hospital visit ratio (RSHVR) for outpatient surgery patients, the measure uses hierarchical logistic regression to model the log-odds of the outcome as a function of the patient demographic and clinical characteristics, surgical procedure, and a random facility-specific intercept. This strategy accounts for within-facility correlation of the observed outcome, and it accommodates the assumption that underlying differences in quality across HOPDs lead to systematic difference in outcomes. For fairness, the model adjusts for demographic and clinical characteristics and procedural variables that vary across patient populations, are unrelated to quality, and influence the outcome in order to help ensure differences in the measure score do not reflect differences in case mix and surgical procedure mix across HOPDs.

### **1.4. Measure Testing and Results**

We tested the final measure specifications against the National Quality Forum's (NQF's) criteria for scientific soundness and importance, including evaluating the measure score variation. Using a 20% sample of Medicare data from 2010, the national observed rate of hospital visits following same-day surgery at HOPDs was 10.0%. The facility-level RSHVR showed significant

variation. Using bootstrapping techniques, we constructed 95% interval estimates (similar to confidence intervals) and used the estimates to place HOPDs into three performance categories: worse than expected, no different than expected, and better than expected. Based on this technique we categorized 80 HOPDs as worse than expected, 4,119 as no different than expected, and 35 as better than expected.

## **1.5. Summary**

In summary, this report describes the final measure specifications for a risk-standardized measure of unplanned hospital visits within 7 days to assess same-day HOPD surgery quality at the facility level. Stakeholder and expert input informed measure development throughout. The measure is scientifically sound and reveals important variation across HOPDs. The intent of this measure is to illuminate variation in quality of care across HOPDs for same-day surgeries, inform patient choice, and drive quality improvement.

## 2. Introduction

National efforts to measure and improve the quality of outpatient surgery are essential given increasing delivery of general surgeries in outpatient facilities. Due to advances in surgical and anesthetic techniques, nearly 70% of all surgical procedures in the US are now performed in the outpatient setting,<sup>1</sup> with many of these performed at HOPDs as same-day surgeries.<sup>11</sup> Same-day surgery offers significant patient benefits as compared with inpatient surgery, including shorter waiting times, avoidance of hospitalizations, and rapid return home.<sup>12</sup> Furthermore, same-day surgery costs significantly less than an equivalent inpatient surgery and therefore presents a significant cost saving opportunity to the health system.<sup>12</sup> With the ongoing shift towards outpatient surgery, assessing the quality of surgical care provided by HOPDs has become increasingly important.

Unanticipated hospital visits following same-day surgery reflect quality of care. A hospital visit following same-day surgery is an unexpected and potentially preventable outcome for patients who have a low anticipated risk. In the literature reported, hospital visit rates following 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.<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 such as uncontrolled pain, nausea, and vomiting that may result in unplanned hospitalization following surgery. Furthermore, admissions for primarily non-clinical reasons, such as lack of transport home, and admissions for logistical issues, such as delayed start of surgery, are common causes of unanticipated and potentially avoidable hospital admissions following same-day surgery.

Several factors make hospital visits a priority quality indicator. Many providers are unaware of the post-surgical hospital visits that occur since patients often present to the ED or to different hospitals. Reporting this outcome will illuminate problems that may not currently be visible. In addition, hospital visits is a broad, patient-centered outcome that reflects the full range of reasons leading to hospitalization among patients undergoing same-day surgery. Furthermore, hospital visit rates vary among HOPDs, suggesting variation in surgical care quality among HOPDs.<sup>7</sup>

In this report, we outline the final specifications for a quality measure of risk-adjusted unplanned hospital visits following same-day surgery at HOPDs. This measure uses nationwide Medicare claims data from Medicare FFS patients aged 65 years and older to allow reporting of performance for all HOPDs in the US. Currently, there are no publicly available quality reports of providers or HOPDs that perform same-day surgery at HOPDs. Thus, this measure addresses

an important quality measurement gap and there is an opportunity to enhance the information available to patients choosing among HOPDs that provide outpatient same-day surgery. Further, providing outcome rates to HOPDs will make visible to clinicians meaningful quality differences and incentivize improvement.

## 3. Methods

### 3.1. Measure Development Process

CORE led the development of the measure under the guidance of CMS. The CORE team consisted of a multidisciplinary team of clinicians, health services researchers, and statisticians with expertise in outcome measure development. CORE obtained clinical input from three surgical consultants during development. CORE also convened, through a public process, a national TEP consisting of patients, expert clinicians, methodologists, researchers, and providers to provide input on the measure methodology. Additionally, CORE held a public comment period soliciting stakeholder input on the measure methodology.

### 3.2. Data Sources

Consistent with scientific consensus standards for publicly reported outcomes measures,<sup>13-15</sup> we sought to define a clinically coherent group of patients for inclusion in the measure, adjust for case mix and surgical procedure mix differences across providers, and accurately attribute outcomes to HOPDs. These considerations informed our definition of the measure cohort and selection of data sources used for measure development. Data sources must have the ability to link patient data across care settings to identify appropriate surgical procedures for inclusion, comorbidities for risk adjustment, and the outcome of hospital visits. We therefore used claims data, as it supports these linkages and is available for all enrolled Medicare FFS patients.

To develop and test the patient-level model, CORE used 2009-2011 claims data from the Medicare Inpatient, Outpatient, and Carrier (Part B Physician) Standard Analytical Files (SAF). We identified outpatient surgical procedures using Medicare 20% FFS sample of beneficiaries' claims from the Carrier SAF which consists of physician claims from HOPDs. We linked physician claims for surgical procedures performed at HOPDs to the corresponding HOPD facility claim in the Medicare 100% Outpatient SAF in order to obtain a HOPD facility identifier. We identified the outcomes of ED visits and observation stays after outpatient surgery from the 100% hospital Outpatient SAF and inpatient hospital admissions from the 100% Medicare Provider Analysis and Review (MedPAR) file. The measure cohort included patients with outpatient same-day surgery in 2010, and we used inpatient and outpatient data from 2009 to derive comorbidities for risk adjustment for these patients.

For measure development and testing, we randomly split the 2010 data into Development and Validation Split Samples (each sample including approximately 50% of outpatient surgeries contained in the 2010 data). For patients in these samples, we used data from 2009 to derive comorbidities for risk adjustment. We derived a cohort of same-day surgeries in 2011 for

temporal validation of the model (2011 Validation Sample), using 2010 data for risk adjustment. We used a combined 2009-2011 20% sample to test the measure score reliability.

### **3.3. Study Cohort**

The target population for this measure is Medicare FFS patients aged 65 years and older undergoing outpatient same-day surgery at HOPDs. We chose the Medicare FFS population because of the availability of a national dataset (Medicare claims) that could be used to develop, test, and publicly report the measure. We define the target population based on the following inclusion and exclusion criteria.

#### *3.3.1. Inclusion Criteria*

- We include outpatient surgeries performed at HOPDs.

Rationale: The measure is a facility-level measure of HOPDs.

Details: Operationally, we include surgeries where a claim is present in the Medicare outpatient data indicating an HOPD surgical procedure. We identify physician claims identified as Outpatient Hospital Department/or Physician Office by the Line Place of Service Code in the Part B Carrier SAF. We then link these claims to Outpatient SAF claims to identify the HOPD where the surgery took place.

The Medicare 3-day payment window policy affects some surgeries performed at HOPDs. The policy deems outpatient services (including surgical procedures) provided by a hospital or any Part B entity wholly owned or operated by a hospital (such as an HOPD) in the three calendar days preceding the date of a beneficiary's inpatient admission as related to the admission. For outpatient surgical procedures affected, the HOPD facility claim (for the technical portion of the surgical procedure) is bundled with the inpatient claim and is not recorded in the Medicare Outpatient SAF; the Medicare Physician claim for professional services rendered is still submitted separately.

To ensure the capture of HOPD surgical procedures potentially affected by the policy, we identify in the Medicare Carrier SAF physician claims for surgery in the HOPD setting with an inpatient admission within three days and lacking a corresponding HOPD facility claim. We then attribute the surgery identified as affected by this policy to the appropriate HOPD using the facility provider ID from the inpatient claim.

Surgeries for which an outpatient claim is not filed are not included in the measure cohort.

- We only include surgery that can be performed as same-day surgery.

Rationale: This approach identifies a clinically coherent group of low- to moderate-risk surgeries that can be safely performed as same-day surgeries and do not typically require an overnight stay or an inpatient admission.

Details: Operationally, we limit inclusion of HOPD surgeries to those on Medicare's list of covered ambulatory surgery center (ASC) procedures for 2013 (with the exception of eye surgeries). Medicare developed this list for ASCs to identify surgeries that can be safely-performed as same-day surgeries and do not typically require an overnight stay. This list of surgeries is publicly available at: <http://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/ASCPayment/ASC-Regulations-and-Notices-Items/CMS-1589-FC.html> (see 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.

Although Medicare developed this list of surgeries for ASCs, we use it for this HOPD measure for two reasons. First, it aligns with our target cohort of surgeries that have a low to moderate risk profile and are safe to be performed as same-day surgeries. By only including surgeries on this list in the measure, we effectively do not include surgeries performed at HOPDs that typically require an overnight stay which are more complex, higher risk surgeries. Second, we use this list of surgeries for practical considerations. The ASC list is publicly available, is annually reviewed and updated by Medicare, and includes a transparent public comment submission and review process for addition and/or removal of procedures codes. Using an existing, defined list of same-day surgical procedures, rather than defining surgical procedures de novo, is useful for long-term measure maintenance. Procedures listed in Medicare's list of covered ASC procedures are defined using Healthcare Common Procedure Coding System (HCPCS) and Common Procedural Terminology (CPT) codes.

- We include substantive surgeries performed at HOPDs with the exception of eye surgery.

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

Details: Operationally, we identify substantive surgical procedures using the global surgery indicator (GSI) value 090 which identifies surgical procedures of greater

complexity and follow-up care based on Relative Value Units (RVUs). We do not include minor non-surgical procedures (GSI code 000) or minor surgeries (GSI code 010).

The measure does not include eye surgery. Although eye surgery is considered a substantive (GSI 090) surgery, its risk profile is more representative of ‘minor’ surgery, in that it is characterized by high volume and a low outcome rate. Specifically, our preliminary analysis showed that all eye surgeries had a very low outcome rate (1.3% at 7 days), with no temporal elevation in risk of hospital visits post-surgery. This suggests hospital visits are not a good measure of the quality of eye surgery. Furthermore, eye surgery is a very high volume surgical procedure (38% of all surgeries based on our preliminary cohort criteria). Our concern is that the extremely high volume and very low outcome rate may diminish our ability to distinguish any quality signal from other surgeries. Therefore, we do not include eye surgery in the measure cohort.

- We include cystoscopy with intervention.

Rationale: All endoscopy procedures are considered non-surgical procedures based on Medicare coding (GSI code 000) and are not included in the measure cohort. However, we include cystoscopy with intervention because it is a common procedure, often performed for therapeutic intervention by surgical teams, and our preliminary analysis indicated an outcome rate and causes of hospital visits post-procedure similar to other surgeries in the measure cohort.

Details: Operationally, we define cystoscopy with intervention using the procedure codes indicated in Appendix A. We only consider cystoscopy with therapeutic intervention and do not include cystoscopy alone or cystoscopy with biopsy alone in the measure cohort.

We do not include other endoscopy procedures in the measure cohort. These endoscopy procedures such as colonoscopy are lower risk procedures often with a high volume and a low outcome rate (much like minor surgeries), are often diagnostic procedures (rather than therapeutic), are not typically performed by surgical teams, and do not require an operating room.

- Where multiple procedures occur concurrently, we only include surgeries that are performed concurrently with another low to moderate risk procedure.

Rationale: Occasionally more than one surgery may be performed and some of these surgeries may be higher risk procedures.

Details: Operationally, when multiple codes occur, we only include surgeries that are performed concurrently with other surgeries and procedure listed on Medicare’s list of covered ASC procedures. We do not include same-day surgeries performed concurrently with a higher risk procedure such as an inpatient-only surgery.

- We include surgeries for 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 all claims available for identifying comorbidities for risk adjustment.

### 3.3.2. Exclusion Criteria

- We exclude surgeries for patients without continuous enrollment in Medicare FFS Parts A and B in the one month after the surgery.

Rationale: We exclude these patients to ensure all patients have full data available for outcome assessment.

## 3.4. Outcome

We define the outcome as any (i.e., one or more) hospital visit within 7 days of an outpatient surgery. We focus on the outcome of hospital visits 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. Because some hospital visits (i.e., admissions directly after surgery and post-discharge visits) after surgery are medically indicated, we do not expect the hospital visit rate to be zero. The goal is to measure and illuminate variation in risk-adjusted hospital visits following surgery for quality improvement.

We define a hospital visit as 1) an inpatient admission directly after surgery or 2) any ED visit, observation stay, or unplanned inpatient admission occurring after discharge from the HOPD. Admissions and return visits are well described and recognized indicators of quality in outpatient same-day surgery. We outline below a more specific rationale for each component of the outcome.

- Inpatient admissions directly following surgery

Rationale: The literature suggests 1.3-13.6% of outpatient surgeries at HOPDs result in an inpatient admission with the admission rate varying by type of surgery and HOPD case mix.<sup>3,7-9,16-26</sup> Of these admissions, 40-60% are reported to be due to adverse effects of the surgery, anesthesia, or due to other suspected medical problems such as chest

pain.<sup>3,7-9,16-26</sup> A smaller proportion of admissions are due to non-clinical reasons such as lack of transport home or logistical issues such as delayed start of surgery.<sup>3,7-9,16-24</sup> When specifically assessed, up to 40% of direct admissions after outpatient surgery have been found to be preventable.<sup>24</sup>

Some variation in admissions may occur due to variation in provider decision-making about when patients need to be admitted. For example, some providers may routinely admit a patient after outpatient surgery while others may choose to observe a similar patient overnight as an outpatient. Therefore, admission variation among providers may reflect a degree of practice variation as well as quality. Nevertheless, we recommend measuring admissions directly after surgery because an admission is typically unexpected for same-day surgery, and our overall goal is to illuminate variation in admissions following outpatient surgeries to improve quality.

- Any ED visit, observation stay visit, or unplanned inpatient admission occurring after discharge from the HOPD (we describe unplanned post-discharge admissions in Section 3.4.2)

Rationale: Major and minor adverse events, such as uncontrolled pain, urinary retention, infection, bleeding, and venous thromboembolism, are well documented to occur post-discharge and result in unanticipated hospital visits.<sup>17,18,27</sup> Some hospital visits post-discharge are for scheduled follow-up care provided after surgery (e.g., visits for rehabilitation). We remove these ‘planned’ hospital visits from the outcome (see Section 3.4.1).

In defining the outcome, we considered the alternative of measuring hospital visits after discharge from the HOPD only, and not inpatient admissions directly following surgery. This approach has the advantage of capturing any event that is serious enough that the patient needs to seek hospital care. Unanticipated hospital visits in the immediate days following surgery are highly likely to be related to surgery quality and less likely due to practice variation. However, the disadvantage of this approach is that we would not count in the measure adverse events that require immediate hospital admissions. For this reason, we combined admissions directly after surgery and post-discharge hospital visits in the measure.

We define ED visits and observation stays using billing codes or revenue center codes identified in Medicare Part B outpatient hospital claims (see Appendix B).

### *3.4.1. Outcome Timeframe*

We limit the outcome of hospital visits to 7 days since existing literature suggests the vast majority of adverse events after surgery occur within the first 7 days following the surgery.<sup>4,17</sup> We observed in our own data the highest rates of hospital visits occurring within 7 days of surgery (see Section 4.1). Based on empiric analyses and expert input, we concluded that unplanned hospital visits within 7 days is the optimal timeframe to ensure capture of surgery-related adverse events and to minimize capture of hospital visits unrelated to the surgery.

### *3.4.2. Removal of Planned Admissions from the Outcome*

For inpatient admissions occurring after Day 1 following surgery, we only include unplanned admissions in the measure outcome. We consider admissions occurring on the day of the surgery (Day 0) and Day 1 post-surgery “unplanned” as the vast majority of these admissions are inpatient admissions directly following surgery. “Planned” admissions are those planned by providers for anticipated medical treatment or procedures that must be provided in the inpatient setting. We do not count these in the outcome because variation in planned admissions does not reflect quality differences.

To identify admissions as planned or unplanned we use an algorithm we previously developed for CMS’s hospital readmission measures, CMS Planned Readmission Algorithm Version 3.0.<sup>28</sup> In brief, the algorithm uses the procedure codes and principal discharge diagnosis code on each hospital claim to identify admissions that are typically planned and may occur after a surgery. A few specific, limited types of care are always considered planned (e.g., major organ transplant, rehabilitation, or maintenance chemotherapy). Otherwise, a planned admission is defined as a non-acute admission for a scheduled procedure (e.g., total hip replacement or cholecystectomy). Post-discharge admissions for an acute illness or for complications of care are never considered planned.

See Appendix C for the detailed planned admission algorithm.

## **3.5. Model Development**

### *3.5.1. Overview*

The measure adjusts for HOPD case mix and surgical procedure mix differences based on patient demographic and clinical characteristics and surgical procedural complexity. Risk adjustment is necessary to ensure that variation in the measure score among providers is due to quality of care rather than differences in case mix or surgical procedure mix.

The measure score is a ratio of the predicted to expected number of post-surgical hospital visits among the HOPD's patients. It is analogous to an observed/expected ratio, but accounts for clustering and sample size variation across HOPDs. The denominator is the expected number of hospital visits given the HOPD's case mix and surgical procedure mix. The numerator is the number of hospital visits predicted for the HOPD's patients accounting for its observed rate, the number of surgeries performed at the HOPD, the case mix, and the surgical procedure mix. A ratio less than one indicates the HOPD's patients have fewer post-surgical visits than expected compared to HOPDs with similar surgical procedures and patients, and a ratio greater than one indicates the HOPD's patients have more visits than expected.

To calculate a HOPD RSHVR, the measure uses a two-level hierarchical logistic regression model (see Appendix D). We model the log-odds of the outcome from an index outpatient surgery as a function of the patient demographic, procedure, and clinical characteristics, and a random outpatient facility-specific intercept. This strategy accounts for within-facility correlation of the observed outcome and sample size differences, and accommodates the assumption that underlying differences in quality across HOPDs lead to systematic differences in outcomes. This approach is tailored to, and appropriate for, a publicly reported outcome measure as articulated in published scientific guidelines.<sup>13-15</sup>

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

CORE considered candidate variables for risk-adjustment that had an association with adverse surgical outcomes or hospital visits following surgery as identified in the literature and through expert clinical input and statistical testing. We considered the following candidate variables for risk adjustment:

- Patient age, sex, and comorbidity variables

For candidate variables, based on the literature and clinical input, CORE identified variables of interest that were both clinically relevant and had a documented or clinically plausible relationship with the outcome. Appendix E presents the candidate patient variables.

- Surgical procedural complexity

We tested two candidate variables of procedural complexity:

- Work RVU of the procedure: Work RVUs are assigned to each CPT procedure code and approximate procedure complexity by incorporating elements of physician time and effort. Surgeries with increasing complexity are assigned a

higher work RVU. For patients with multiple concurrent CPT procedure codes, we risk adjust for the CPT code with the highest Work RVU value.

- Anatomical body system group using the Agency for Healthcare Research and Quality (AHRQ) Clinical Classification Software (CCS):<sup>29</sup> We use the body system variable, in addition to the Work RVU of the procedure, to account for organ specific difference in risk and complications which are not adequately captured by the Work RVU alone.

This approach to accounting for procedural complexity is similar to that described in the literature and used for risk adjustment in the American College of Surgeons' National Surgical Quality Improvement Program (NSQIP).<sup>30</sup>

### *3.5.3. Final Variable Selection*

To select the final variables to include in the risk-adjustment model, we fitted an initial logistic regression model with all candidate variables to predict the outcome of hospital visits within 7 days. The Development Split Sample was a randomly selected split sample of our 2010 cohort. To develop a parsimonious model, we then iteratively removed non-significant variables from the initial model using a stepwise purposeful selection approach described by Hosmer and Lemeshow.<sup>31</sup> We retained all variables significant at  $p < 0.05$  in the final model.

### *3.5.4. Model Performance*

To assess performance of the patient-level risk-adjustment model in the 2010 Development Split Sample, we calculated the area under the receiver operating characteristic curve as measured by the c-statistic. To test model discrimination, we calculated observed hospital visit rates in the lowest and highest deciles on the basis of predicted hospital visit probabilities.

### *3.5.5. Model Validation*

We undertook several analyses to further validate the patient-level risk-adjustment model. First, to validate the consistency of the patient-level risk-adjustment model, we compared the model performance in the 2010 Development Split Sample with its performance in the 2010 Validation Split Sample. We evaluated model comparison by evaluation of the c-statistic, model information criteria (Akaike Information Criteria [AIC], Bayesian Information Criteria [BIC]), and model discrimination (predictive ability).<sup>32</sup> We recalibrated the model in the 2010 Validation Split Sample. We further assessed how our model performed across time by re-evaluating our model in the 2011 Medicare 20% Validation Sample or 2011 Validation Sample. Second, we examined the stability of the risk factor frequencies and model estimates across the three datasets. Third, to further validate the adequacy of risk-adjustment variables, we compared the

performance of the model against the Charlson Comorbidity Index<sup>33-35</sup> and the Elixhauser Comorbidity Measure<sup>35,36</sup> which are claims-based non-condition specific or “generic” comorbidity indices that are widely used in the literature for comorbidity risk adjustment. We hypothesized that our surgery-specific risk-adjustment model was superior to these “generic” risk-adjustment models.

### *3.5.6. Calculation of Facility-Level Measure Score*

We estimated the measure score by fitting the hierarchical logistic regression model to the 2010 20% Medicare FFS sample. We calculated the measure score (RSHVR) for each HOPD by computing the ratio of the number of predicted unplanned hospital visits to the number of expected unplanned hospital visits. The numerator is the number of unplanned hospital visits the HOPD is predicted to have, accounting for the observed unplanned hospital visit rate, the number of surgeries performed at the HOPD, and the HOPD’s case mix. The expected rate is the number of unplanned hospital visits the HOPD is expected to have based on the nation’s performance with that HOPD’s case mix and surgical procedure mix.

To further explore how the measure categorizes relative performance, we classified HOPDs into three performance categories using the approach CMS employs for reporting similarly structured hospital outcome measures on the website *Hospital Compare* (<http://www.medicare.gov/hospitalcompare/>). Specifically, we used bootstrapping to empirically construct a 95% interval estimate for each RSHVR (Appendix D, Section D4). If the HOPD’s entire interval estimate was below the national average ratio (1.00) we classified the HOPD as having “better than expected” performance. If the entire interval estimate was above 1.00, we classified the HOPD as having “worse than expected” performance. If the HOPD’s interval estimate included 1.00, we classified it as “no different than expected.”

### *3.5.7. Facility-Level Measure Score Reliability Testing*

We tested the reliability of the measure score by calculating the intraclass correlation coefficient (ICC) of the measure score by assessing two patient samples at the same HOPD. To calculate the ICC, we combined three years of the Medicare 20% FFS sample (2009-2011) for HOPDs with  $\geq 2$  surgeries, then randomly split the samples within each provider. The ICC evaluates the agreement between the RSHVRs calculated in the two randomly selected samples.

### *3.5.8. Facility-Level Measure Score Disparities Testing*

We evaluated the potential impact of race and socioeconomic status (SES) to consider the implications for measure reporting using two methods.

First, at the patient level, we assessed if adjustment for Medicare dual-eligibility status (as a marker of low SES) and race affect HOPD measure scores by comparing the facility-specific measure score with and without adjustment for SES and race.

Second, at a facility level, we assessed if HOPDs with a high proportion of dual-eligible patients (a marker of low socioeconomic burden) or African-American patients perform as well on the measure as HOPDs with a lower proportion of dual-eligible or African American patients. To perform this analysis, we categorized HOPDs into quartiles based on the proportion of Medicaid dual-eligible patients and the proportion of African American patients and then examined the distribution of measure scores across quartiles.

### *3.5.9. 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 statement via an online survey following the final TEP meeting:

“The risk-standardized hospital visit ratios obtained from the outpatient surgery measure as specified can be used to distinguish between better and worse quality facilities.”

The survey offered participants six response options ranging from “strongly disagree” to “strongly agree.”

### *3.5.10. Statistical Software*

We performed statistical analyses using SAS version 9.3 (SAS Institute Inc., Cary, NC). We estimated the hierarchical logistic regression model using the GLIMMIX procedure in SAS.

## 4. Results

### 4.1. Development and Validation Samples

After applying all inclusion and exclusion criteria, the 2010 Medicare 20% FFS dataset included 212,104 outpatient same-day surgeries performed at 4,234 HOPDs. The 2010 Development and Validation Split Samples consisted of 106,052 surgeries each. Patients undergoing outpatient surgery had an average age of 76 years (Table 1). Appendix F outlines the top 10 most common surgeries included in the measure within each body system.

The 7-day unplanned hospital visit rate in the Medicare sample was 10.0% (Table 2). Of these hospital visits, approximately 65% were admissions directly to the hospital after surgery and the remaining 35% were post-discharge hospital visits. Hospital visits after surgery were for a diverse array of reasons. However, potentially preventable causes such as urinary retention, pain, nausea, vomiting, bleeding, syncope, and other surgery related complications were common diagnoses associated with unplanned hospital visits (Table 3).

The majority of hospital visits occurred during the first 7 days following HOPD surgery (Figure 1). This observation was consistent irrespective of body system (Figure 2).

### 4.2. Patient-Level Risk-Adjustment Model

#### 4.2.1. Candidate and Final Variables

Candidate variables identified for the preliminary model consisted of age, sex, comorbidities (46 variables), and two variables to adjust for surgical procedural complexity (see Appendix E, Table E1). Table 4 shows the final variables included in the model and the corresponding parameter estimates and odds ratios for risk of the outcome for the Development and Validation Samples.

#### 4.2.2. Model Performance

The final model c-statistic in the 2010 Development Split Sample was 0.71, which indicated good model discrimination. Additionally, the risk decile plots showed good discrimination; the model performed well in each of the risk deciles (Figure 3, Figure 4, and Figure 5). The mean observed unplanned hospital visit rate in the 2010 Development Split Sample ranged from 2.3% in the lowest decile of predicted surgery hospital visit rate to 26.7% in the highest predicted risk decile, a range of 24.4% (Table 5).

### *4.2.3. Model Validation*

Model performance was similar for the two validation datasets (Table 4, Table 5, Figure 3, Figure 4, and Figure 5). The regression coefficients of the model variables were also stable in the 2010 Development Split Sample and the 2010 Validation Split Sample and 2011 Validation Sample (Table 4). The patient-level model performed better than the same model substituting either the Charlson or Elixhauser Comorbidity Indices for risk adjustment (Table 6). Our model had a higher c-statistic (0.71) than the models developed using the Charlson (0.59) or Elixhauser (0.60) Indices.

## **4.3. Facility-Level Measure Score**

### *4.3.1. Facility-Measure Score Variation*

Using the 20% Sample of Medicare FFS data from 2010 (sample included 212,104 surgeries from 4,234 HOPDs) we found considerable variation in the measure score among HOPDs (Figure 6). We found that 211 HOPDs at or below the 5<sup>th</sup> percentile had at least 24% fewer than expected post-surgical hospital visits and 212 HOPDs at or above the 95<sup>th</sup> percentile had at least 34% more hospital visits than would be expected given their case mix and surgical procedure mix at HOPDs with similar patients. Using a bootstrapped 95% interval estimate, we categorized 80 HOPDs as worse than expected, 4,119 as no different as expected, and 35 as better than expected.

### *4.3.2. Facility-Measure Score Reliability Testing*

Testing measure score reliability indicated an ICC [2,1] of 0.50 (95% CI 0.48-0.53) indicating moderate measure score reliability.

### *4.3.3. Facility-Measure Score Disparities Testing*

Disparities testing of the measure score showed that the facility-specific measure scores (RSHVRs) unadjusted at the patient level for Medicare dual eligibility status or race were highly correlated with the facility-specific RSHVRs adjusted for Medicare dual eligibility status or race (Figure 7 and Figure 8). These findings suggests further adjustment for SES or race has minimal impact on the measure score

At a facility level, the distribution of RSHVRs was similar irrespective of the proportion of dual-eligible patients or African American per HOPD (Figure 9 and Figure 10). Although the distributions for the top quartiles (highest proportion of low-SES or African-American patients)

showed the highest outliers, there was substantial overlap across all quartiles and many HOPDs in the top quartile performed well on the measure.

#### *4.3.4. Face Validity Testing*

Thirteen TEP members completed the face validity survey. Of these, 4 TEP members indicated they strongly agreed, 8 TEP members indicated they moderately agreed, and one TEP members somewhat agreed with the statement.

## 5. Summary

Outpatient same-day surgery is exceedingly common in the US among Medicare beneficiaries. We estimated that approximately 1 million outpatient same-day surgeries were performed in 2010 among HOPDs using our cohort definition. Our analysis suggests that 10% of same-day surgical procedures at HOPDs among Medicare 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. More importantly, we showed significant variation in unplanned hospital visits among HOPDs after adjusting for case mix and surgical procedure mix, which suggests variation in quality of care. Hospital visits following same-day surgery are unexpected by patients, currently largely invisible to providers, and costly to the healthcare system. The measure as specified has the potential to illuminate these quality differences, inform patient choice, and drive quality improvement with the ultimate goal of reducing unplanned hospital visits following outpatient surgery.

## 6. References

1. Cullen KA, Hall MJ, Golosinskiy A. Ambulatory surgery in the United States, 2006. *National health statistics reports*. Jan 28 2009(11):1-25.
2. Majholm B, Engbaek J, Bartholdy J, et al. Is day surgery safe? A Danish multicentre study of morbidity after 57,709 day surgery procedures. *Acta anaesthesiologica Scandinavica*. Mar 2012;56(3):323-331.
3. Linares-Gil MJ, Pelegri-Isanta MD, Pi-Siqués F, Amat-Rafols S, Esteva-Ollé MT, Gomar C. Unanticipated admissions following ambulatory surgery. *Ambulatory Surgery*. 12// 1997;5(4):183-188.
4. Fleisher LA, Pasternak LR, Herbert R, Anderson GF. Inpatient hospital admission and death after outpatient surgery in elderly patients: importance of patient and system characteristics and location of care. *Archives of surgery (Chicago, Ill. : 1960)*. Jan 2004;139(1):67-72.
5. Coley KC, Williams BA, DaPos SV, Chen C, Smith RB. Retrospective evaluation of unanticipated admissions and readmissions after same day surgery and associated costs. *Journal of clinical anaesthesia*. Aug 2002;14(5):349-353.
6. Hollingsworth JM, Saigal CS, Lai JC, Dunn RL, Strobe SA, Hollenbeck BK. Surgical quality among Medicare beneficiaries undergoing outpatient urological surgery. *The Journal of urology*. Oct 2012;188(4):1274-1278.
7. Bain J, Kelly H, Snadden D, Staines H. Day surgery in Scotland: patient satisfaction and outcomes. *Quality in health care : QHC*. Jun 1999;8(2):86-91.
8. Fortier J, Chung F, Su J. Unanticipated admission after ambulatory surgery--a prospective study. *Canadian journal of anaesthesia = Journal canadien d'anesthesie*. Jul 1998;45(7):612-619.
9. Aldwinckle RJ, Montgomery JE. Unplanned admission rates and postdischarge complications in patients over the age of 70 following day case surgery. *Anaesthesia*. Jan 2004;59(1):57-59.
10. Mezei G, Chung F. Return hospital visits and hospital readmissions after ambulatory surgery. *Annals of surgery*. Nov 1999;230(5):721-727.
11. Russo A, Elixhauser A, Steiner C, Wier L. Hospital-Based Ambulatory Surgery, 2007: Statistical Brief #86. *Healthcare Cost and Utilization Project (HCUP) Statistical Briefs*. Rockville (MD): Agency for Health Care Policy and Research (US); 2006.
12. International Association for Ambulatory Surgery. Day Surgery: Development and Practice. International Association for Ambulatory Surgery (IASS); 2006: <http://www.iaas-med.com/files/historical/DaySurgery.pdf>.
13. Normand S-LT, Shahian DM. Statistical and clinical aspects of hospital outcomes profiling. *Stat Sci*. 2007;22(2):206-226.
14. Krumholz HM, Brindis RG, Brush JE, et al. Standards for statistical models used for public reporting of health outcomes: an American Heart Association Scientific Statement from the Quality of Care and Outcomes Research Interdisciplinary Writing Group: cosponsored by the Council on Epidemiology and Prevention and the Stroke Council. Endorsed by the American College of Cardiology Foundation. *Circulation*. Jan 24 2006;113(3):456-462.
15. National Quality Forum. Measure Evaluation Criteria and Guidance on Evaluation. 2013; <http://www.qualityforum.org/WorkArea/linkit.aspx?LinkIdentifier=id&ItemID=73365>, July 2013.
16. Margovsky A. Unplanned admissions in day-case surgery as a clinical indicator for quality assurance. *The Australian and New Zealand journal of surgery*. Mar 2000;70(3):216-220.
17. Mattila K, Toivonen J, Janhunen L, Rosenberg PH, Hynynen M. Postdischarge symptoms after ambulatory surgery: first-week incidence, intensity, and risk factors. *Anesthesia and analgesia*. Dec 2005;101(6):1643-1650.

18. Minatti WR, Flavio B, Pablo C, Raúl R, Guillermo P, Miguel S. Postdischarge unplanned admission in ambulatory surgery—a prospective study. *Ambulatory Surgery*. 1// 2006;12(3):107-112.
19. Morales R, Esteve N, Casas I, Blanco C. Why are ambulatory surgical patients admitted to hospital?: Prospective study. *Ambulatory Surgery*. 3/15/ 2002;9(4):197-205.
20. Ogg T, Hitchcock M, Penn S. Day surgery admissions and complications. *Ambulatory Surgery*. 1998;6:101-106.
21. Mingus ML, Bodian CA, Bradford CN, Eisenkraft JB. Prolonged surgery increases the likelihood of admission of scheduled ambulatory surgery patients. *Journal of clinical anesthesia*. Sep 1997;9(6):446-450.
22. Laeeque R, Samad A, Raja AJ. Day care surgery at a university hospital--who is responsible after discharge. *JPMA. The Journal of the Pakistan Medical Association*. Dec 2001;51(12):422-427.
23. Crew JP, Turner KJ, Millar J, Cranston DW. Is day case surgery in urology associated with high admission rates? *Annals of the Royal College of Surgeons of England*. Nov 1997;79(6):416-419.
24. Awan FN, Zulkifli MS, McCormack O, et al. Factors involved in unplanned admissions from general surgical day-care in a modern protected facility. *Irish medical journal*. May 2013;106(5):153-154.
25. Rudkin GE, Bacon AK, Burrow B, et al. Review of efficiencies and patient satisfaction in Australian and New Zealand day surgery units: a pilot study. *Anaesthesia and intensive care*. Feb 1996;24(1):74-78.
26. Paez A, Redondo E, Linares A, Rios E, Vallejo J, Sanchez-Castilla M. Adverse events and readmissions after day-case urological surgery. *International braz j urol : official journal of the Brazilian Society of Urology*. May-Jun 2007;33(3):330-338.
27. Twersky R, Fishman D, Homel P. What happens after discharge? Return hospital visits after ambulatory surgery. *Anesthesia and analgesia*. Feb 1997;84(2):319-324.
28. Horwitz L, Grady J, Dorsey K, et al. 2014 Measures Updates and Specifications Report: Hospital-Wide All-Cause Unplanned Readmission--Version 3.0. 2014; <http://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/HospitalQualityInits/Measure-Methodology.html>, 2014.
29. HCUP Clinical Classifications Software for Services and Procedures. Healthcare Cost and Utilization Project (HCUP). 2008. Agency for Healthcare Research and Quality, Rockville, MD [http://www.hcup-us.ahrq.gov/toolssoftware/ccs\\_svcsproc/ccsvproc.jsp](http://www.hcup-us.ahrq.gov/toolssoftware/ccs_svcsproc/ccsvproc.jsp), 2014.
30. Raval MV, Cohen ME, Ingraham AM, et al. Improving American College of Surgeons National Surgical Quality Improvement Program risk adjustment: incorporation of a novel procedure risk score. *Journal of the American College of Surgeons*. Dec 2010;211(6):715-723.
31. Hosmer D, Lemeshow S. *Applied Logistic Regression*. New York: John Wiley & Sons; 2000.
32. DeLong ER, DeLong DM, Clarke-Pearson DL. Comparing the areas under two or more correlated receiver operating characteristic curves: a nonparametric approach. *Biometrics*. Sep 1988;44(3):837-845.
33. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *Journal of chronic diseases*. 1987;40(5):373-383.
34. Romano PS, Roos LL, Jollis JG. Adapting a clinical comorbidity index for use with ICD-9-CM administrative data: differing perspectives. *Journal of clinical epidemiology*. Oct 1993;46(10):1075-1079; discussion 1081-1090.
35. Quan H, Sundararajan V, Halfon P, et al. Coding algorithms for defining comorbidities in ICD-9-CM and ICD-10 administrative data. *Medical care*. Nov 2005;43(11):1130-1139.
36. Elixhauser A, Steiner C, Harris DR, Coffey RM. Comorbidity measures for use with administrative data. *Medical care*. Jan 1998;36(1):8-27.

## 7. Tables and Figures

**Table 1. Frequency of Risk Model Variables in the Medicare Development and Validation Datasets**

Variables	2010 Development Split Sample		2010 Validation Split Sample		2011 Validation Sample	
	#	%	#	%	#	%
<b>N</b>	106,052		106,052		201,632	
Age: Mean (SD)	76.0	7.0	75.9	7.00	76.0	7.0
<b>Comorbidities:</b>						
Cancer (CC 7 - 12)	36,340	34.3	36,826	34.7	69,833	34.6
Diabetes and DM Complications (CC 15-19, 119, 120)	33,939	32.0	33,936	32.0	65,147	32.3
Disorders of Fluid/Electrolyte/Acid-Base (CC 23)	16,526	15.6	16,495	15.6	32,381	16.1
Intestinal Obstruction/Perforation (CC 31)	2,854	2.7	2,881	2.7	5,346	2.7
Inflammatory Bowel Disease (CC 33)	1,185	1.1	1,144	1.1	2,227	1.1
Bone/Joint/Muscle Infections/Necrosis(CC 37)	2,258	2.1	2,215	2.1	4,140	2.1
Hematological Disorders including Coagulation Defects and Iron Deficiency (CC 44, 46, 47)	33,414	31.5	32,929	31.1	63,351	31.4
Dementia or Senility (CC 49-50)	8,959	8.4	8,855	8.4	17,108	8.5
Psychiatric Disorders (CC 54-60)	19,578	18.5	19,640	18.5	39,255	19.47
Hemiplegia, Paraplegia, Paralysis, Functional Disability (CC 67-69, 100-103, 177-178)	5,169	4.9	5,202	4.9	10,044	5.0
Other Significant CNS Disease (CC 72-75)	4,395	4.1	4,380	4.1	8,554	4.2
Cardiorespiratory Arrest, Failure and Respiratory Dependence (CC 77-79)	6,048	5.7	6,049	5.7	12,082	6.0
Chronic Heart Failure (CC 80)	20,577	19.4	20,320	19.2	38,632	19.2
Ischemic Heart Disease (CC 81-84)	36,638	34.5	36,426	34.4	68,344	33.9
Hypertension and Hypertensive Disorders (CC 89- 91)	76,248	71.9	75,985	71.7	144,196	71.5
Arrhythmias (CC 92-93)	34,671	32.7	34,577	32.6	66,482	33.0
Vascular Disease (CC 104-106)	33,921	32.0	33,834	31.9	64,271	32.0
Chronic Lung Disease (CC 108-110)	24,823	23.4	24,866	23.5	47,025	23.3
UTI and Other Urinary Tract Disorders (CC 135-136)	41,475	39.1	41,108	38.8	77,922	38.7

Variables	2010 Development Split Sample		2010 Validation Split Sample		2011 Validation Sample	
	#	%	#	%	#	%
Pelvic Inflammatory Disease and Other Specified Female Genital Disorders (CC 138)	4,126	3.9	4,009	3.8	7,491	3.7
Chronic Ulcers (CC 148-149)	6,091	5.7	5,993	5.7	11,298	5.6
Cellulitis, Local Skin Infection (CC 152)	12,557	11.8	12,422	11.7	23,194	11.5
Prior Significant Fracture (CC 157-159)	6,293	5.9	6,102	5.8	11,686	5.8
Morbid Obesity (ICD-9-CM code: 278.01)	1,983	1.9	2,004	1.9	4,229	2.1
<b>Procedural Information:</b>						
Work Relative Value Units: Mean (SD)	8.43	3.7	8.43	3.7	8.45	3.7
<i>Body System Operated On:</i>						
Cardiovascular	16,089	15.2	15,925	15.0	32,014	15.1
Digestive	15,555	14.7	15,585	14.7	31,140	14.7
Ear	592	0.6	684	0.6	1,276	0.6
Endocrine	354	0.3	313	0.3	667	0.3
Female Genitalia	891	0.8	829	0.8	1,720	0.8
Hemic-Lymphatic	778	0.7	833	0.8	1,611	0.8
Skin & Breast	14,867	14.0	14,900	14.1	29,767	14.0
Male Genitalia	4,866	4.6	4,835	4.6	9,701	4.6
Musculoskeletal	25,716	24.2	25,651	24.2	51,367	24.2
Nervous	5,568	5.3	5,582	5.3	11,150	5.3
Nose-Throat-Pharynx	1,814	1.7	1,775	1.7	3,589	1.7
Respiratory	108	0.1	116	0.1	224	0.1
Urinary	18,854	17.8	19,024	17.9	37,878	17.9

**Table 2. Crude HOPD Unplanned Hospital Visit Rate, Overall and by Body System**

Categorization	Surgeries	Unplanned Hospital Visit Rate at 7 Days	
	#	#	%
Total (all outpatient surgeries)	212,104	21,131	10.0
<i>By Body System Group</i>			
Cardiovascular	32,041	3,601	11.2
Digestive	31,292	4,349	13.9
Ear	1,366	63	4.6
Endocrine	668	184	27.5
Female Genitalia	2,121	502	23.7
Hemic/Lymphatic	5,218	493	9.4
Skin/Breast	31,154	1,872	6.0
Male Genitalia	10,178	2,047	20.1
Musculoskeletal	53,111	4,473	8.4
Nervous System	12,325	427	3.5
Nose/Throat/Pharynx	3,762	414	11.0
Respiratory	228	37	16.2
Urinary	38,891	3,894	10.0

Data source: 2010 Medicare 20% FFS sample

**Table 3. Top Hospital Visit Diagnoses Following HOPD Same-Day Surgery**

ICD-9 Code	ICD-9 Description	#	%
78820	Retention of urine, unspecified	919	3.7
60001	Hypertrophy (benign) of prostate with urinary obstruction and other lower urinary tract symptoms	835	3.4
55321	Incisional hernia without mention of obstruction or gangrene	454	1.8
99811	Hemorrhage complicating a procedure	314	2.3
5990	Urinary tract infection, site not specified	404	1.6
42781	Sinoatrial node dysfunction	389	1.6
57410	Calculus of gallbladder with other cholecystitis, without mention of obstruction	341	1.4
99673	Other complications due to renal dialysis device, implant, and graft	305	1.2
4280	Congestive heart failure, unspecified	296	1.2
1749	Malignant neoplasm of breast (female), unspecified	273	1.1
42731	Atrial fibrillation	272	1.1
99859	Other postoperative infection	266	1.1
5921	Calculus of ureter	264	1.1
33818	Other acute postoperative pain	253	1.0
9975	Urinary complications, not elsewhere classified	213	0.9
7802	Syncope and collapse	204	0.8
55221	Incisional ventral hernia with obstruction	199	0.8
486	Pneumonia, organism unspecified	198	0.8
56400	Constipation, unspecified	196	0.8
78659	Chest pain other	195	0.8

Data source: 2010 Medicare 20% FFS sample

**Table 4. Model Parameter Estimates and Odds Ratios in the Medicare Development and Validation Samples**

Variable	2010 Development Split Sample		2010 Validation Split Sample		2011 Validation Sample	
	Estimate	Odds Ratio (95% CI)	Estimate	Odds Ratio (95% CI)	Estimate	Odds Ratio (95% CI)
Intercept	-4.273		-4.125		-4.207	
Age > 65	0.022	1.02 (1.02-1.03)	0.019	1.02 (1.02-1.02)	0.020	1.02 (1.02-1.02)
<b>Comorbidities:</b>						
Cancer (CC 7 - 12)	0.051	1.05 (1.01-1.10)	0.096	1.10 (1.05-1.15)	0.076	1.08 (1.04-1.12)
Diabetes and DM Complications (CC 15-19, 119, 120)	0.076	1.08 (1.03-1.13)	0.034	1.03 (0.99-1.08)	0.089	1.09 (1.06-1.13)
Disorders of Fluid/Electrolyte/Acid-Base (CC 23)	0.122	1.13 (1.07-1.20)	0.148	1.16 (1.09-1.23)	0.156	1.17 (1.12-1.22)
Intestinal Obstruction/Perforation (CC 31)	0.163	1.18 (1.06-1.31)	0.226	1.25 (1.13-1.39)	0.207	1.23 (1.14-1.33)
Inflammatory Bowel Disease (CC 33)	0.192	1.21 (1.02-1.44)	-0.133	0.88 (0.72-1.06)	0.081	1.08 (0.95-1.24)
Bone/Joint/Muscle Infections/Necrosis(CC 37)	0.271	1.31 (1.15-1.50)	0.298	1.35 (1.18-1.54)	0.263	1.30 (1.18-1.44)
Hematological Disorders Including Coagulation Defects and Iron Deficiency (CC 44, 46, 47)	0.075	1.08 (1.03-1.13)	0.062	1.06 (1.01-1.12)	0.098	1.10 (1.06-1.14)
Dementia or Senility (CC 49-50)	0.138	1.15 (1.07-1.23)	0.141	1.15 (1.07-1.24)	0.142	1.15 (1.09-1.21)
Psychiatric Disorders (CC 54-60)	0.111	1.12 (1.06-1.18)	0.114	1.12 (1.06-1.18)	0.078	1.08 (1.04-1.12)
Hemiplegia, Paraplegia, Paralysis, Functional Disability (CC 67-69, 100-103, 177-178)	0.155	1.17 (1.07-1.27)	0.080	1.08 (0.99-1.18)	0.133	1.14 (1.07-1.22)
Other Significant CNS Disease (CC 72-75)	0.179	1.20 (1.09-1.31)	0.131	1.14 (1.04-1.25)	0.130	1.14 (1.06-1.22)
Cardiorespiratory Arrest, Failure and Respiratory Dependence (CC 77-79)	0.171	1.19 (1.09-1.29)	0.132	1.14 (1.05-1.24)	0.068	1.07 (1.01-1.14)
Chronic Heart Failure (CC 80)	0.133	1.14 (1.08-1.21)	0.208	1.23 (1.16-1.31)	0.167	1.18 (1.13-1.24)
Ischemic Heart Disease (CC 81-84)	0.081	1.08 (1.03-1.14)	0.089	1.09 (1.04-1.15)	0.103	1.11 (1.07-1.15)
Hypertension and Hypertensive Disorders (CC 89- 91)	0.071	1.07 (1.01-1.14)	0.025	1.03 (0.97-1.09)	0.021	1.02 (0.98-1.07)
Arrhythmias (CC 92-93)	0.076	1.08 (1.03-1.13)	0.115	1.12 (1.07-1.18)	0.117	1.12 (1.08-1.17)
Vascular Disease (CC 104-106)	0.084	1.09 (1.04-1.14)	0.071	1.07 (1.02-1.13)	0.064	1.07 (1.03-1.11)
Chronic Lung Disease (CC 108-110)	0.124	1.13 (1.08-1.19)	0.131	1.14 (1.09-1.20)	0.132	1.14 (1.10-1.18)
UTI and Other Urinary Tract Disorders (CC 135-136)	0.107	1.11 (1.06-1.17)	0.077	1.08 (1.03-1.13)	0.095	1.10 (1.06-1.14)
Pelvic Inflammatory Disease and Other Specified Female Genital Disorders (CC 138)	0.299	1.35 (1.22-1.49)	0.222	1.25 (1.13-1.39)	0.103	1.11 (1.02-1.20)
Chronic Ulcers (CC 148-149)	0.115	1.12 (1.03-1.23)	0.161	1.17 (1.08-1.28)	0.065	1.07 (1.00-1.14)
Cellulitis, Local Skin Infection (CC 152)	0.066	1.07 (1.00-1.14)	0.127	1.14 (1.06-1.21)	0.100	1.10 (1.05-1.16)
Prior Significant Fracture (CC 157-159)	0.502	1.65 (1.53-1.78)	0.427	1.53 (1.42-1.66)	0.497	1.64 (1.55-1.74)

Variable	2010 Development Split Sample		2010 Validation Split Sample		2011 Validation Sample	
	Estimate	Odds Ratio (95% CI)	Estimate	Odds Ratio (95% CI)	Estimate	Odds Ratio (95% CI)
Morbid Obesity (ICD-9-CM code: 278.01)	0.272	1.31 (1.15-1.50)	0.230	1.26 (1.10-1.44)	0.236	1.27 (1.15-1.39)
<b>Procedural Information:</b>						
Work Relative Value Units	0.137	1.15 (1.14-1.15)	0.136	1.15 (1.14-1.15)	0.133	1.14 (1.14-1.15)
<i>Body System Operated On:</i>						
Cardiovascular	-0.044	0.96 (0.88-1.04)	-0.091	0.91 (0.84-0.99)	-0.167	0.85 (0.80-0.90)
Digestive	0.400	1.49 (1.38-1.61)	0.352	1.42 (1.32-1.53)	0.357	1.43 (1.35-1.51)
Ear	REF	1.00	REF	1.00	REF	1.00
Endocrine	1.160	3.19 (2.54-4.01)	1.111	3.04 (2.39-3.86)	1.041	2.83 (2.39-3.36)
Female Genitalia	0.679	1.97 (1.66-2.35)	0.506	1.66 (1.38-2.00)	0.645	1.91 (1.67-2.17)
Hemic-Lymphatic	-0.449	0.64 (0.48-0.85)	-0.226	0.80 (0.63-1.02)	-0.153	0.86 (0.72-1.03)
Skin & Breast	-0.642	0.53 (0.48-0.58)	-0.666	0.51 (0.47-0.56)	-0.642	0.53 (0.49-0.56)
Male Genitalia	0.483	1.62 (1.48-1.78)	0.386	1.47 (1.34-1.61)	0.348	1.42 (1.32-1.52)
Musculoskeletal	-0.047	0.95 (0.88-1.03)	-0.120	0.89 (0.82-0.96)	-0.078	0.93 (0.87-0.98)
Nervous	-0.908	0.40 (0.34-0.47)	-0.774	0.46 (0.40-0.54)	-0.930	0.39 (0.35-0.44)
Nose-Throat-Pharynx	0.353	1.42 (1.22-1.67)	0.229	1.26 (1.08-1.47)	0.282	1.33 (1.18-1.49)
Respiratory	0.072	1.07 (0.65-1.79)	0.245	1.28 (0.80-2.04)	0.211	1.24 (0.85-1.80)
Urinary	0.322	1.38 (1.27-1.50)	0.277	1.32 (1.22-1.43)	0.222	1.25 (1.18-1.33)

**Table 5. Risk-Adjustment Model Performance Summaries in the Medicare Development and Validation Samples**

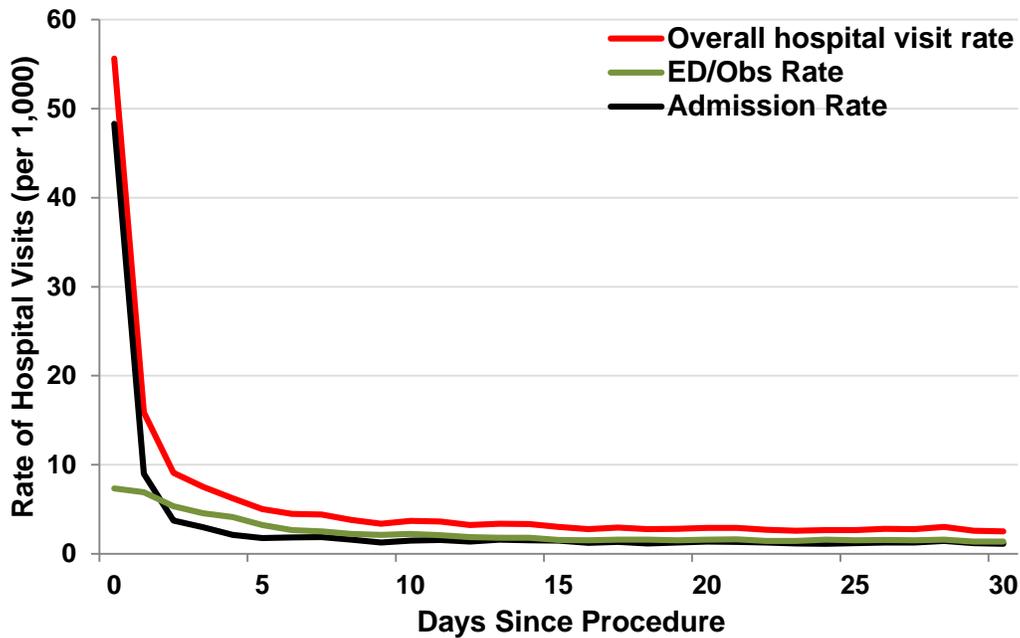
Characteristic	2010 Development Split Sample	2010 Validation Split Sample	2011 Validation Sample
Year	2010 (50%)	2010 (50%)	2011(100%)
N	106,052	106,052	201,632
# of Hospital Visits in 7 days	10,492 (10.0%)	10,639 (10.0%)	18,653 (9.3%)
Calibration ( $\gamma_0, \gamma_1$ )	(0,1)	(-0.05, 0.96)	(-0.18, 0.95)
c-statistic	0.71	0.70	0.70
Predictive Ability (Lowest-Highest Risk Decile)	2.3%-26.7%	2.5%-26.3%	2.2%-24.5%

**Table 6. Validation of the Measure's Risk-Adjustment Model against Generic Claims-Based Comorbidity Indices**

Characteristic	2010 Development Split Sample Model	Charlson Model	Elixhauser Model
Akaike Information Criteria (AIC)	62938.78	67552.28	67217.16
Bayesian Information Criteria (BIC)	63455.65	67571.42	67504.31
c-statistic	0.71	0.59	0.60
Predictive Ability (Lowest-Highest Risk Decile)	2.3%-26.7%	7.0%-16.8%	6.4%-18.1%

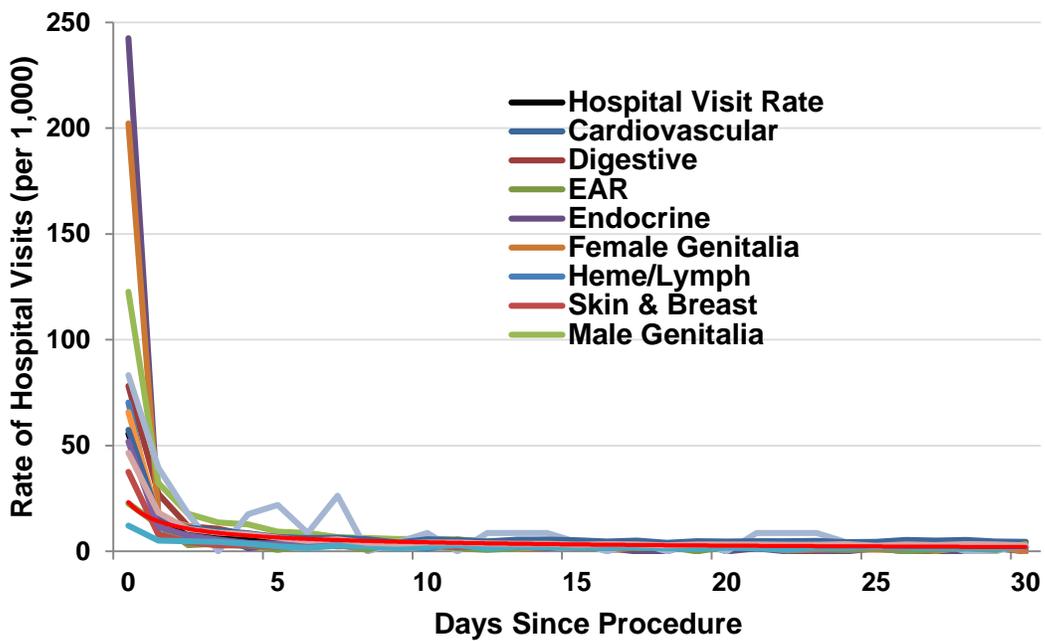
Note: The observed c-statistic for the surgery specific model was superior to Charlson model ( $P < 0.001$ ) and Elixhauser model ( $P < 0.001$ ) based on statistical testing.

**Figure 1. Timing of Unplanned Hospital Visits Following Same-Day Surgery at HOPDs (Event Rate per Day Post-discharge for 0-30 Day Period)**



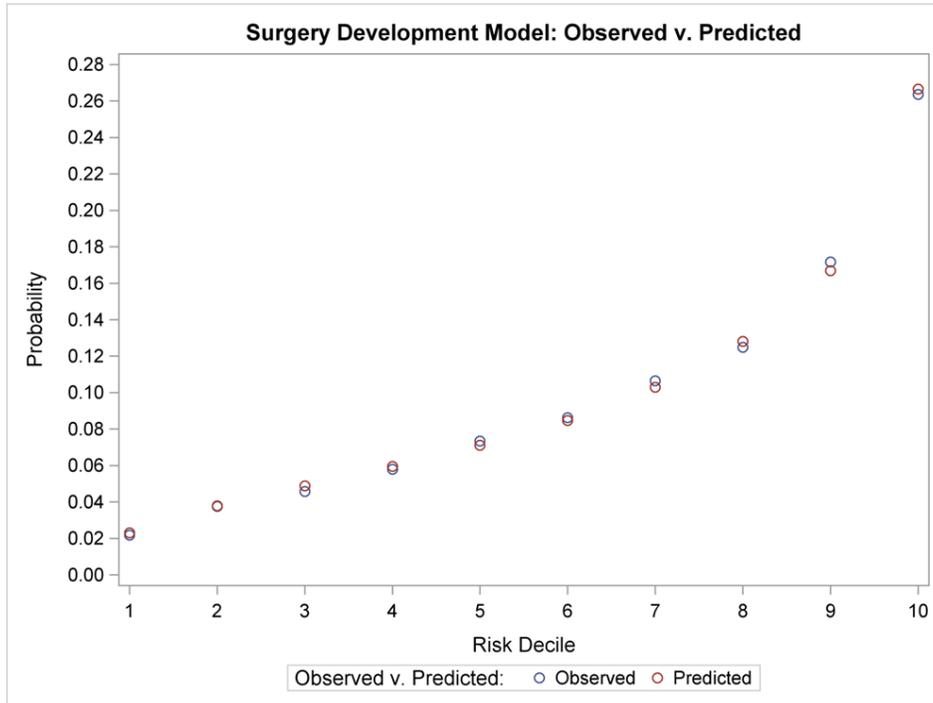
Data source: 2010 Medicare 20% FFS sample

**Figure 2. Timing of Unplanned Hospital Visits Following Same-Day Surgery at HOPDs by Body System (Event Rate per Day Post-discharge for 0-30 Day Period)**

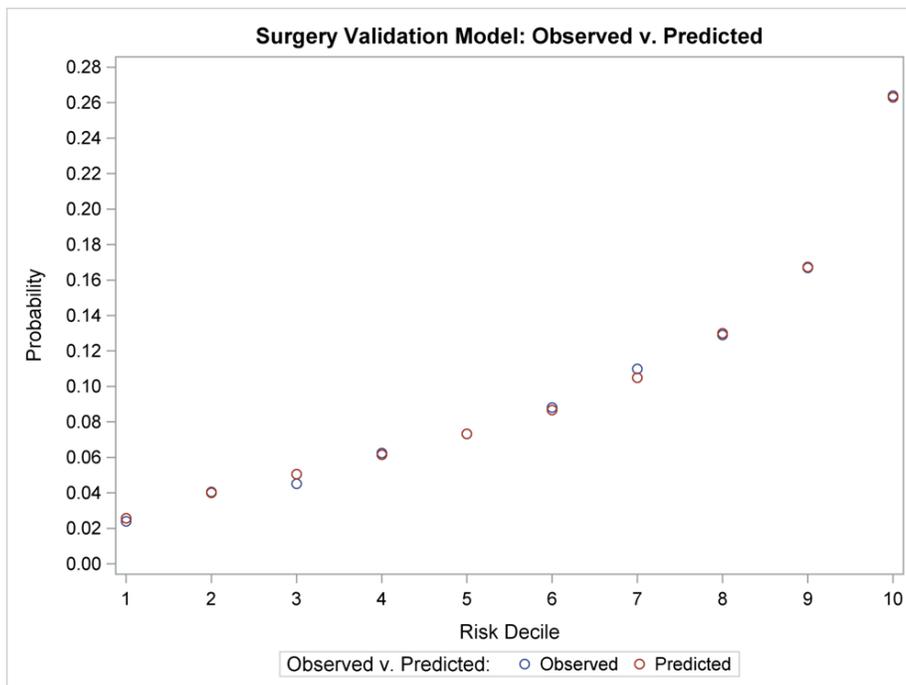


Data source: 2010 Medicare 20% FFS sample

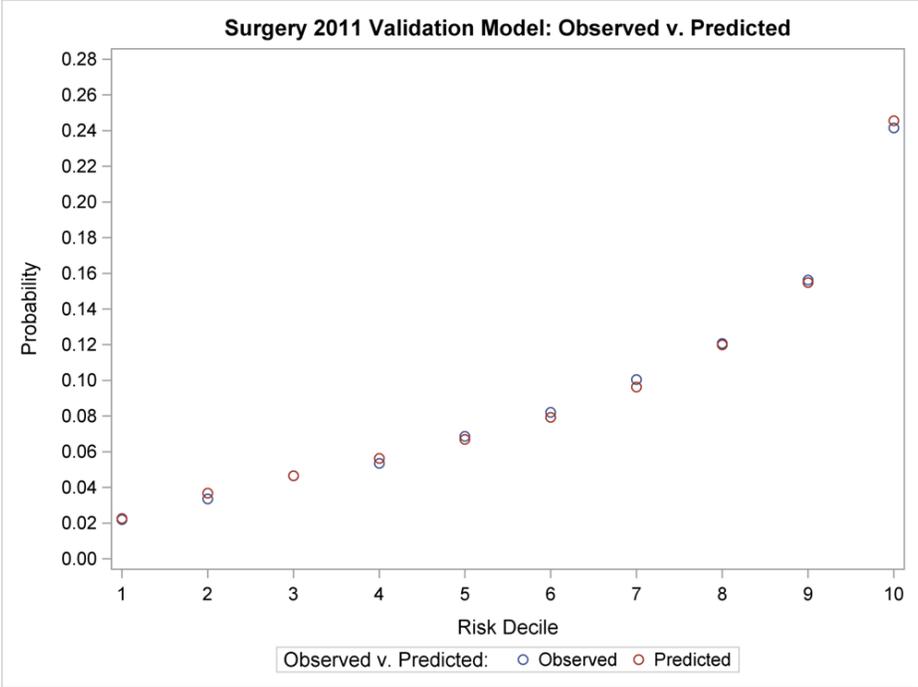
**Figure 3. Calibration Plot of Predicted versus Observed Outcomes across Deciles of Patient Risk in the 2010 Development Split Sample**



**Figure 4. Calibration Plot of Predicted versus Observed Outcomes across Deciles of Patient Risk in the 2010 Validation Split Sample**



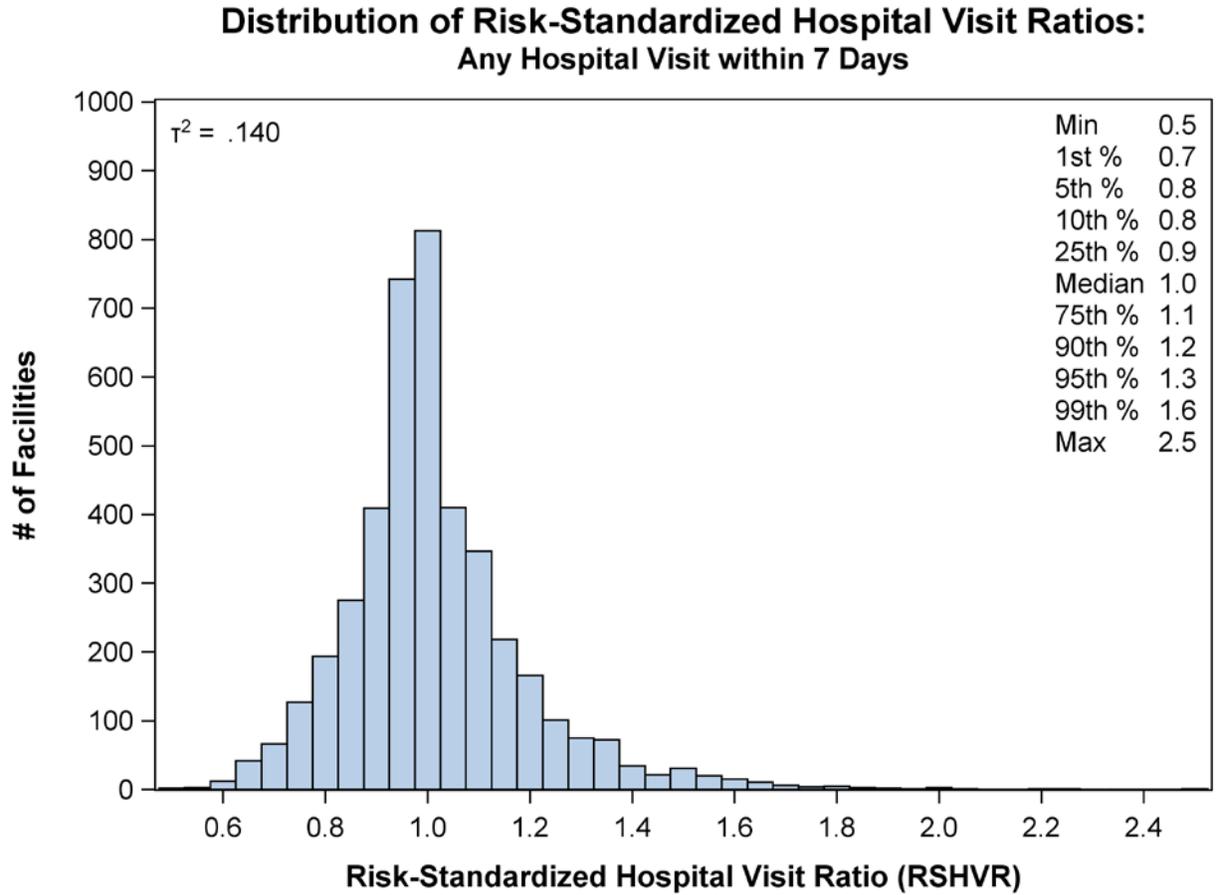
**Figure 5. Calibration Plot of Predicted versus Observed Outcomes across Deciles of Patient Risk in the 2011 Validation Sample**



Data source: Medicare 20% FFS sample

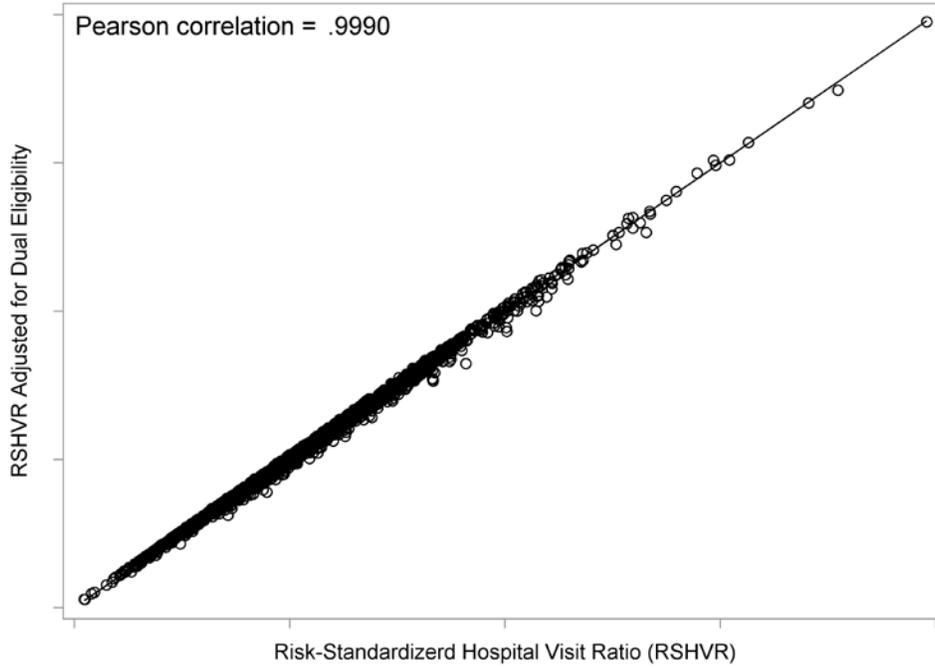
**Figure 6. Distribution of RSHVRs Following Same-Day Surgery at HOPDs**

Note: HOPDs with ratios less than one have fewer post-surgical hospital visits than expected given their case mix and surgical procedure mix, and HOPDs with ratios greater than one have more post-surgical hospital visits than expected given their case mix and surgical procedure mix.



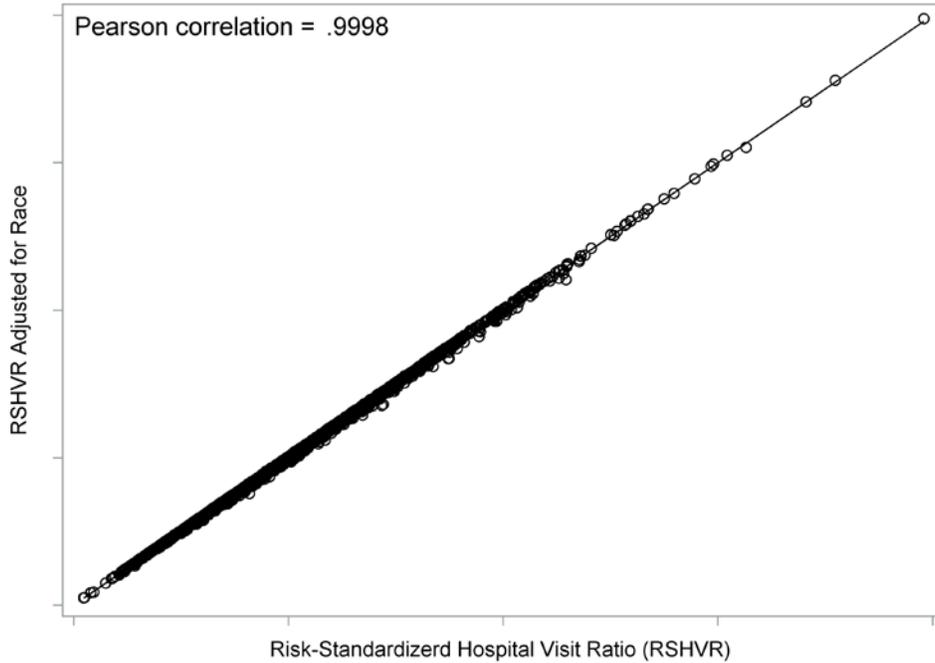
Data source: 2010 Medicare 20% FFS sample (includes 212,104 surgeries from 4,234 HOPDs)

**Figure 7. Plot of HOPD Measure Score (RSHVRs) with and without Adjustment for Medicaid Dual Eligibility Status**



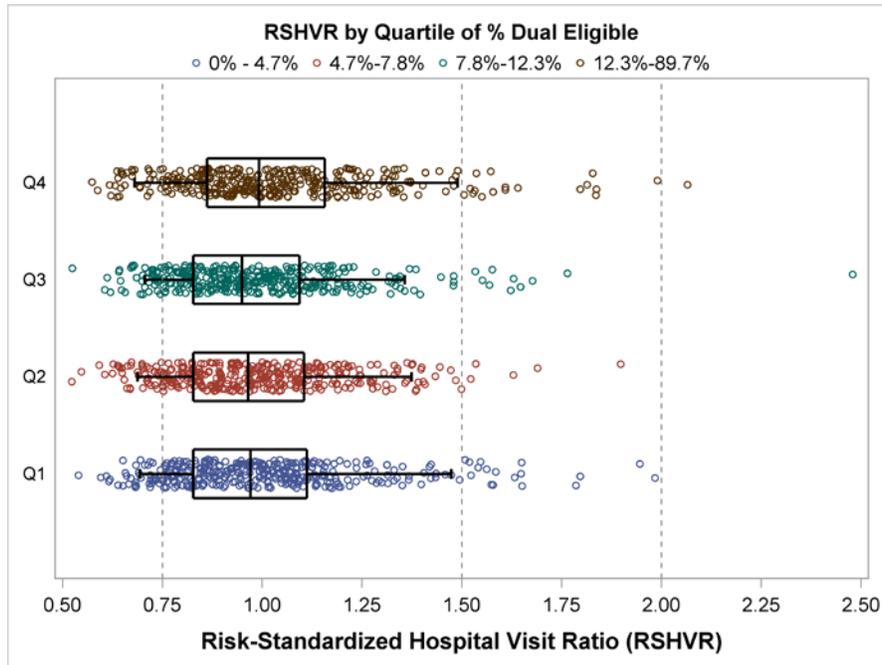
Data Source: 2010 Medicare 20% FFS sample (includes N=4,234 HOPDs)

**Figure 8. Plot of HOPD Measure Score (RSHVRs) with and without Adjustment for the African-American Race**



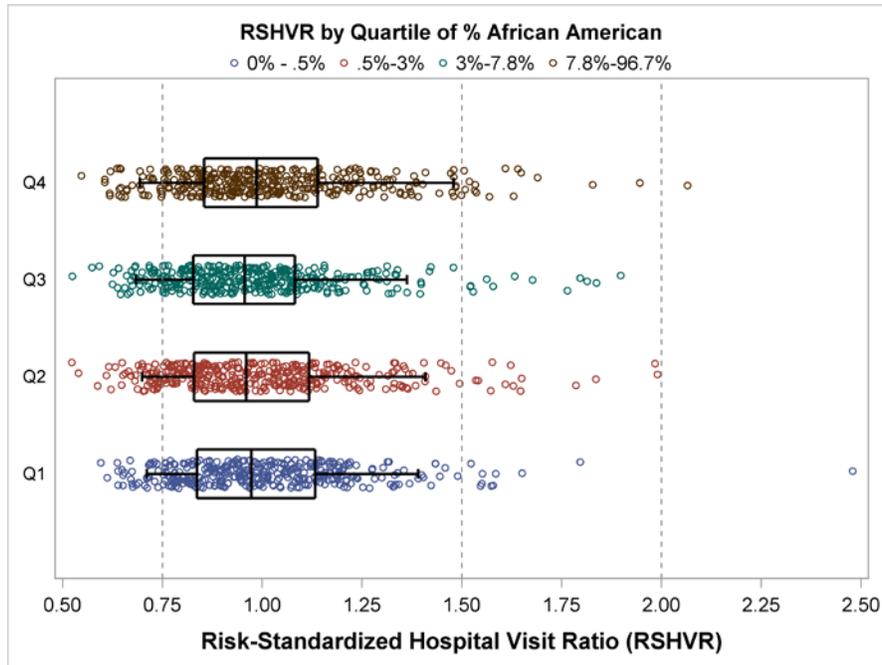
Data Source: 2010 Medicare 20% FFS sample (includes N=4,234 HOPDs)

**Figure 9. Boxplots of RSHVRs Comparing HOPDs with Varying Proportions of Dual-Eligible (Low SES) Patients (Quartile 1: HOPDs with Few Dual-Eligible Patients; Quartile 4: HOPDs with Many Dual-Eligible Patients)**



Data Source: 2010 Medicare 20% FFS sample limited to N=1,451 HOPDs with  $\geq 50$  same-day surgeries

**Figure 10. Boxplots of RSHVRs Comparing HOPDs with Varying Proportions of African-American Patients (Quartile 1: HOPDs with Few African-American Patients; Quartile 4: HOPDs with many African-American Patients)**



Data Source: 2010 Medicare 20% FFS sample limited to N=1,451 HOPDs with  $\geq 50$  same-day surgeries

## 8. Appendices

## Appendix A: List of Included CPT Procedure Codes Defining Cystoscopy with Intervention

**Table A. Procedure Codes Used to Define Cystoscopy with Intervention Included in Measure**

Note:

- This list does not include diagnostic cystoscopy procedures (cystoscopy alone or cystoscopy plus biopsy)
- Medicare identifies all procedure codes listed below as safe to be performed as a same-day procedure without typically requiring an overnight stay

CPT Code	Procedure Description
52214	Cystourethroscopy, with fulguration (including cryosurgery or laser surgery) of trigone, bladder neck, prostatic fossa, urethra, or periurethral glands
52224	Cystourethroscopy, with fulguration (including cryosurgery or laser surgery) or treatment of minor (less than 0.5 cm) lesion(s) with or without biopsy
52234	Cystourethroscopy, with fulguration (including cryosurgery or laser surgery) and/or resection of; small bladder tumor(s) (0.5 up to 2.0 cm)
52235	cystourethroscopy, with fulguration (including cryosurgery or laser surgery) and/or resection of; medium bladder tumor(s) (2.0 to 5.0 cm)
52240	Cystourethroscopy, with fulguration (including cryosurgery or laser surgery) and/or resection of; large bladder tumor(s)
52250	Cystourethroscopy with insertion of radioactive substance, with or without biopsy or fulguration
52260	Cystourethroscopy, with dilation of bladder for interstitial cystitis; general or conduction (spinal) anesthesia
52265	Cystourethroscopy, with dilation of bladder for interstitial cystitis; local anesthesia
52270	Cystourethroscopy, with internal urethrotomy; female
52275	Cystourethroscopy, with internal urethrotomy; male
52276	Cystourethroscopy with direct vision internal urethrotomy
52277	Cystourethroscopy, with resection of external sphincter (sphincterotomy)
52281	Cystourethroscopy, with calibration and/or dilation of urethral stricture or stenosis, with or without meatotomy, with or without injection procedure for cystography, male or female
52282	Cystourethroscopy, with insertion of permanent urethral stent
52283	Cystourethroscopy, with steroid injection into stricture

<b>CPT Code</b>	<b>Procedure Description</b>
52285	Cystourethroscopy for treatment of the female urethral syndrome with any or all of the following: urethral meatotomy, urethral dilation, internal urethrotomy, lysis of urethrovaginal septal fibrosis, lateral incisions of the bladder neck, and fulguration of polyp(s) of urethra, bladder neck, and/or trigone
52287	Cystourethroscopy, with injection(s) for chemodenervation of the bladder
52290	Cystourethroscopy; with ureteral meatotomy, unilateral or bilateral
52300	Cystourethroscopy; with resection or fulguration of orthotopic ureterocele(s), unilateral or bilateral
52301	Cystourethroscopy; with resection or fulguration of ectopic ureterocele(s), unilateral or bilateral
52305	Cystourethroscopy; with incision or resection of orifice of bladder diverticulum, single or multiple
52310	Cystourethroscopy, with removal of foreign body, calculus, or ureteral stent from urethra or bladder (separate procedure); simple
52315	Cystourethroscopy, with removal of foreign body, calculus, or ureteral stent from urethra or bladder (separate procedure); complicated
52317	litholapaxy: crushing or fragmentation of calculus by any means in bladder and removal of fragments; simple or small (less than 2.5 cm)
52318	Litholapaxy: crushing or fragmentation of calculus by any means in bladder and removal of fragments; complicated or large (over 2.5 cm)
52320	Cystourethroscopy (including ureteral catheterization); with removal of ureteral calculus
52325	Cystourethroscopy (including ureteral catheterization); with fragmentation of ureteral calculus (eg, ultrasonic or electro-hydraulic technique)
52327	Cystourethroscopy (including ureteral catheterization); with subureteric injection of implant material
52330	Cystourethroscopy (including ureteral catheterization); with manipulation, without removal of ureteral calculus
52332	Cystourethroscopy, with insertion of indwelling ureteral stent (eg, gibbons or double-j type)
52334	Cystourethroscopy with insertion of ureteral guide wire through kidney to establish a percutaneous nephrostomy, retrograde
52341	Cystourethroscopy; with treatment of ureteral stricture (eg, balloon dilation, laser, electrocautery, and incision)
52342	Cystourethroscopy; with treatment of ureteropelvic junction stricture (eg, balloon dilation, laser, electrocautery, and incision)
52343	Cystourethroscopy; with treatment of intra-renal stricture (eg, balloon dilation, laser, electrocautery, and incision)
52344	Cystourethroscopy with ureteroscopy; with treatment of ureteral stricture (eg, balloon dilation, laser, electrocautery, and incision)
52345	Cystourethroscopy with ureteroscopy; with treatment of ureteropelvic junction stricture (eg, balloon dilation, laser, electrocautery, and incision)
52346	Cystourethroscopy with ureteroscopy; with treatment of intra-renal stricture (eg, balloon dilation, laser, electrocautery, and incision)

<b>CPT Code</b>	<b>Procedure Description</b>
52352	Cystourethroscopy, with ureteroscopy and/or pyeloscopy; with removal or manipulation of calculus (ureteral catheterization is included)
52353	Cystourethroscopy, with ureteroscopy and/or pyeloscopy; with lithotripsy (ureteral catheterization is included)
52354	Cystourethroscopy, with ureteroscopy and/or pyeloscopy; with biopsy and/or fulguration of ureteral or renal pelvic lesion
52355	Cystourethroscopy, with ureteroscopy and/or pyeloscopy; with resection of ureteral or renal pelvic tumor
52400	Cystourethroscopy with incision, fulguration, or resection of congenital posterior urethral valves, or congenital obstructive hypertrophic mucosal folds
52402	Cystourethroscopy with transurethral resection or incision of ejaculatory ducts

## Appendix B: ED Visits and Observation Stays Definition

**Table B. HCPCS Codes or Revenue Center Codes that Define ED Visits and Observation Stays**

Billing (HCPCS) or Revenue Code*	Description
Emergency Department Definition	
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
Observation Stay Definition	
0762	Observation room
G0378†	Hospital observation service, per hour

\*Identified in Medicare Part B Outpatient hospital claims.

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

## Appendix C: Surgery Measure Planned Admission Algorithm

### *C1. Planned Admission Algorithm Overview*

The planned admission algorithm is adapted from the CMS Planned Readmission Algorithm Version 3.0. The algorithm is a set of criteria for classifying admissions occurring post-discharge from the HOPD and within 7 days of a HOPD surgery as planned or unplanned using Medicare claims. CMS seeks to count only unplanned admissions in the measure outcome, because variation in planned admissions does not reflect quality differences.

CORE developed the planned readmission algorithm under contract to CMS based on a hospital-wide (not condition-specific) cohort of patients. The current algorithm, Version 3.0, was modified slightly from Version 2.1, which has been reviewed and endorsed by the NQF. Version 3.0 incorporates improvements made following a validation study of the algorithm using data from a review of 634 medical records at seven hospitals.

As detailed in the next section, we have adapted the planned admission algorithm for the measure of hospital visits after hospital outpatient surgery. The algorithm classifies admissions as planned or unplanned using a flow chart (**Figure PA1**) and four 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 Classification 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 Admission Algorithm Version 3.0 – HOPD Surgery Population*

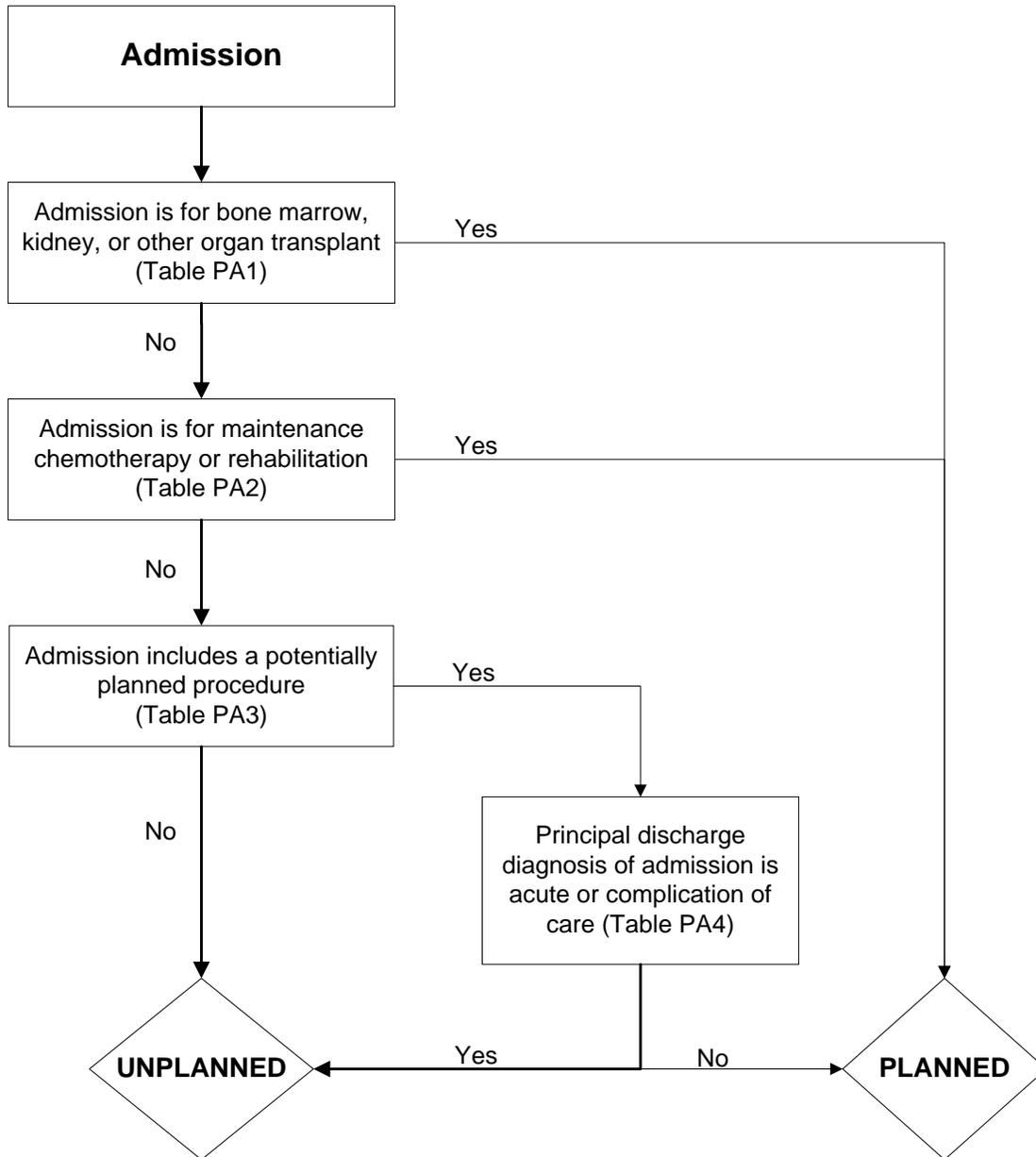
The HOPD surgery population algorithm uses the flow chart (**Figure PA1**) and **Table PA1-Table PA4**, adapted for the HOPD surgery population, to identify specific procedure categories and discharge diagnosis categories to classify admissions as planned or unplanned. As illustrated in the flow chart (**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 one 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 56 AHRQ procedure CCS categories from among 231 AHRQ procedure CCS categories and 11 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 one 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 101 diagnosis groups from among 285 AHRQ condition categories and six 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).

C3. Figures and Tables for Planned Admission Algorithm Version 3.0 – HOPD surgery Population

Figure PA1: Planned Admission Algorithm Version 3.0 – HOPD Surgery Population – Flow Chart



**Table PA1: Procedure Categories that are Always Planned (Version 3.0 – HOPD Surgery Population)**

<b>Procedure CCS</b>	<b>Description</b>
64	Bone marrow transplant
105	Kidney transplant
176	Other organ transplantation

**Table PA2: Diagnosis Categories that are Always Planned (Version 3.0 – HOPD Surgery Population)**

<b>Diagnosis CCS</b>	<b>Description</b>
45	Maintenance chemotherapy
254	Rehabilitation

**Table PA3: Potentially Planned Procedure Categories (Version 3.0 – HOPD Surgery Population)**

Code type	Code	Description
Procedure CCS	3	Laminectomy; excision intervertebral disc
Procedure CCS	5	Insertion of catheter or spinal stimulator and injection into spinal
Procedure CCS	9	Other OR therapeutic nervous system procedures
Procedure CCS	10	Thyroidectomy; partial or complete
Procedure CCS	12	Other therapeutic endocrine procedures
Procedure CCS	33	Other OR therapeutic procedures on nose; mouth and pharynx
Procedure CCS	36	Lobectomy or pneumonectomy
Procedure CCS	38	Other diagnostic procedures on lung and bronchus
Procedure CCS	40	Other diagnostic procedures of respiratory tract and mediastinum
Procedure CCS	43	Heart valve procedures
Procedure CCS	44	Coronary artery bypass graft (CABG)
Procedure CCS	45	Percutaneous transluminal coronary angioplasty (PTCA)
Procedure CCS	47	Diagnostic cardiac catheterization; coronary arteriography
Procedure CCS	48	Insertion; revision; replacement; removal of cardiac pacemaker or cardioverter/defibrillator
Procedure CCS	49	Other OR heart procedures
Procedure CCS	51	Endarterectomy; vessel of head and neck
Procedure CCS	52	Aortic resection; replacement or anastomosis
Procedure CCS	53	Varicose vein stripping; lower limb
Procedure CCS	55	Peripheral vascular bypass
Procedure CCS	56	Other vascular bypass and shunt; not heart
Procedure CCS	59	Other OR procedures on vessels of head and neck
Procedure CCS	62	Other diagnostic cardiovascular procedures
Procedure CCS	66	Procedures on spleen
Procedure CCS	67	Other therapeutic procedures; hemic and lymphatic system
Procedure CCS	74	Gastrectomy; partial and total
Procedure CCS	78	Colorectal resection
Procedure CCS	79	Local excision of large intestine lesion (not endoscopic)
Procedure CCS	84	Cholecystectomy and common duct exploration
Procedure CCS	85	Inguinal and femoral hernia repair
Procedure CCS	86	Other hernia repair
Procedure CCS	99	Other OR gastrointestinal therapeutic procedures
Procedure CCS	104	Nephrectomy; partial or complete
Procedure CCS	106	Genitourinary incontinence procedures
Procedure CCS	107	Extracorporeal lithotripsy; urinary
Procedure CCS	109	Procedures on the urethra
Procedure CCS	112	Other OR therapeutic procedures of urinary tract
Procedure CCS	113	Transurethral resection of prostate (TURP)
Procedure CCS	114	Open prostatectomy
Procedure CCS	119	Oophorectomy; unilateral and bilateral
Procedure CCS	120	Other operations on ovary
Procedure CCS	124	Hysterectomy; abdominal and vaginal
Procedure CCS	129	Repair of cystocele and rectocele; obliteration of vaginal vault

Code type	Code	Description
Procedure CCS	132	Other OR therapeutic procedures; female organs
Procedure CCS	142	Partial excision bone
Procedure CCS	152	Arthroplasty knee
Procedure CCS	153	Hip replacement; total and partial
Procedure CCS	154	Arthroplasty other than hip or knee
Procedure CCS	157	Amputation of lower extremity
Procedure CCS	158	Spinal fusion
Procedure CCS	159	Other diagnostic procedures on musculoskeletal system
Procedure CCS	166	Lumpectomy; quadrantectomy of breast
Procedure CCS	167	Mastectomy
Procedure CCS	169	Debridement of wound; infection or burn
Procedure CCS	170	Excision of skin lesion
Procedure CCS	172	Skin graft
ICD-9	30.1, 30.29, 30.3, 30.4, 31.74, 34.6	Laryngectomy, revision of tracheostomy, scarification of pleura (from Proc CCS 42- Other OR Rx procedures on respiratory system and mediastinum)
ICD-9	38.18	Endarterectomy leg vessel (from Proc CCS 60- Embolectomy and endarterectomy of lower limbs)
ICD-9	55.03, 55.04	Percutaneous nephrostomy with and without fragmentation (from Proc CCS 103- Nephrotomy and nephrostomy)
ICD-9	94.26, 94.27	Electroshock therapy (from Proc CCS 218- Psychological and psychiatric evaluation and therapy)

**Table PA4: Acute Diagnosis Categories (Version 3.0 – HOPD Surgery Population)**

Code Type	Code	Description
Diagnosis CCS	1	Tuberculosis
Diagnosis CCS	2	Septicemia (except in labor)
Diagnosis CCS	3	Bacterial infection; unspecified site
Diagnosis CCS	4	Mycoses
Diagnosis CCS	5	HIV infection
Diagnosis CCS	7	Viral infection
Diagnosis CCS	8	Other infections; including parasitic
Diagnosis CCS	9	Sexually transmitted infections (not HIV or hepatitis)
Diagnosis CCS	54	Gout and other crystal arthropathies
Diagnosis CCS	55	Fluid and electrolyte disorders
Diagnosis CCS	60	Acute posthemorrhagic anemia
Diagnosis CCS	61	Sickle cell anemia
Diagnosis CCS	63	Diseases of white blood cells
Diagnosis CCS	76	Meningitis (except that caused by tuberculosis or sexually transmitted disease)
Diagnosis CCS	77	Encephalitis (except that caused by tuberculosis or sexually transmitted disease)
Diagnosis CCS	78	Other CNS infection and poliomyelitis
Diagnosis CCS	82	Paralysis
Diagnosis CCS	83	Epilepsy; convulsions
Diagnosis CCS	84	Headache; including migraine
Diagnosis CCS	85	Coma; stupor; and brain damage
Diagnosis CCS	87	Retinal detachments; defects; vascular occlusion; and retinopathy
Diagnosis CCS	89	Blindness and vision defects
Diagnosis CCS	90	Inflammation; infection of eye (except that caused by tuberculosis or sexually transmitted disease)
Diagnosis CCS	91	Other eye disorders
Diagnosis CCS	92	Otitis media and related conditions
Diagnosis CCS	93	Conditions associated with dizziness or vertigo
Diagnosis CCS	99	Hypertension with complications
Diagnosis CCS	100	Acute myocardial infarction (with the exception of ICD-9 codes 410.x2)
Diagnosis CCS	102	Nonspecific chest pain
Diagnosis CCS	104	Other and ill-defined heart disease
Diagnosis CCS	107	Cardiac arrest and ventricular fibrillation
Diagnosis CCS	109	Acute cerebrovascular disease
Diagnosis CCS	112	Transient cerebral ischemia
Diagnosis CCS	116	Aortic and peripheral arterial embolism or thrombosis
Diagnosis CCS	118	Phlebitis; thrombophlebitis and thromboembolism
Diagnosis CCS	120	Hemorrhoids
Diagnosis CCS	122	Pneumonia (except that caused by TB or sexually transmitted disease)
Diagnosis CCS	123	Influenza
Diagnosis CCS	124	Acute and chronic tonsillitis
Diagnosis CCS	125	Acute bronchitis
Diagnosis CCS	126	Other upper respiratory infections
Diagnosis CCS	127	Chronic obstructive pulmonary disease and bronchiectasis

Code Type	Code	Description
Diagnosis CCS	128	Asthma
Diagnosis CCS	129	Aspiration pneumonitis; food/vomitus
Diagnosis CCS	130	Pleurisy; pneumothorax; pulmonary collapse
Diagnosis CCS	131	Respiratory failure; insufficiency; arrest (adult)
Diagnosis CCS	135	Intestinal infection
Diagnosis CCS	137	Diseases of mouth; excluding dental
Diagnosis CCS	139	Gastroduodenal ulcer (except hemorrhage)
Diagnosis CCS	140	Gastritis and duodenitis
Diagnosis CCS	142	Appendicitis and other appendiceal conditions
Diagnosis CCS	145	Intestinal obstruction without hernia
Diagnosis CCS	146	Diverticulosis and diverticulitis
Diagnosis CCS	148	Peritonitis and intestinal abscess
Diagnosis CCS	153	Gastrointestinal hemorrhage
Diagnosis CCS	154	Noninfectious gastroenteritis
Diagnosis CCS	157	Acute and unspecified renal failure
Diagnosis CCS	159	Urinary tract infections
Diagnosis CCS	165	Inflammatory conditions of male genital organs
Diagnosis CCS	168	Inflammatory diseases of female pelvic organs
Diagnosis CCS	172	Ovarian cyst
Diagnosis CCS	197	Skin and subcutaneous tissue infections
Diagnosis CCS	198	Other inflammatory condition of skin
Diagnosis CCS	225	Joint disorders and dislocations; trauma-related
Diagnosis CCS	226	Fracture of neck of femur (hip)
Diagnosis CCS	227	Spinal cord injury
Diagnosis CCS	228	Skull and face fractures
Diagnosis CCS	229	Fracture of upper limb
Diagnosis CCS	230	Fracture of lower limb
Diagnosis CCS	232	Sprains and strains
Diagnosis CCS	233	Intracranial injury
Diagnosis CCS	234	Crushing injury or internal injury
Diagnosis CCS	235	Open wounds of head; neck; and trunk
Diagnosis CCS	237	Complication of device; implant or graft
Diagnosis CCS	238	Complications of surgical procedures or medical care
Diagnosis CCS	239	Superficial injury; contusion
Diagnosis CCS	240	Burns
Diagnosis CCS	241	Poisoning by psychotropic agents
Diagnosis CCS	242	Poisoning by other medications and drugs
Diagnosis CCS	243	Poisoning by nonmedicinal substances
Diagnosis CCS	244	Other injuries and conditions due to external causes
Diagnosis CCS	245	Syncope
Diagnosis CCS	246	Fever of unknown origin
Diagnosis CCS	247	Lymphadenitis
Diagnosis CCS	249	Shock
Diagnosis CCS	250	Nausea and vomiting
Diagnosis CCS	251	Abdominal pain
Diagnosis CCS	252	Malaise and fatigue
Diagnosis CCS	253	Allergic reactions

Code Type	Code	Description
Diagnosis CCS	259	Residual codes; unclassified
Diagnosis CCS	650	Adjustment disorders
Diagnosis CCS	651	Anxiety disorders
Diagnosis CCS	652	Attention-deficit, conduct, and disruptive behavior disorders
Diagnosis CCS	653	Delirium, dementia, and amnesic and other cognitive disorders
Diagnosis CCS	656	Impulse control disorders, NEC
Diagnosis CCS	658	Personality disorders
Diagnosis CCS	660	Alcohol-related disorders
Diagnosis CCS	661	Substance-related disorders
Diagnosis CCS	662	Suicide and intentional self-inflicted injury
Diagnosis CCS	663	Screening and history of mental health and substance abuse codes
Diagnosis CCS	670	Miscellaneous disorders
ICD-9*	03282	Diphtheritic myocarditis
ICD-9*	03640	Meningococcal carditis nos
ICD-9*	03641	Meningococcal pericarditis
ICD-9*	03642	Meningococcal endocarditis
ICD-9*	03643	Meningococcal myocarditis
ICD-9*	07420	Coxsackie carditis nos
ICD-9*	07421	Coxsackie pericarditis
ICD-9*	07422	Coxsackie endocarditis
ICD-9*	07423	Coxsackie myocarditis
ICD-9*	11281	Candidal endocarditis
ICD-9*	11503	Histoplasma capsulatum pericarditis
ICD-9*	11504	Histoplasma capsulatum endocarditis
ICD-9*	11513	Histoplasma duboisii pericarditis
ICD-9*	11514	Histoplasma duboisii endocarditis
ICD-9*	11593	Histoplasmosis pericarditis
ICD-9*	11594	Histoplasmosis endocarditis
ICD-9*	1303	Toxoplasma myocarditis
ICD-9*	3910	Acute rheumatic pericarditis
ICD-9*	3911	Acute rheumatic endocarditis
ICD-9*	3912	Acute rheumatic myocarditis
ICD-9*	3918	Acute rheumatic heart disease nec
ICD-9*	3919	Acute rheumatic heart disease nos
ICD-9*	3920	Rheumatic chorea w heart involvement
ICD-9*	3980	Rheumatic myocarditis
ICD-9*	39890	Rheumatic heart disease nos
ICD-9*	39899	Rheumatic heart disease nec
ICD-9*	4200	Acute pericarditis in other disease
ICD-9*	42090	Acute pericarditis nos
ICD-9*	42091	Acute idiopath pericarditis
ICD-9*	42099	Acute pericarditis nec
ICD-9*	4210	Acute/subacute bacterial endocarditis
ICD-9*	4211	Acute endocarditis in other diseases
ICD-9*	4219	Acute/subacute endocarditis nos
ICD-9*	4220	Acute myocarditis in other diseases
ICD-9*	42290	Acute myocarditis nos

Code Type	Code	Description
ICD-9*	42291	Idiopathic myocarditis
ICD-9*	42292	Septic myocarditis
ICD-9*	42293	Toxic myocarditis
ICD-9*	42299	Acute myocarditis nec
ICD-9*	4230	Hemopericardium
ICD-9*	4231	Adhesive pericarditis
ICD-9*	4232	Constrictive pericarditis
ICD-9*	4233	Cardiac tamponade
ICD-9*	4290	Myocarditis nos
ICD-9†	4260	Atrioventricular
ICD-9†	42610	Atrioventricular block nos
ICD-9†	42611	Atrioventricular block-1st degree
ICD-9†	42612	Atrioventricular block-mobitz ii
ICD-9†	42613	Atrioventricular block-2nd degree nec
ICD-9†	4262	Left bundle branch hemiblock
ICD-9†	4263	Left bundle branch block nec
ICD-9†	4264	Right bundle branch block
ICD-9†	42650	Bundle branch block nos
ICD-9†	42651	Right bundle branch block/left posterior fascicular block
ICD-9†	42652	Right bundle branch block/left ant fascicular block
ICD-9†	42653	Bilateral bundle branch block nec
ICD-9†	42654	Trifascicular block
ICD-9†	4266	Other heart block
ICD-9†	4267	Anomalous atrioventricular excitation
ICD-9†	42681	Lown-ganong-levine syndrome
ICD-9†	42682	Long qt syndrome
ICD-9†	4269	Conduction disorder nos
ICD-9‡	4272	Paroxysmal tachycardia nos
ICD-9‡	7850	Tachycardia nos
ICD-9‡	42789	Cardiac dysrhythmias nec
ICD-9‡	4279	Cardiac dysrhythmia nos
ICD-9‡	42769	Premature beats nec
ICD-9§	39891	Rheumatic heart failure
ICD-9§	4280	Congestive heart failure
ICD-9§	4281	Left heart failure
ICD-9§	42820	Unspecified systolic heart failure
ICD-9§	42821	Acute systolic heart failure
ICD-9§	42823	Acute on chronic systolic heart failure
ICD-9§	42830	Unspecified diastolic heart failure
ICD-9§	42831	Acute diastolic heart failure
ICD-9§	42833	Acute on chronic diastolic heart failure
ICD-9§	42840	Unspec combined syst & dias heart failure
ICD-9§	42841	Acute combined systolic & diastolic heart failure
ICD-9§	42843	Acute on chronic combined systolic & diastolic heart failure
ICD-9§	4289	Heart failure nos
ICD-9**	5740	Calculus of gallbladder with acute cholecystitis

Code Type	Code	Description
ICD-9**	57400	Calculus of gallbladder with acute cholecystitis without mention of obstruction
ICD-9**	57401	Calculus of gallbladder with acute cholecystitis with obstruction
ICD-9**	5743	Calculus of bile duct with acute cholecystitis
ICD-9**	57430	Calculus of bile duct with acute cholecystitis without mention of obstruction
ICD-9**	57431	Calculus of bile duct with acute cholecystitis with obstruction
ICD-9**	5746	Calculus of gallbladder and bile duct with acute cholecystitis
ICD-9**	57460	Calculus of gallbladder and bile duct with acute cholecystitis without mention of obstruction
ICD-9**	57461	Calculus of gallbladder and bile duct with acute cholecystitis with obstruction
ICD-9**	5748	Calculus of gallbladder and bile duct with acute and chronic cholecystitis
ICD-9**	57480	Calculus of gallbladder and bile duct with acute and chronic cholecystitis without mention of obstruction
ICD-9**	57481	Calculus of gallbladder and bile duct with acute and chronic cholecystitis with obstruction
ICD-9**	5750	Acute cholecystitis
ICD-9**	57512	Acute and chronic cholecystitis
ICD-9**	5761	Cholangitis
ICD-9 <sup>††</sup>	5770	Acute pancreatitis

\*These ICD-9 codes represent acute ICD-9 codes within Dx CCS 97: Peri-; endo-; and myocarditis; cardiomyopathy

<sup>†</sup>These ICD-9 codes represent acute ICD-9 codes within Dx CCS 105: Conduction disorders

<sup>‡</sup>These ICD-9 codes represent acute ICD-9 codes within DX CCS 106: Dysrhythmia

<sup>§</sup>These ICD-9 codes represent acute ICD-9 codes within Dx CCS 108: Congestive heart failure; nonhypertensive

\*\* These ICD-9 codes represent acute ICD-9 codes within Dx CCS 149: Biliary tract disease

<sup>††</sup> This ICD-9 code represents acute ICD-9 codes within Dx CCS 152: Pancreatic disorders

## Appendix D: Measure Score Calculation and Reporting

### D1. Risk-Standardized Measure Score Calculation Algorithm

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

$$h(Y_{ij}) = \alpha_i + \beta \mathbf{Z}_{ij} \quad (1)$$

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

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

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

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

### D2. Provider Performance Reporting

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

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

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

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

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

### D3. 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 a HOPD is performing better than, worse than, or no different from expected. A HOPD is considered better than expected if its entire confidence interval falls below one, and considered worse if the entire confidence interval falls above one. It is considered no different if the confidence interval overlaps one.

More specifically, we use a bootstrapping procedure 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.

### D4. Bootstrapping Algorithm

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

1. Sample  $I$  HOPDs with replacement.
2. Fit the hierarchical logistic regression model using all patients within each sampled HOPD. We use as starting values the parameter estimates obtained by fitting the model to all HOPDs. If some HOPDs 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, HOPD adjusted outcomes, distribution,  $\hat{\mu}^{(b)}$  and  $\hat{\tau}^{2(b)}$ .
  - c. The set of facility-specific intercepts and corresponding variances:  $\{\hat{\alpha}_i^{(b)}, \hat{\text{var}}(\hat{\alpha}_i^{(b)}); i = 1, 2, \dots, I\}$ .
3. We generate a HOPD 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  $\alpha_i^{(b*)} \sim N(\hat{\alpha}_i^{(b)}, \hat{\text{var}}(\hat{\alpha}_i^{(b)}))$  for the unique set of HOPDs sampled in Step 1.
4. Within each unique HOPD  $i$  sampled in Step 1, and for each case  $j$  in that HOPD, we calculate  $\hat{y}_{ij}^{(b)}$ ,  $\hat{e}_{ij}^{(b)}$ , and  $\hat{s}_i(Z)^{(b)}$  where  $\hat{\beta}^{(b)}$  and  $\hat{\mu}^{(b)}$  are obtained from Step 2 and  $\hat{\alpha}_i^{(b*)}$  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**

<b>Candidate Patient Demographic, Comorbidity, and Procedural Complexity Variables for Risk Adjustment</b>	
<b>Variable Category</b>	<b>Rationale</b>
<b>Demographic Characteristics</b>	<b>Rationale</b>
Age	Increasing age is associated with greater risk of adverse events and unplanned hospital visits
Sex	Male sex is associated with greater risk of unplanned hospital visits
<b>Comorbidities (CC grouping)</b>	
HIV (CC 1)	Associated with increased risk of procedure related adverse events and unplanned hospital visits
Septic Shock (CC 2)	Associated with increased risk of infection, adverse events in the inpatient setting
Other Infection (CC 3-6)	Associated with increased risk of infection, adverse events
Cancer (CC 7 - 9)	Associated with increased risk of unplanned hospital visits
Diabetes and DM Complications (CC 15-19, 119, 120)	Associated with increased risk of procedure related adverse events and unplanned hospital visits
Protein-Caloric Malnutrition (CC 21)	Age related factor, Measure of functional impairment, associated with increased risk of hospitalization
Disorders of Fluid/Electrolyte/Acid-Base (CC 23)	Associated with increased risk of procedure related adverse events
Liver Disease (CC 25-30)	Associated with increased risk of procedure related adverse events and bleeding
Intestinal Obstruction Perforation (CC 31)	May increase the risk of adverse events/and or unplanned hospital visits
Pancreatic Disease (CC 32) and Peptic Ulcer, Hemorrhage, Other Specified Gastrointestinal Disorders (CC 34)	May increase the risk of adverse events/and or unplanned hospital visits
Inflammatory Bowel Disease (CC 33)	May increase the risk of adverse events/and or unplanned hospital visits
Bone/Joint/Muscle Infections/Necrosis (CC 37)	May increase the risk of adverse events/and or unplanned hospital visits
Musculoskeletal Group (CC 38-39, 41-42)	May increase the risk of adverse events/and or unplanned hospital visits
Hematological Disorders including Coagulation Defects and Iron Deficiency (CC 44-47)	May increase the risk of adverse events/and or unplanned hospital visits
Delirium and Encephalopathy (CC 48)	May increase the risk of adverse events/and or unplanned hospital visits
Dementia or Senility (CC 49-50)	Age related factor, Measure of functional impairment, associated with increased risk of hospitalization

<b>Candidate Patient Demographic, Comorbidity, and Procedural Complexity Variables for Risk Adjustment</b>	
<b>Variable Category</b>	<b>Rationale</b>
Drug and Alcohol Abuse/Dependence (CC 51-53)	Associated with increased risk of adverse events and hospital visits
Psychiatric Disorders (CC 54-56; 58 - 60)	Associated with increased risk of hospital visits
Hemiplegia, Paraplegia, Paralysis, Functional Disability (CC 67-69, 100-103, 177-178)	Age related factor, Measure of functional impairment, associated with increased risk of hospitalization
Polyneuropathy (CC 71)	May increase the risk of adverse events/and or unplanned hospital visits
Other Significant CNS Disease (CC 72-75)	May increase the risk of adverse events/and or unplanned hospital visits
Cardiorespiratory Arrest, Failure and Respiratory Dependence (CC 77-79)	May increase the risk of adverse events/and or unplanned hospital visits
Chronic Heart Failure (CC 80)	Heart disease is associated with an increased risk of cardiopulmonary adverse events post-surgery. Heart failure is associated with an increased risk of unplanned hospital visits
Ischemic Heart Disease (CC 81-84)	Associated with an increased risk of cardiopulmonary adverse events post-surgery
Valvular and Rheumatic Heart Disease (CC 86)	Associated with an increased risk of cardiopulmonary adverse events post-surgery
Hypertension and Hypertensive disease (CC 89-91)	Associated with an increased risk of adverse events post-surgery
Arrhythmias (CC 92-93)	Associated with an increased risk of cardiopulmonary adverse events post-surgery
Stroke/TIA (CC 95-97)	Associated with an increased risk of adverse events post-surgery
Cerebral Atherosclerosis, Aneurysm, and Other CVD (CC 98-99)	May increase the risk of adverse events/and or unplanned hospital visits
Vascular Disease (CC 104-106)	Associated with an increased risk of adverse events post-surgery
Chronic Lung Disease (CC 108-110)	Associated with increased risk of anesthesia and procedure related adverse events
Pneumonia (CC 111-113)	Associated with increased risk of anesthesia and procedure related adverse events
Pleural Effusion/Pneumothorax (CC 114)	May increase the risk of adverse events/and or unplanned hospital visits
Chronic Renal Disease (CC 128 - 131)	Associated with increased risk of procedure related adverse events and unplanned hospital visits
Nephritis (CC 132)	May increase the risk of adverse events/and or unplanned hospital visits
Urinary Obstruction and Retention (CC 133)	Associated with increased risk of procedure related adverse events especially urinary retention

<b>Candidate Patient Demographic, Comorbidity, and Procedural Complexity Variables for Risk Adjustment</b>	
<b>Variable Category</b>	<b>Rationale</b>
UTI and Other Urinary Tract Disorders (CC 135-136)	May increase the risk of adverse events/and or unplanned hospital visits
Pelvic Inflammatory Disease and Other Specified Female Genital Disorders (CC 138)	May increase the risk of adverse events/and or unplanned hospital visits
Male Genital Disorders (CC 140)	May increase the risk of adverse events/and or unplanned hospital visits
Chronic Ulcers (CC 148-149)	Age related factor, Measure of functional impairment, associated with increased risk of hospitalization
Prior Head Injury (CC 154-156)	May increase the risk of adverse events/and or unplanned hospital visits
Prior Significant Fracture (CC 157-159)	May increase the risk of adverse events/and or unplanned hospital visits
Morbid Obesity (ICD-9 code 278.01)	Associated with increased risk of anesthesia and procedure related adverse events in some studies
<b>Procedural Complexity</b>	
Work RVU	Work RVUs are assigned to each CPT procedure code and approximate procedure complexity by incorporating elements of physician time and effort
AHRQ Surgery Body System	Based on the AHRQ Clinical Classification System (CCS) which groups individual CPT codes by site of operation (body system). We adjust for this variable in addition to the RVU because this captures organ specific complexity and complications that are not adequately captured by the RVU value alone.

**Table E2. CCs that are not Risk-Adjusted for if they Only Occur at the Procedure**

<b>CC</b>	<b>Description</b>
17	Diabetes with Acute Complications
23	Disorders of Fluid/Electrolyte/Acid-Base
31	Intestinal Obstruction/Perforation
46	Coagulation Defects and Other Specified Gastrointestinal Disorders
75	Coma, Brain Compression/Anoxic Damage
77	Respirator Dependence/Tracheostomy Status
78	Respiratory Arrest
79	Cardio-Respiratory Failure and Shock
80	Congestive Heart Failure
81	Acute Myocardial Infarction
82	Unstable Angina and Other Acute Ischemic Heart Disease
92	Specified Heart Arrhythmias

<b>CC</b>	<b>Description</b>
93	Other Heart Rhythm and Conduction Disorders
100	Hemiplegia/Hemiparesis
101	Diplegia (Upper), Monoplegia, and Other Paralytic Syndromes
102	Speech, Language, Cognitive, Perceptual
104	Vascular Disease with Complications
105	Vascular Disease
106	Other Circulatory Disease
135	Urinary Tract Infection
152	Cellulitis, Local Skin Infection
158	Hip Fracture/Dislocation
159	Major Fracture, Except of Skull, Vertebrae, or Hip

## Appendix F: Top Surgeries per Body System and Top Discharge Diagnoses for Hospital Visits by Body System

**Table F1. Top 10 Surgeries per Body System Group in the HOPD Measure Cohort**

*Results are based on a 2010 20% sample of Medicare FFS patients aged ≥65 years*

Body System	CPT	CPT Description	#	% of All Surgeries within Body System
<b>Cardiovascular</b>	33233	Removal of pm generator	7,590	16.6
	33213	Insert pulse gen dual leads	6,290	13.8
	33241	Remove pulse generator	4,463	9.8
	33208	Insrt heart pm atrial & vent	4,408	9.7
	33240	Insrt pulse gen w/singl lead	4,202	9.2
	36821	Av fusion direct any site	2,697	5.9
	33249	Nsert pace-defib w/lead	2,456	5.4
	36870	Percut thrombect av fistula	1,608	3.5
	36830	Artery-vein nonautograft	1,480	3.2
	33212	Insert pulse gen sngl lead	1,414	3.1
<b>Digestive</b>	49505	Prp i/hern init reduc >5 yr	8,484	25.8
	47562	Laparoscopic cholecystectomy	6,407	19.5
	47563	Laparo cholecystectomy/ graph	3,014	9.2
	49650	Lap ing hernia repair init	1,956	6.0
	49560	Rpr ventral hern init reduc	1,943	5.9
	49585	Rpr umbil hern reduc > 5 yr	1,724	5.3
	49520	Rerepair ing hernia reduce	1,004	3.1
	49507	Prp i/hern init block >5 yr	725	2.2
	46260	Remove in/ex hem groups 2+	659	2.0
	49587	Rpr umbil hern block > 5 yr	613	1.9
<b>Ear</b>	69930	Implant cochlear device	221	15.1
	69631	Repair eardrum structures	202	13.8
	69110	Remove external ear partial	143	9.7
	69145	Remove ear canal lesion(s)	98	6.7
	69714	Implant temple bone w/stimul	97	6.6
	69643	Revise middle ear & mastoid	55	3.7
	69660	Revise middle ear bone	53	3.6
	69633	Rebuild eardrum structures	48	3.3
	69310	Rebuild outer ear canal	43	2.9
	69620	Repair of eardrum	42	2.9
<b>Endocrine</b>	60220	Partial removal of thyroid	526	78
	60210	Partial thyroid excision	59	8.8
	60225	Partial removal of thyroid	35	5.2
	60280	Remove thyroid duct lesion	24	3.6
	60200	Remove thyroid lesion	23	3.4
	60212	Partial thyroid excision	6	0.9
	60281	Remove thyroid duct lesion	1	0.1
<b>Female genitalia</b>	57240	Repair bladder & vagina	566	25.1

Body System	CPT	CPT Description	#	% of All Surgeries within Body System
	57250	Repair rectum & vagina	222	9.8
	58571	Tlh w/t/o 250 g or less	203	9.0
	57260	Repair of vagina	203	9.0
	56620	Partial removal of vulva	200	8.9
	57295	Revise vag graft via vagina	113	5.0
	57522	Conization of cervix	108	4.8
	57520	Conization of cervix	103	4.6
	58552	Laparo-vag hyst incl t/o	100	4.4
	57268	Repair of bowel bulge	70	3.1
<b>Hemic/lymphatic</b>	38525	Biopsy/removal lymph nodes	4,475	84.2
	38745	Remove armpit lymph nodes	283	5.3
	38740	Remove armpit lymph nodes	184	3.5
	38760	Remove groin lymph nodes	94	1.8
	38308	Incision of lymph channels	88	1.7
	38542	Explore deep node(s) neck	67	1.3
	38520	Biopsy/removal lymph nodes	63	1.2
	38700	Removal of lymph nodes neck	29	0.5
	38530	Biopsy/removal lymph nodes	12	0.2
	38555	Removal neck/armpit lesion	9	0.2
<b>Male genitalia</b>	52648	Laser surgery of prostate	3,265	31.3
	52601	Prostatectomy (TURP)	2,572	24.7
	55875	Transperi needle place pros	801	7.7
	55040	Removal of hydrocele	553	5.3
	55873	Cryoablate prostate	407	3.9
	55520	Removal of sperm cord lesion	367	3.5
	54405	Insert multi-comp penis pros	344	3.3
	52649	Prostate laser enucleation	297	2.8
	52630	Remove prostate regrowth	275	2.6
	54520	Removal of testis	234	2.2
<b>Musculoskeletal</b>	29881	Knee arthroscopy/surgery	4,782	6.5
	29880	Knee arthroscopy/surgery	4,100	5.5
	29827	Arthroscop rotator cuff repr	3,623	4.9
	26055	Incise finger tendon sheath	3,269	4.4
	28285	Repair of hammertoe	3,189	4.3
	29824	Shoulder arthroscopy/surgery	2,376	3.2
	20680	Removal of support implant	2,276	3.1
	29823	Shoulder arthroscopy/surgery	1,848	2.5
	23412	Repair rotator cuff chronic	1,654	2.2
	29822	Shoulder arthroscopy/surgery	1,363	1.8
<b>Nervous system</b>	64721	Carpal tunnel surgery	8,088	61.6
	29848	Wrist endoscopy/surgery	1,323	10.1
	64718	Revise ulnar nerve at elbow	952	7.3
	64581	Implant neuroelectrodes	930	7.1
	28080	Removal of foot lesion	297	2.3
	63655	Implant neuroelectrodes	287	2.2

<b>Body System</b>	<b>CPT</b>	<b>CPT Description</b>	<b>#</b>	<b>% of All Surgeries within Body System</b>
	64719	Revise ulnar nerve at wrist	236	1.8
	64708	Revise arm/leg nerve	124	0.9
	64704	Revise hand/foot nerve	72	0.5
	28035	Decompression of tibia nerve	65	0.5
<b>Nose, throat, pharynx</b>	30520	Repair of nasal septum	1,281	27.2
	30140	Resect inferior turbinate	790	16.8
	42415	Excise parotid gland/lesion	248	5.3
	30130	Excise inferior turbinate	198	4.2
	41112	Excision of tongue lesion	191	4.1
	30117	Removal of intranasal lesion	144	3.1
	42440	Excise submaxillary gland	140	3.0
	42826	Removal of tonsils	124	2.6
	40520	Partial excision of lip	102	2.2
	41120	Partial removal of tongue	99	2.1
<b>Respiratory</b>	31588	Revision of larynx	95	40.4
	31611	Surgery/speech prosthesis	46	19.6
	31613	Repair windpipe opening	22	9.4
	31820	Closure of windpipe lesion	17	7.2
	31825	Repair of windpipe defect	16	6.8
	31614	Repair windpipe opening	14	6.0
	31580	Revision of larynx	7	3.0
	31400	Revision of larynx	6	2.6
	31300	Removal of larynx lesion	4	1.7
	31582	Revision of larynx	3	1.3
<b>Skin/breast</b>	19301	Partical mastectomy	5,073	14.7
	19125	Excision breast lesion	3,230	9.4
	14060	Skin tissue rearrangement	2,998	8.7
	14040	Skin tissue rearrangement	2,254	6.5
	19120	Removal of breast lesion	2,109	6.1
	15260	Skin full graft een & lips	1,699	4.9
	19303	Mast simple complete	1,049	3.0
	14041	Skin tissue rearrangement	852	2.5
	19302	P-mastectomy w/ln removal	816	2.4
	15100	Skin splt grft trnk/arm/leg	794	2.3
<b>Urinary</b>	52332	Cystoscopy and treatment	9,625	20.77
	50590	Fragmenting of kidney stone	5,213	11.25
	52235	Cystoscopy and treatment	3,324	7.17
	52234	Cystoscopy and treatment	2,960	6.39
	52281	Cystoscopy and treatment	2,844	6.14
	52353	Cystouretero w/lithotripsy	2,769	5.97
	52310	Cystoscopy and treatment	2,672	5.76
	52224	Cystoscopy and treatment	2,646	5.71
	57288	Repair bladder defect	2,495	5.38
	52240	Cystoscopy and treatment	2,285	4.93

**Table F2. Top 10 Primary Diagnosis Codes for Unplanned Hospital Visits within 7 Days of Surgery by Body System Group for HOPD Surgery**

Results are based on a 2010 20% sample of Medicare FFS patients aged  $\geq 65$  years. *Note:* If a patient is admitted to a hospital directly after the HOPD surgery, the patient may have the same primary diagnosis as coded for the HOPD surgery.

Group	ICD-9 Code	ICD-9 Description	#	%
<b>Cardiovascular</b>	99673	Comp-ren dialys dev/grft	251	9.3
	4280	CHF NOS	191	7.1
	99601	Malfunc cardiac pacemake	100	3.7
	40391	Hyp kid NOS w cr kid V	76	2.8
	4260	Atriovent block complete	75	2.8
	42789	Cardiac dysrhythmias NEC	74	2.8
	99672	Comp-oth cardiac device	53	2.0
	99811	Hemorrhage complic proc	51	1.9
	42781	Sinoatrial node dysfunct	50	1.9
<b>Digestive</b>	78820	Retention urine NOS	244	9.9
	57400	Cholelith w ac cholecyst	179	7.2
	9974	Surg comp-digestv system	95	3.8
	9975	Surg compl-urinary tract	80	3.2
	78900	Abdmnal pain unspcf site	61	2.5
	99811	Hemorrhage complic proc	59	2.4
	56400	Constipation NOS	59	2.4
	33818	Acute postop pain NEC	58	2.3
	99812	Hematoma complic proc	50	2.0
	5750	Acute cholecystitis	40	1.6
<b>Ear</b>	1732	Malig neo skin ear	4	6.9
	99811	Hemorrhage complic proc	4	6.9
	38918	Sensonrl hear loss,bilat	3	5.2
	99739	Respiratory comp NEC	2	3.5
	38603	Actv Meniere, vestibular	2	3.5
	7804	Dizziness and giddiness	2	3.5
	78701	Nausea with vomiting	2	3.5
	38600	Meniere's disease NOS	2	3.5
	56039	Impaction intestine NEC	1	1.7
	38642	Oval window fistula	1	1.7
<b>Endocrine</b>	2411	Nontox multinodul goiter	4	12.1
	193	Malign neopl thyroid	3	9.1
	2410	Nontox uninodular goiter	3	9.1
	4280	CHF NOS	2	6.1
	42731	Atrial fibrillation	2	6.1
	226	Benign neoplasm thyroid	2	6.1
	78060	Fever NOS	1	3.0
	20280	Oth lymph unsp xtrndl org	1	3.0
	56211	Dvrtcli colon w/o hmrhg	1	3.0
	99812	Hematoma complic proc	1	3.0
<b>Female genitalia</b>	6202	Ovarian cyst NEC/NOS	7	6.9

Group	ICD-9 Code	ICD-9 Description	#	%
	56400	Constipation NOS	6	5.9
	61801	Cystocele, midline	5	5.0
	9975	Surg compl-urinary tract	4	4.0
<b>Hemic/lymphatic</b>	1749	Malign neopl breast NOS	24	13.4
	78820	Retention urine NOS	10	5.6
	99811	Hemorrhage complic proc	10	5.6
	1748	Malign neopl breast NEC	7	3.9
	56400	Constipation NOS	6	3.4
	99812	Hematoma complic proc	5	2.8
	2330	Ca in situ breast	5	2.8
	99859	Other postop infection	3	1.7
	41071	Subendo infarct, initial	3	1.7
	19889	Secondary malig neo NEC	3	1.7
<b>Male genitalia</b>	78820	Retention urine NOS	194	19.0
	99631	Malfunc urethral cath	48	4.7
	99811	Hemorrhage complic proc	47	4.6
	5990	Urin tract infection NOS	46	4.5
	60001	BPH w urinary obs/LUTS	41	4.0
	60784	Impotence, organic origin	40	3.9
	9975	Surg compl-urinary tract	39	3.8
	99676	Comp-genitourin dev/grft	31	3.0
	185	Malign neopl prostate	27	2.6
	V536	Fitting urinary devices	26	2.6
<b>Musculoskeletal</b>	8404	Sprain rotator cuff	108	2.8
	81342	Fx distal radius NEC-cl	103	2.7
	8244	Fx bimalleolar-closed	87	2.3
	33818	Acute postop pain NEC	80	2.1
	99859	Other postop infection	71	1.9
	78820	Retention urine NOS	71	1.9
	8246	Fx trimalleolar-closed	68	1.8
	99678	Comp-oth int ortho devic	66	1.7
	99642	Dislocate prosthetic jt	65	1.7
	81200	Fx up end humerus NOS-cl	65	1.7
<b>Nervous system</b>	3540	Carpal tunnel syndrome	14	4.1
	33818	Acute postop pain NEC	13	3.9
	7295	Pain in limb	10	3.0
	78659	Chest pain NEC	9	2.7
	72981	Swelling of limb	9	2.7
	9962	Malfun neuro device/graf	9	2.7
	7802	Syncope and collapse	8	2.4
	78820	Retention urine NOS	7	2.1
	81342	Fx distal radius NEC-cl	7	2.1
	5990	Urin tract infection NOS	6	1.8
<b>Nose, throat, pharynx</b>	99811	Hemorrhage complic proc	21	7.6
	5272	Sialoadenitis	21	7.6
	78820	Retention urine NOS	17	6.1
	32723	Obstructive sleep apnea	12	4.3

Group	ICD-9 Code	ICD-9 Description	#	%
	7847	Epistaxis	12	4.3
	2102	Ben neo major salivary	10	3.6
	99889	Oth spcf cmplc procd NEC	6	2.2
	486	Pneumonia, organism NOS	5	1.8
	78659	Chest pain NEC	5	1.8
	470	Deviated nasal septum	5	1.8
<b>Respiratory</b>	47831	Vocal paral unilat part	5	14.7
	51902	Tracheostomy - mech comp	4	11.8
	51909	Tracheostomy comp NEC	3	8.8
	78701	Nausea with vomiting	2	5.9
	47832	Vocal paral unilat total	2	5.9
	5070	Food/vomit pneumonitis	2	5.9
	47830	Vocal cord paralysis NOS	2	5.9
	56400	Constipation NOS	1	2.9
	5289	Oral soft tissue dis NEC	1	2.9
	51881	Acute respiratory failure	1	2.9
<b>Skin/breast</b>	99811	Hemorrhage complic proc	65	6.5
	1749	Malign neopl breast NOS	41	4.1
	99883	Non-healing surgcl wound	32	3.2
	99859	Other postop infection	31	3.1
	99812	Hematoma complic proc	24	2.4
	78820	Retention urine NOS	20	2.0
	99669	React-int pros devic NEC	14	1.4
	27651	Dehydration	14	1.4
	7802	Syncope and collapse	14	1.4
	78659	Chest pain NEC	14	1.4
<b>Urinary</b>	78820	Retention urine NOS	336	7.2
	5921	Calculus of ureter	254	5.5
	5990	Urin tract infection NOS	210	4.5
	5920	Calculus of kidney	151	3.3
	1889	Malig neo bladder NOS	144	3.1
	1888	Malig neo bladder NEC	127	2.7
	59970	Hematuria NOS	100	2.2
	99811	Hemorrhage complic proc	96	2.1
	60001	BPH w urinary obs/LUTS	89	1.9
	9975	Surg compl-urinary tract	80	1.7

**Note:**

1. Planned admissions are removed from the results; only unplanned hospital visits are provided.
2. Body system groupings are based on the AHRQ Clinical Classification Software (CCS) for procedures.

## **ERRATA**

### **1. Data Processing Error**

In preparation for the national confidential reporting (dry run) of a related measure – CMS’s Facility 7-Day Risk-Standardized Hospital Visit Rate after Outpatient Colonoscopy measure – we identified a data processing error in the coding of the input files, which we have corrected. The programming error incorrectly matched cases in which a patient had multiple procedures. These mismatches led to unnecessary exclusions from the cohort and incorrectly identified outcomes. The correction resulted in a slight increase in both the number of cases (1.5% increase in the cohort size) and the overall outcome rate (from 9.96% to 10.62%) for the surgery measure, but did not affect model performance or fit.

### **2. Odds Ratio Calculation Error**

Table 4 in the original technical report (Part 1, pages 35-36) contained a calculation error for the odds ratios of the body system variable. Corrected values are presented in the table below.

**Table 4 (Updated). Model Parameter Estimates and Odds Ratios in the Medicare Development and Validation Samples**

Variable	2010 Development Split Sample		2010 Validation Split Sample		2011 Validation Sample	
	Estimate	Odds Ratio (95% CI)	Estimate	Odds Ratio (95% CI)	Estimate	Odds Ratio (95% CI)
Intercept	-3.951	-	-3.848	-	-3.985	-
Age > 65	0.022	1.02 (1.02-1.03)	0.019	1.02 (1.02-1.02)	0.020	1.02 (1.02-1.02)
<b>Comorbidities</b>						
Cancer (CC 7-12)	0.051	1.05 (1.01-1.10)	0.096	1.10 (1.05-1.15)	0.076	1.08 (1.04-1.12)
Diabetes and DM Complications (CC 15-19, 119, 120)	0.076	1.08 (1.03-1.13)	0.034	1.03 (0.99-1.08)	0.089	1.09 (1.06-1.13)
Disorders of Fluid/Electrolyte/Acid-Base (CC 23)	0.122	1.13 (1.07-1.20)	0.148	1.16 (1.09-1.23)	0.156	1.17 (1.12-1.22)
Intestinal Obstruction/Perforation (CC 31)	0.163	1.18 (1.06-1.31)	0.226	1.25 (1.13-1.39)	0.207	1.23 (1.14-1.33)
Inflammatory Bowel Disease (CC 33)	0.192	1.21 (1.02-1.44)	-0.133	0.88 (0.72-1.06)	0.081	1.08 (0.95-1.24)
Bone/Joint/Muscle Infections/Necrosis (CC 37)	0.271	1.31 (1.15-1.50)	0.298	1.35 (1.18-1.54)	0.263	1.30 (1.18-1.44)
Hematological Disorders Including Coagulation Defects and Iron Deficiency (CC 44, 46, 47)	0.075	1.08 (1.03-1.13)	0.062	1.06 (1.01-1.12)	0.098	1.10 (1.06-1.14)
Dementia or Senility (CC 49-50)	0.138	1.15 (1.07-1.23)	0.141	1.15 (1.07-1.24)	0.142	1.15 (1.09-1.21)
Psychiatric Disorders (CC 54-60)	0.111	1.12 (1.06-1.18)	0.114	1.12 (1.06-1.18)	0.078	1.08 (1.04-1.12)
Hemiplegia, Paraplegia, Paralysis, Functional Disability (CC 67-69, 100-103, 177-178)	0.155	1.17 (1.07-1.27)	0.080	1.08 (0.99-1.18)	0.133	1.14 (1.07-1.22)
Other Significant CNS Disease (CC 72-75)	0.179	1.20 (1.09-1.31)	0.131	1.14 (1.04-1.25)	0.130	1.14 (1.06-1.22)
Cardiorespiratory Arrest, Failure and Respiratory Dependence (CC 77-79)	0.171	1.19 (1.09-1.29)	0.132	1.14 (1.05-1.24)	0.068	1.07 (1.01-1.14)
Chronic Heart Failure (CC 80)	0.133	1.14 (1.08-1.21)	0.208	1.23 (1.16-1.31)	0.167	1.18 (1.13-1.24)
Ischemic Heart Disease (CC 81-84)	0.081	1.08 (1.03-1.14)	0.089	1.09 (1.04-1.15)	0.103	1.11 (1.07-1.15)
Hypertension and Hypertensive Disease (CC 89-91)	0.071	1.07 (1.01-1.14)	0.025	1.03 (0.97-1.09)	0.021	1.02 (0.98-1.07)
Arrhythmias (CC 92-93)	0.076	1.08 (1.03-1.13)	0.115	1.12 (1.07-1.18)	0.117	1.12 (1.08-1.17)
Vascular Disease (CC 104-106)	0.084	1.09 (1.04-1.14)	0.071	1.07 (1.02-1.13)	0.064	1.07 (1.03-1.11)
Chronic Lung Disease (CC 108-110)	0.124	1.13 (1.08-1.19)	0.131	1.14 (1.09-1.20)	0.132	1.14 (1.10-1.18)
UTI and Other Urinary Tract Disorders (CC 135-136)	0.107	1.11 (1.06-1.17)	0.077	1.08 (1.03-1.13)	0.095	1.10 (1.06-1.14)
Pelvic Inflammatory Disease and Other Specified Female Genital Disorders (CC 138)	0.299	1.35 (1.22-1.49)	0.222	1.25 (1.13-1.39)	0.103	1.11 (1.02-1.20)

Variable	2010 Development Split Sample		2010 Validation Split Sample		2011 Validation Sample	
	Estimate	Odds Ratio (95% CI)	Estimate	Odds Ratio (95% CI)	Estimate	Odds Ratio (95% CI)
Chronic Ulcers (CC 148-149)	0.115	1.12 (1.03-1.23)	0.161	1.17 (1.08-1.28)	0.065	1.07 (1.00-1.14)
Cellulitis, Local Skin Infection (CC 152)	0.066	1.07 (1.00-1.14)	0.127	1.14 (1.06-1.21)	0.100	1.10 (1.05-1.16)
Prior Significant Fracture (CC157-159)	0.502	1.65 (1.53-1.78)	0.427	1.53 (1.42-1.66)	0.497	1.64 (1.55-1.74)
Morbid Obesity (ICD-9-CM code: 278.01)	0.272	1.31 (1.15-1.50)	0.230	1.26 (1.10-1.44)	0.236	1.27 (1.15-1.39)
<b>Procedural Information</b>						
Work Relative Value Units	0.137	1.15 (1.14-1.15)	0.136	1.15(1.14-1.15)	0.133	1.14 (1.14-1.15)
<i>Body System Operated On:</i>						
Cardiovascular	-0.366	0.69 (0.64-0.75)	-0.368	0.69 (0.64-0.75)	-0.388	0.68 (0.64-0.72)
Digestive	0.079	1.08 (1.01-1.16)	0.075	1.08 (1.00-1.16)	0.135	1.14 (1.08-1.21)
Ear	-1.701	0.18 (0.12-0.28)	-1.506	0.22 (0.15-0.32)	-1.358	0.26 (0.20-0.33)
Endocrine	0.838	2.31 (1.81-2.95)	0.835	2.30 (1.78-2.98)	0.819	2.27 (1.89-2.73)
Female Genitalia	0.358	1.43 (1.19-1.72)	0.229	1.26 (1.03-1.53)	0.423	1.53 (1.33-1.75)
Hemic-Lymphatic	-0.770	0.46 (0.34-0.63)	-0.503	0.60 (0.47-0.79)	-0.375	0.69 (0.57-0.84)
Skin & Breast	-0.963	0.38 (0.35-0.42)	-0.943	0.39 (0.36-0.43)	-0.864	0.42 (0.39-0.45)
Male Genitalia	0.162	1.18 (1.07-1.29)	0.109	1.12 (1.02-1.23)	0.126	1.13 (1.06-1.22)
Musculoskeletal	-0.369	0.69 (0.64-0.74)	-0.397	0.67 (0.62-0.72)	-0.300	0.74 (0.70-0.78)
Nervous	-1.230	0.29 (0.25-0.35)	-1.051	0.35 (0.30-0.41)	-1.152	0.32 (0.28-0.36)
Nose-Throat-Pharynx	0.031	1.03 (0.87-1.22)	-0.048	0.95 (0.81-1.13)	0.060	1.06 (0.94-1.20)
Respiratory	-0.250	0.78 (0.45-1.35)	-0.032	0.97 (0.58-1.61)	-0.011	0.99 (0.66-1.49)
Urinary	REF	1.00	REF	1.00	REF	1.00

## **2016 Technical Report Addendum**

### **Measure Updates and Specifications for Hospital Visits after Hospital Outpatient Surgery Version 1.1**

**Submitted by:**

Yale New Haven Health Services Corporation – Center for Outcomes Research and Evaluation  
(YNHHSC/CORE)

**Prepared for:**

Centers for Medicare & Medicaid Services (CMS)

**June 2016**

## TABLE OF CONTENTS

LIST OF TABLES .....	3
LIST OF FIGURES .....	3
1. INTRODUCTION .....	5
2. 2016 MEASURE UPDATES.....	6
2.1. Rationale for Measure Updates.....	6
2.2. Detailed Discussion of Measure Updates .....	7
2.2.1. Update Exclusion Criterion for Medicare FFS Enrollment.....	7
2.2.2. Addition of Exclusion Criterion for Same-Day, Separate-Claim ED Visits .....	7
2.2.3. Update to Handling of Multiple Qualifying Procedures within 7 Days .....	8
2.2.4. Update to Planned Admission Algorithm .....	8
2.2.5. Update to Version 22 of Hierarchical Condition Categories to Accommodate ICD-10-CM Codes.....	10
2.2.6. Clarification Regarding Surgeries on Same Claim as ED Visits or Observation Stays .....	12
2.2.7. Clarification Regarding Medicare’s List of Covered ASC Procedures to Define Low-to Moderate-Risk Same-Day Surgeries.....	12
3. UPDATED MODEL COHORT, RISK VARIABLE FREQUENCIES AND COEFFICIENTS, OUTCOME RATES, AND PERFORMANCE .....	14
3.1. Approaches to Evaluating Updated Model Specifications Using 2010 Surgery Dataset.....	14
3.2. Model Cohort Before and After Updates .....	14
3.3. Frequency of Risk Variables Before and After Updates.....	15
3.4. Risk Variable Coefficients Before and After Updates .....	17
3.5. Outcome Rates before and after Updates.....	19
3.6. Model Performance Before and After Updates.....	19
4. CURRENT MEASURE SPECIFICATIONS .....	21
4.1. Cohort .....	21
4.2. Risk Adjustment .....	22
4.3. Outcome .....	24
5. PLANNED ADMISSION ALGORITHM FOR SURGERY MEASURE VERSION 1.1 .....	26
6. COMPARISON OF VARIABLES AS DEFINED IN VERSION 12 AND VERSION 22 OF THE HIERARCHICAL CONDITION CATEGORY MODEL.....	42

## LIST OF TABLES

Table 2.2.1. Updates to Planned Readmission Algorithm Version 3.0 .....	10
Table 2.2.2. Risk-Adjustment Variable Frequencies as Defined by HCC Versions 12 and 22.....	11
Table 3.2.1. Impact of Updates to Cohort Exclusions.....	14
Table 3.3.1. Impact of Updates on Frequency of Risk Variables .....	15
Table 3.4.1. Impact of Updates on Logistic Regression Model Variable Coefficients and Odds Ratios .....	17
Table 3.5.1. Impact of Updates on Observed Number and Rate of 7-Day Unplanned Hospital Visits by Body System .....	19
Table 3.6.1. Impact of Updates on Logistic Regression Model Performance.....	19
Table 4.2.1. Risk Variables for Surgery Measure .....	22
Table 4.2.2. Complication-of-Care Variables Not Used in Risk Adjustment if Occurring Only During Procedure .....	23
Table 5.1. Procedure Categories that are Always Planned (Planned Readmission Algorithm Version 4.0 – adapted for HOPD Surgery Measure Version 1.1) .....	27
Table 5.2. Diagnosis Categories that are Always Planned (Planned Readmission Algorithm Version 4.0 – adapted for HOPD Surgery Measure Version 1.1) .....	27
Table 5.3. Procedure Categories that are Potentially Planned (Planned Readmission Algorithm Version 4.0 – adapted for HOPD Surgery Measure Version 1.1) .....	27
Table 5.4. Diagnosis Categories that are Acute (Planned Readmission Algorithm Version 4.0 – adapted for HOPD Surgery Measure Version 1.1) .....	32
Table 6.1. Comparison of Variables as Defined in Version 12 and Version 22 of the Hierarchical Condition Category System .....	42
Table 6.2. Complication-of-Care Variables Not Used in Risk Adjustment if Occurring Only During Procedure .....	46

## LIST OF FIGURES

Figure 5.1. Planned Admission Algorithm Flowchart .....	26
---	----

## **Center for Outcomes Research & Evaluation (CORE) Project Team**

Mayur M. Desai, Ph.D., M.P.H. – Project Lead

Craig S. Parzynski, M.S. – Lead Analyst

Rana Searfoss, B.A. – Project Coordinator

Hayley J. Dykhoff, B.A. – Research Assistant

Zhenqiu Lin, Ph.D. – Supporting Analyst

Megan LoDolce, M.A. – Project Manager

Lori Geary, M.P.H. – Project Associate Director

Harlan M. Krumholz, M.D., S.M. – Principal Investigator

Elizabeth E. Drye, M.D., S.M. – Project Director

### **Acknowledgements**

This work is a collaborative effort, and the authors gratefully acknowledge and thank the ongoing support of Mathematica Policy Research; Isuru Ranasinghe of the University of Adelaide; and Elizabeth Bainger, Vinitha Meyyur, and Pierre Yong at the Centers for Medicare & Medicaid Services for their contributions to this work.

## 1. INTRODUCTION

This addendum to the original measure technical report describes updates to the Centers for Medicare & Medicaid Services' (CMS's) Hospital Visits after Hospital Outpatient Surgery measure since the measure's endorsement by the National Quality Forum (NQF) in 2015. It also presents the current measure specifications and the results of routine testing performed on the revised measure.

[Section 2](#) of this addendum describes the updates to the measure made in 2016 and their rationale. Some measure updates arose as a result of stakeholder feedback received during CMS's confidential national reporting (dry run) for a related measure – the Facility 7-Day Risk-Standardized Hospital Visit Rate after Outpatient Colonoscopy measure. Additionally, other measure updates arose as part of the measure's regular reevaluation activities.

[Section 3](#) presents measure testing results.

[Section 4](#) presents the measure specifications for the updated version of the measure, Version 1.1. Readers who are interested in only the current specifications can skip to this section.

[Section 5](#) and [Section 6](#) present the detailed coding tables that accompany the measure specifications.

## 2. 2016 MEASURE UPDATES

### 2.1. Rationale for Measure Updates

Measure reevaluation ensures that the risk-standardized models are continually assessed and remain valid, given possible changes in clinical practice and coding standards over time. We modified the surgery measure to (1) adapt technical improvements identified during the recent national dry run of a related measure, Facility 7-Day Risk-Standardized Hospital Visit Rate after Outpatient Colonoscopy, and (2) incorporate routine updates to CMS's Planned Readmission Algorithm, as well as the transition to ICD-10 data. As this addendum describes, we made the following modifications to the surgery measure:

#### (1) Technical improvements

- Updated the exclusion criterion to exclude surgeries for patients who lack continuous enrollment in Medicare fee-for-service (FFS) Parts A and B in the 7 days after surgery;
- Added an exclusion criterion to exclude surgeries that are billed on the same day but on a separate claim as an emergency department (ED) visit, unless the ED visit has a diagnosis indicative of a complication of care; and
- Updated how the measure handles cases in which patients undergo two or more qualifying procedures within a 7-day period.

#### (2) Incorporation of component updates

- Applied changes from the updated Planned Readmission Algorithm Version 4.0, which were based on findings from a validation study and the review of those findings by clinical experts, to the surgery measure's planned admission algorithm; and
- Specified the risk variables and complication-of-care variables to the Hierarchical Condition Categories (HCC) Version 22 to accommodate ICD-10 codes in the current data.

In addition, this addendum describes clarifications regarding the measure's specifications:

- The measure does not include hospital outpatient department (HOPD) surgeries that appear on the same claim as an ED visit or observation stay; and
- The measure defines low- to moderate-risk same-day surgeries using the version of Medicare's list of covered ambulatory surgery center (ASC) procedures that corresponds with the data time period for measure calculation.

## 2.2. Detailed Discussion of Measure Updates

In this section, we describe each change or clarification, its rationale, and the impact it has on the surgery measure's cohort size or outcome rate, using the cohort derived from the 2010 Medicare FFS dataset (see original measure technical report, Part 1, Section 3.2 of this document, for a detailed description of datasets).

### 2.2.1. Update Exclusion Criterion for Medicare FFS Enrollment

The measure now excludes surgeries for patients who are not continuously enrolled in Medicare FFS Parts A and B for *at least 7 days* after the surgery (rather than at least 30 days, as specified in the original measure). CMS will continue to exclude patients with fewer than 7 days post-surgery enrollment to ensure all patients have full data available for outcome assessment. This is a minor adjustment shortening the requirement for continuous enrollment in order to exclude index procedures only when necessary.

#### Effect on the Measure

From an initial cohort size of 216,228 HOPD surgical procedures, this update decreased the number of cases excluded due to lack of continuous enrollment from 833 (0.40%) to 73 (0.03%), resulting in a net increase of 760 cases in the index cohort.

### 2.2.2. Addition of Exclusion Criterion for Same-Day, Separate-Claim ED Visits

The measure already does not include surgeries that appeared on the same hospital outpatient claim as an ED visit, since it is not possible to determine whether the surgery was the cause of, subsequent to, or during the ED visit. During the dry run of the Facility 7-Day Risk-Standardized Hospital Visit Rate after Outpatient Colonoscopy measure, however, facilities reported instances in which the measure counted same-day ED visits billed on separate claims ("same-day, separate-claim" cases) as outcomes, including ED visits that occurred before the colonoscopy procedure. Analysis of the dry run data indicated that the diagnoses on many of these same-day, separate-claim ED visits could be outcomes related to the preparation for the procedure or effects of the procedure. Consistent with the same-claim ED visit exclusion, the surgery measure will now also exclude surgeries in which a patient had an ED visit on the same day, but the ED visit was billed on a different claim, because we cannot determine the order of events.

However, the measure will *not* exclude surgeries with same-day, separate-claim ED visits when the diagnosis for the ED visit is indicative of a post-surgery complication. The measure classifies these diagnoses using the Agency for Healthcare Research and Quality (AHRQ) Clinical

Classification Software (CCS) groups. The measure considers ED visits with the following diagnoses as outcomes:

- AHRQ CCS 237 – Complication of device; implant or graft
- AHRQ CCS 238 – Complications of surgical procedures or medical care
- AHRQ CCS 257 – Other aftercare
- ICD-9-CM code 338.18 – Acute pain

In these scenarios, the procedure is counted in the index cohort and the ED visit is counted as an outcome.

#### Effect on the Measure

This exclusion criterion update resulted in excluding 537 (0.25%) surgeries from the index cohort. In addition, these 537 cases would no longer count as outcomes.

#### *2.2.3. Update to Handling of Multiple Qualifying Procedures within 7 Days*

Previously, the timeframe for outcome assessment was 7 days after each procedure that occurred within a 7-day period. Therefore, it was possible for a single outcome to be attributed to two or more index procedures. For example, consider the following scenario: a patient has Procedure #1 on Day 1, Procedure #2 on Day 4, and an ED visit on Day 6. Using the previous specifications, the outcome on Day 6 would be attributed to both of the procedures. Using the updated specifications, however, the outcome on Day 6 will be attributed to only the second procedure, and the outcome for the first procedure will be no hospital visit because there was no unplanned hospital visit between Procedures #1 and #2.

#### Effect on the Measure

This resulted in decreasing the observed outcome rate from 10.49% to 10.45%. This change was negligible, as only 1,229 (0.6%) patients in the measure had two or more procedures within 7 days.

#### *2.2.4. Update to Planned Admission Algorithm*

CMS's Planned Readmission Algorithm Version 4.0 distinguishes between planned and unplanned hospital visits based on the procedures performed and the primary discharge diagnoses of the visits. CMS modified Version 3.0 and is using Version 4.0 for 2016 public reporting of the readmission measures used in the Hospital Inpatient Quality Reporting program. We had previously adapted Version 3.0 for identifying planned admissions in the surgery measure. Version 4.0 incorporates improvements made following a validation study of

the algorithm which used data from a medical record review of 634 charts at 7 hospitals and review of the results of that study by clinical experts.

We reviewed the changes for their applicability to the surgery measure. We found them to be applicable, and thus have incorporated them into the measure. We briefly describe the changes here and present a rationale for each in [Table 2.2.1](#) below. More information about the changes from Version 3.0 to Version 4.0 is available in Section 3.2.1 of the 2016 Hospital-Wide All-Cause Readmission Measure Updates and Specifications Report, available on the QualityNet website at: ([www.qualitynet.org](http://www.qualitynet.org)) > Hospitals – Inpatient > Claims-Based Measures > Readmission Measures > Measure Methodology.

#### Removal of Potentially Planned Procedure Categories

Version 4.0 of the Planned Readmission Algorithm removes the following five AHRQ CCS categories from the potentially planned procedure list (see [Table 5.3](#)) because, in the validation study, admissions with these procedures were more often unplanned rather than planned:

- AHRQ CCS 47 - Diagnostic cardiac catheterization; coronary arteriography
- AHRQ CCS 48 - Insertion; revision; replacement; removal of cardiac pacemaker or cardioverter/defibrillator
- AHRQ CCS 62 - Other diagnostic cardiovascular procedures
- AHRQ CCS 157 - Amputation of lower extremity
- AHRQ CCS 169 - Debridement of wound; infection or burn

#### Addition of Potentially Planned Procedures Category

Version 4.0 of the Planned Readmission Algorithm adds AHRQ CCS procedure category 1, Incision and excision of CNS (central nervous system), to the potentially planned procedure list (see [Table 5.3](#)).

The rationale for each change is listed in [Table 2.2.1](#). The full list of codes for the surgery measure's planned admission algorithm (adapted from the Planned Readmission Algorithm Version 4.0) is located in [Section 5](#).

**Table 2.2.1. Updates to Planned Readmission Algorithm Version 3.0**

Action	Procedure category	Rationale
<b>Remove from potentially planned procedure list</b>	Diagnostic cardiac catheterization; coronary arteriography (AHRQ CCS 47)	These cardiac procedures are rarely the main reason for an elective inpatient hospitalization. Typically, these procedures are done during an observation stay. Removal of these procedure categories from the potentially planned procedures list reduces the rate of misclassification of unplanned readmissions as planned.
	Insertion; revision; replacement; removal of cardiac pacemaker or cardioverter/defibrillator (AHRQ CCS 48)	
	Other diagnostic cardiovascular procedures (AHRQ CCS 62)	
	Amputation of lower extremity (AHRQ CCS 157)	Readmissions for these procedures typically represent worsening of wound unresponsive to previous management.
	Debridement of wound; infection or burn (AHRQ CCS 169)	Removal of these procedure categories from the potentially planned procedures list reduces the rate of misclassification of unplanned readmissions as planned.
<b>Add to potentially planned procedure list</b>	Incision and excision of CNS (AHRQ CCS 1)	Patients admitted with newly diagnosed brain tumors may be electively readmitted for definitive management. The addition of this procedure category to the acute diagnoses list reduces the misclassification of planned readmissions as unplanned.

### Effect on the Measure

These changes improve the accuracy of the algorithm by decreasing the number of readmissions that the algorithm mistakenly designated as planned or unplanned. After accounting for the refinement in the handling of multiple qualifying procedures within 7 days (see [Section 2.2.3](#) above), the changes to the planned admission algorithm slightly increased the observed outcome rate from 10.45% to 10.48%.

### *2.2.5. Update to Version 22 of Hierarchical Condition Categories to Accommodate ICD-10-CM Codes*

The clinical variables used in the measure’s risk-adjustment model are defined using CMS’s Hierarchical Condition Categories (HCCs), which group the thousands of ICD-9 diagnosis codes into fewer than 200 clinically-coherent categories. We use the HCCs, without the hierarchical logic, to group diagnoses into risk variables. Most of our risk variables are made up of several related CCs.

CMS maintains the HCC system, updating HCCs to reflect changes in coding. The HCC version used to develop the surgery measure, Version 12, groups only ICD-9 codes. To accommodate the current use of ICD-10 codes, we re-specified the risk variable definitions using Version 22, which maps either ICD-9 or ICD-10 codes into CCs.

The goal of specifying the measure in Version 22 and ICD-10 was to maintain the fidelity of the variables originally defined with Version 12. The challenge was that the two HCC versions group ICD-9 diagnoses slightly differently, so some of the CCs do not contain exactly the same ICD-9 content. In addition, ICD-9 and ICD-10 codes do not correspond one-to-one, so, even where a CC includes the same ICD-9 codes in both versions, the corresponding ICD-10 for the CC may cover a slightly different range of diagnoses than the ICD-9 codes for the CC.

We, therefore, approximated the original variables defined in Version 12/ICD-9 as closely as we could using Version 22 (see [Table 6.1](#) in [Section 6](#) for variable definitions in both Version 12 and Version 22). We additionally specified the list of risk variables that are not used in risk adjustment if they occur only during the index procedure (also called the complication-of-care variables) to use Version 22 (see [Table 6.2](#) in [Section 6](#)). We clinically reviewed all variables for which the switch to Version 22 notably changed the diagnoses included in the variable. Finally, after redefining the risk-adjustment variables in Version 22, we examined the change in frequency of each risk variable using our ICD-9-coded 2010 surgery cohort (see [Table 2.2.2](#) below).

### Effect on the Measure

Overall, updating the variables to HCC Version 22 had little effect on the frequencies of the risk factors used for risk adjustment. We will further test the impact of these changes as ICD-10 data become available.

**Table 2.2.2. Frequencies of CC Risk-Adjustment Variables, as Defined by HCC Version 12 and Version 22**

Risk-Adjustment Variable	HCC Version 12		HCC Version 22	
	#	%	#	%
Cancer	81,482	37.79	81,482	37.79
Diabetes and DM Complications	79,355	36.80	79,455	36.85
Disorders of Fluid/ Electrolyte/ Acid-Base	39,807	18.46	39,807	18.46
Intestinal Obstruction/ Perforation	6,907	3.20	6,907	3.20
Inflammatory Bowel Disease	176,171	81.70	175,654	81.46
Bone/ Joint/ Muscle Infections/ Necrosis	2,767	1.28	2,767	1.28
Hematological Disorders Including Coagulation Defects and Iron Deficiency	5,269	2.44	5,236	2.43
Dementia or Senility	78,778	36.54	78,776	36.53
Psychiatric Disorders	20,631	9.57	20,631	9.57

Risk-Adjustment Variable	HCC Version 12		HCC Version 22	
	#	%	#	%
Hemiplegia, Paraplegia, Paralysis, Functional Disability	45,732	21.21	44,752	20.76
Other Significant CNS Disease	12,267	5.69	10,357	4.80
Cardiorespiratory Arrest, Failure and Respiratory Dependence	10,176	4.72	10,176	4.72
Chronic Heart Failure	14,439	6.70	9,376	4.35
Ischemic Heart Disease	47,698	22.12	47,704	22.12
Hypertension and Hypertensive Disease	84,745	39.30	84,745	39.30
Arrhythmias	79,827	37.02	79,803	37.01
Vascular Disease	79,839	37.03	79,839	37.03
Chronic Lung Disease	58,095	26.94	58,095	26.94
UTI and other Urinary Tract Disorders	98,132	45.51	95,662	44.37
Pelvic Inflammatory Disease and Other Specified Female Genital Disorders	9,441	4.38	9,441	4.38
Chronic Ulcers	14,186	6.58	14,186	6.58
Cellulitis, Local Skin Infection	29,520	13.69	29,520	13.69
Prior Significant Fracture	14,152	6.56	14,152	6.56

### 2.2.6. Clarification Regarding Surgeries on Same Claim as ED Visits or Observation Stays

The measure does not include surgeries that are billed on the same hospital outpatient claim as an ED visit or observation stay. This is not a measure update; rather, it is a clarification of the original measure specifications. CMS decided to not include these surgeries in the measure calculation because the sequence of events in these cases is not clear. It is not possible to use claims data to determine whether the surgery was the cause of, subsequent to, or during the ED visit or observation stay.

### 2.2.7. Clarification Regarding Medicare’s List of Covered ASC Procedures to Define Low- to Moderate-Risk Same-Day Surgeries

The measure includes a clinically-coherent group of low- to moderate-risk surgeries that can be safely performed as same-day surgeries and do not typically require an overnight stay or an inpatient admission (except for eye surgeries). Operationally, we limit inclusion of HOPD surgeries to those on Medicare’s list of covered ASC procedures. This list is maintained annually, and we will use the list that corresponds with the data time period used for measure calculation. This list of surgeries is publicly available at:

<https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/ASCPayment/ASC-Regulations-and-Notices.html> (see Addendum AA of the Final Rule with Comment Period).

Further, we restrict Medicare’s list of covered ASC procedures using the Global Surgical Package

(GSP) indicator. Only procedures indicated as 090 (90-day post-operative period; major procedures) are included in this measure. Information about the GSP can be found at: <https://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/downloads/GlobalSurgery-ICN907166.pdf>. GSP indicators for Current Procedural Terminology (CPT) codes can be found using the CMS tool located at: <https://www.cms.gov/apps/physician-fee-schedule/overview.aspx>.

### 3. UPDATED MODEL COHORT, RISK VARIABLE FREQUENCIES AND COEFFICIENTS, OUTCOME RATES, AND PERFORMANCE

#### 3.1. Approaches to Evaluating Updated Model Specifications Using 2010 Surgery Dataset

We evaluated the updated model specifications in the dataset used for measure development. The dataset includes Medicare FFS claims for surgeries performed from January to December 2010 (see original technical report, Section 3.2 of Part 1 of this document, for details on this dataset). Specifically, we examined changes in (1) model cohort, (2) frequency of risk variables, (3) risk variable coefficients, (4) outcome rates, and (5) model performance before and after the updates described in [Section 2](#).

We computed two summary statistics to assess model performance: the predictive ability according to deciles of patient risk and the area under the receiver operating characteristic (ROC) curve as a c-statistic. The c-statistic is an indicator of the model’s discriminant ability or ability to correctly classify those who have and have not returned for a hospital visit within 7 days of their surgery. Potential values range from 0.5, meaning no better than chance, to 1.0, an indication of perfect prediction. Perfect prediction implies patients’ outcomes can be predicted completely by their risk factors, and physicians and hospitals play no role in patients’ outcomes.

#### 3.2. Model Cohort Before and After Updates

The current exclusion criteria for the measure are presented in [Section 4.1](#). The number and percentage of surgeries meeting each exclusion criterion in the dataset are presented in [Table 3.2.1](#) below. Note that the numbers excluded are not mutually exclusive. As the results in the table show, updates to the exclusion criteria had a negligible impact on the surgery measure cohort; there was a net increase of 225 cases.

**Table 3.2.1. Impact of Updates to Cohort Exclusions**

Exclusion Criterion	Cohort Before Updates (N=216,228)	Cohort After Updates (N=216,228)	Net Change
Surgeries for patients who lacked continuous enrollment in Medicare FFS Parts A and B in the 7 days after surgery - number (%) excluded	833 (0.40%)	73 (0.03%)	760
Surgeries with same-day, separate-claim ED visits - number (%) excluded	n/a	537 (0.25%)	-537
<b>Final Cohort</b>	215,395	215,620	225

### 3.3. Frequency of Risk Variables Before and After Updates

We examined the change in frequency of the demographic and clinical risk variables. As the results in [Table 3.3.1](#) below show, variable frequencies remained largely unchanged. Note that the work Relative Value Units (RVUs) approximate surgical procedural complexity by incorporating elements of physician time and effort. For patients with multiple concurrent CPT procedure codes, we risk adjust for the CPT code with the highest work RVU value. Additionally, anatomical body system groups are defined using AHRQ CCSs and are maintained by AHRQ. Please note that the dataset used for this analysis did not include any ICD-10 claims data because ICD-10 codes were not yet in use.

**Table 3.3.1 Impact of Updates on Frequency of Risk Variables**

Risk Factor	Before Updates		After Updates	
	#	%	#	%
N	215,395	-	215,620	-
Age – mean (SD)	75.95	6.99	75.95	7.00
<b>Comorbidities</b>				
Cancer	81,385	37.78	81,482	37.79
Diabetes and DM Complications	79,203	36.77	79,455	36.85
Disorders of Fluid/Electrolyte/Acid-Base	39,662	18.41	39,807	18.46
Intestinal Obstruction/Perforation	6,889	3.20	6,907	3.20
Inflammatory Bowel Disease	2,767	1.28	2,767	1.28
Bone/Joint/Muscle Infections/Necrosis	5,250	2.44	5,236	2.43
Hematological Disorders Including Coagulation Defects and Iron Deficiency	78,575	36.48	78,776	36.53
Dementia or Senility	20,535	9.53	20,631	9.57
Psychiatric Disorders	45,632	21.19	44,752	20.76
Hemiplegia, Paraplegia, Paralysis, Functional Disability	12,229	5.68	10,357	4.80
Other Significant CNS Disease	10,151	4.71	10,176	4.72
Cardiorespiratory Arrest, Failure and Respiratory Dependence	14,369	6.67	9,376	4.35
Chronic Heart Failure	47,511	22.06	47,704	22.12
Ischemic Heart Disease	84,609	39.28	84,745	39.30
Hypertension and Hypertensive Disorders	175,972	81.70	175,654	81.46
Arrhythmias	79,628	36.97	79,803	37.01
Vascular Disease	79,657	36.98	79,839	37.03
Chronic Lung Disease	57,961	26.91	58,095	26.94
UTI and Other Urinary Tract Disorders	97,950	45.47	95,662	44.37
Pelvic Inflammatory Disease and Other Specified Female Genital Disorders	9,427	4.38	9,441	4.38
Chronic Ulcers	14,131	6.56	14,186	6.58
Cellulitis, Local Skin Infection	29,447	13.67	29,520	13.69

Risk Factor	Before Updates		After Updates	
	#	%	#	%
Prior Significant Fracture	14,120	6.56	14,152	6.56
Morbid Obesity	4,829	2.24	4,834	2.24
<b>Procedural Information:</b>				
Work Relative Value Units	8.46	3.66	8.46	3.66
<i>Body System Operated On:</i>				
Cardiovascular	32,338	15.01	32,478	15.06
Digestive	32,108	14.91	32,123	14.90
Ear	1,286	0.60	1,287	0.60
Endocrine	718	0.33	718	0.33
Female Genitalia	1,798	0.83	1,801	0.84
Hemic-Lymphatic	1,632	0.76	1,635	0.76
Skin & Breast	30,081	13.97	30,138	13.98
Male Genitalia	9,814	4.56	9,829	4.56
Musculoskeletal	52,209	24.24	52,195	24.21
Nervous	11,256	5.23	11,272	5.23
Nose-Throat-Pharynx	3,661	1.70	3,667	1.70
Respiratory	226	0.10	224	0.10
Urinary	38,268	17.77	38,253	17.74

### 3.4. Risk Variable Coefficients Before and After Updates

[Table 3.4.1](#) below shows the logistic regression model variable coefficients and corresponding odds ratios before and after the model specification updates. Overall, the variable effect sizes remained largely unchanged.

**Table 3.4.1 Impact of Updates on Logistic Regression Model Variable Coefficients and Odds Ratios**

Parameter	Before Updates			After Updates		
	Estimate	SE	Odds Ratio (95% CI)	Estimate	SE	Odds Ratio (95% CI)
Intercept	-3.794	0.03	-	-3.885	0.03	-
Age > 65	0.020	0.00	1.02 (1.02-1.02)	0.020	0.00	1.02 (1.02-1.02)
<b>Comorbidities</b>						
Cancer	0.063	0.02	1.07 (1.03-1.10)	0.071	0.02	1.07 (1.04-1.11)
Diabetes and DM Complications	0.066	0.02	1.07 (1.04-1.10)	0.067	0.02	1.07 (1.04-1.10)
Disorders of Fluid/Electrolyte/Acid-Base	0.118	0.02	1.13 (1.08-1.17)	0.125	0.02	1.13 (1.09-1.18)
Intestinal Obstruction/Perforation	0.159	0.04	1.17 (1.09-1.26)	0.166	0.04	1.18 (1.10-1.26)
Inflammatory Bowel Disease	0.026	0.06	1.03 (0.91-1.16)	0.028	0.06	1.03 (0.91-1.16)
Bone/Joint/Muscle Infections/Necrosis	0.302	0.04	1.35 (1.24-1.47)	0.307	0.04	1.36 (1.25-1.48)
Hematological Disorders Including Coagulation Defects and Iron Deficiency	0.075	0.02	1.08 (1.04-1.11)	0.083	0.02	1.09 (1.05-1.12)
Dementia or Senility	0.130	0.02	1.14 (1.09-1.19)	0.147	0.02	1.16 (1.11-1.21)
Psychiatric Disorders	0.111	0.02	1.12 (1.08-1.16)	0.108	0.02	1.11 (1.08-1.15)
Hemiplegia, Paraplegia, Paralysis, Functional Disability	0.117	0.03	1.12 (1.06-1.19)	0.123	0.03	1.13 (1.06-1.20)
Other Significant CNS Disease	0.143	0.03	1.15 (1.08-1.23)	0.143	0.03	1.15 (1.08-1.23)
Cardiorespiratory Arrest, Failure and Respiratory Dependence	0.156	0.03	1.17 (1.11-1.23)	0.129	0.03	1.14 (1.07-1.21)
Chronic Heart Failure	0.165	0.02	1.18 (1.13-1.23)	0.181	0.02	1.20 (1.15-1.25)
Ischemic Heart Disease	0.077	0.02	1.08 (1.05-1.12)	0.072	0.02	1.07 (1.04-1.11)
Hypertension and Hypertensive Disorders	0.047	0.02	1.05 (1.00-1.09)	0.043	0.02	1.04 (1.00-1.09)
Arrhythmias	0.089	0.02	1.09 (1.06-1.13)	0.096	0.02	1.10 (1.07-1.14)
Vascular Disease	0.080	0.02	1.08 (1.05-1.12)	0.086	0.02	1.09 (1.06-1.13)
Chronic Lung Disease	0.113	0.02	1.12 (1.08-1.16)	0.128	0.02	1.14 (1.10-1.17)
UTI and Other Urinary Tract Disorders	0.081	0.02	1.08 (1.05-1.12)	0.091	0.02	1.10 (1.06-1.13)

Parameter	Before Updates			After Updates		
	Estimate	SE	Odds Ratio (95% CI)	Estimate	SE	Odds Ratio (95% CI)
Pelvic Inflammatory Disease and Other Specified Female Genital Disorders	0.196	0.03	1.22 (1.14-1.30)	0.213	0.03	1.24 (1.16-1.32)
Chronic Ulcers	0.117	0.03	1.12 (1.06-1.19)	0.121	0.03	1.13 (1.07-1.19)
Cellulitis, Local Skin Infection	0.117	0.02	1.12 (1.08-1.17)	0.123	0.02	1.13 (1.08-1.18)
Prior Significant Fracture	0.448	0.03	1.56 (1.49-1.65)	0.461	0.03	1.59 (1.51-1.67)
Morbid Obesity	0.194	0.04	1.21 (1.11-1.32)	0.199	0.04	1.22 (1.12-1.33)
<b>Procedural Information</b>						
Work Relative Value Units	0.133	0.00	1.14 (1.14-1.15)	0.137	0.00	1.15 (1.14-1.15)
<i>Body System Operated On:</i>						
Cardiovascular	-0.379	0.03	0.68 (0.65-0.72)	-0.355	0.03	0.70 (0.66-0.74)
Digestive	0.018	0.03	1.02 (0.97-1.07)	0.040	0.03	1.04 (0.99-1.09)
Ear	-1.636	0.14	0.19 (0.15-0.26)	-1.629	0.14	0.20 (0.15-0.26)
Endocrine	0.742	0.09	2.10 (1.77-2.49)	0.771	0.09	2.16 (1.82-2.57)
Female Genitalia	0.240	0.07	1.27 (1.11-1.45)	0.258	0.07	1.29 (1.13-1.48)
Hemic-Lymphatic	-0.610	0.10	0.54 (0.45-0.66)	-0.596	0.10	0.55 (0.46-0.67)
Skin & Breast	-0.972	0.03	0.38 (0.36-0.40)	-0.943	0.03	0.39 (0.37-0.41)
Male Genitalia	0.116	0.03	1.12 (1.05-1.20)	0.140	0.03	1.15 (1.08-1.23)
Musculoskeletal	-0.411	0.03	0.66 (0.63-0.70)	-0.404	0.03	0.67 (0.63-0.70)
Nervous	-1.193	0.06	0.30 (0.27-0.34)	-1.167	0.06	0.31 (0.28-0.35)
Nose-Throat-Pharynx	-0.064	0.06	0.94 (0.84-1.05)	-0.034	0.06	0.97 (0.86-1.08)
Respiratory	-0.139	0.19	0.87 (0.60-1.25)	-0.177	0.19	0.84 (0.58-1.22)
Urinary	Reference			Reference		

### 3.5. Outcome Rates Before and After Updates

As the results in [Table 3.5.1](#) show, the updates to the measure specifications had little effect on the observed outcomes; 7-day unplanned hospital visit rates were comparable before and after the updates for each body system operated on. As noted above, anatomical body system groups are defined using AHRQ CCSs and are maintained by AHRQ.

**Table 3.5.1 Impact of Updates on Observed Number and Rate of 7-Day Unplanned Hospital Visits by Body System**

Body System Operated on	Before Updates		After Updates	
	Number of Outcomes	Outcome Rate	Number of Outcomes	Outcome Rate
<b>Overall</b>	<b>22,866</b>	<b>10.62</b>	<b>22,538</b>	<b>10.45</b>
Cardiovascular	3,995	12.35	4,005	12.33
Digestive	4,455	13.88	4,399	13.69
Ear	58	4.51	57	4.43
Endocrine	194	27.02	193	26.88
Female Genitalia	397	22.08	397	22.04
Hemic-Lymphatic	125	7.66	123	7.52
Integumentary	1,897	6.31	1,895	6.29
Male Genitalia	2,102	21.42	2,101	21.38
Musculoskeletal	4,679	8.96	4,549	8.72
Nervous	359	3.19	351	3.11
Nose-Throat-Pharynx	404	11.04	401	10.94
Respiratory	38	16.81	36	16.07
Urinary	4,163	10.88	4,031	10.54

### 3.6. Model Performance Before and After Updates

Finally, [Table 3.6.1](#) shows the overall model performance before and after the model specification updates. After the updates, the c-statistic increased slightly from 0.699 to 0.704.

**Table 3.6.1 Impact of Updates on Logistic Regression Model Performance**

Characteristic	Before Updates	After Updates
Predictive ability, % (lowest decile – highest decile)	2.67 – 26.88	2.57 – 27.01
c-statistic	0.699	0.704

In summary, we have updated the measure as part of the annual measure reevaluation. Changes to the measure specifications included 1) updating the cohort exclusion criteria, 2)

updating how the measure handles multiple qualifying procedures within 7 days, 3) updating the planned admission algorithm, and 4) updating the model variables to adapt to ICD-10 coding. These refinements of the measure specifications had little effect on the model cohort, risk variable frequencies and coefficients, outcome rates, and model performance.

## 4. CURRENT MEASURE SPECIFICATIONS

### 4.1. Cohort

#### Inclusion Criteria

**1. Surgeries and procedures that are substantial and are typically performed as same-day surgeries**

Rationale: The target cohort is low- to moderate-risk surgeries that can be safely performed as same-day surgeries and do not typically require an overnight stay or an inpatient admission. In addition, they do not occur in conjunction with a same-day emergency department (ED) visit or observation stay. We define same-day surgeries using the Centers for Medicare & Medicaid Services (CMS) ambulatory surgery center (ASC) approved procedure list. The list is comprised of procedures for which the patients are expected to return home the same day as their procedure. We include two types of procedures from this list:

**a. Substantive surgeries performed at hospital outpatient departments (HOPDs) (except eye surgeries)**

Rationale: Ambulatory procedures include a heterogeneous mix of non-surgical procedures, minor surgeries, and more substantive surgeries. We want to include substantive surgeries but not very low-risk (minor) surgeries or non-surgical procedures which typically have a high volume and a very low outcome rate. We define substantive procedures using the Medicare Physician Fee Schedule (MPFS) global surgery indicator (GSI) code 090, which indicates major surgery.

**b. Cystoscopy procedures with intervention**

Rationale: All endoscopy procedures are considered non-surgical procedures based on Medicare coding (GSI code 000). However, we include cystoscopy with intervention because it is a common procedure, often performed for therapeutic intervention by surgical teams, and the outcome rate and causes of hospital visits post-procedure are similar to those for surgeries in the measure cohort.

**2. Surgeries on patients aged 65 or over**

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.

**3. When multiple procedures occur concurrently, we only include surgeries that are performed concurrently with another low- to moderate-risk procedure**

Rationale: Occasionally, more than one surgery may be performed and some of these surgeries may be higher-risk procedures. When multiple procedures occur, we only

include surgeries that are performed concurrently with other surgeries and procedures listed on Medicare’s list of covered ASC procedures.

**4. Surgeries for patients with continuous enrollment in Medicare Fee-for-Service (FFS) Parts A and B in the 12 months prior to the surgery**

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

Exclusion Criteria

**1. Surgeries for patients without continuous enrollment in Medicare FFS Parts A and B in the 7 days after the surgery**

Rationale: We exclude these patients to ensure all patients have full data available for outcome assessment.

**2. Surgeries for patients who have an ED visit on the same day but billed on a separate claim, unless the ED visit has a diagnosis indicative of a complication of care**

Rationale: The sequence of events is not clear. However, the measure will not exclude surgeries with same-day, separate-claim ED visits if the diagnoses are indicative of a complication of care because we want to continue to capture these outcomes.

**4.2. Risk Adjustment**

The tables below list the risk-adjustment variables included in the surgery measure risk model, as specified in Hierarchical Condition Category (HCC) Version 22. See [Section 6](#) for the risk variable crosswalks comparing the Condition Categories (CCs) used in HCC Versions 12 and 22. The full list of codes for the surgery measure’s planned admission algorithm (adapted from the Planned Readmission Algorithm Version 4.0) is located in [Section 5](#).

**Table 4.2.1. Risk Variables for Surgery Measure**

Description	Codes used to define variable (HCC Version 22)
Age minus 65 (years above 65, continuous)	n/a
Cancer	CC 8-14
Diabetes and DM Complications	CC 17-19, 122, 123
Disorders of Fluid/ Electrolyte/ Acid-Base	CC 24
Intestinal Obstruction/ Perforation	CC 33
Inflammatory Bowel Disease	CC 35
Bone/ Joint/ Muscle Infections/ Necrosis	CC 39
Hematological Disorders Including Coagulation Defects and Iron Deficiency	CC 46, 48, 49
Dementia or Senility	CC 51-53

Description	Codes used to define variable (HCC Version 22)
Psychiatric Disorders	CC 57-63
Hemiplegia, Paraplegia, Paralysis, Functional Disability	CC 70, 71, 73, 74, 103-105, 189, 190
Other Significant CNS Disease	CC 77-80
Cardiorespiratory Arrest, Failure and Respiratory Dependence	CC 82-84
Chronic Heart Failure	CC 85
Ischemic Heart Disease	CC 86-89
Hypertension and Hypertensive Disease	CC 94, 95
Arrhythmias	CC 96, 97
Vascular Disease	CC 106-109
Chronic Lung Disease	CC 111-113
UTI and other Urinary Tract Disorders	CC 144, 145
Pelvic Inflammatory Disease and Other Specified Female Genital Disorders	CC 147
Chronic Ulcers	CC 157-161
Cellulitis, Local Skin Infection	CC 164
Prior Significant Fracture	CC 169-171
Morbid Obesity	ICD-9-CM code 278.01 ICD-10-CM code E66.01
Work Relative Value Units (RVUs)*	n/a
Body System Operated On**	n/a

\*CMS assigns work Relative Value Units (RVUs) to each Current Procedural Terminology (CPT) procedure code. The RVUs approximate surgical procedural complexity by incorporating elements of physician time and effort. For patients with multiple concurrent CPT procedure codes, we risk adjust for the CPT code with the highest work RVU value.

\*\*Anatomical body system groups are defined using AHRQ CCSs and are maintained by AHRQ.

**Table 4.2.2. Complication-of-Care Variables Not Used in Risk Adjustment if Occurring Only During Procedure**

Description	Codes used to define variable (HCC Version 22)
Diabetes with Acute Complications	CC 17
Disorders of Fluid/Electrolyte/Acid-Base Balance	CC 24
Intestinal Obstruction/Perforation	CC 33
Coagulation Defects and Other Specified Hematological Disorders	CC 48
Coma, Brain Compression/Anoxic Damage	CC 80
Respirator Dependence/Tracheostomy Status	CC 82
Respiratory Arrest	CC 83

Description	Codes used to define variable (HCC Version 22)
Cardio-Respiratory Failure and Shock	CC 84
Congestive Heart Failure	CC 85
Acute Myocardial Infarction	CC 86
Unstable Angina and Other Acute Ischemic Heart Disease	CC 87
Specified Heart Arrhythmias	CC 96
Other Heart Rhythm and Conduction Disorders	CC 97
Hemiplegia/Hemiparesis	CC 103
Monoplegia, Other Paralytic Syndromes	CC 104
Late Effects of Cerebrovascular Disease, Except Paralysis	CC 105
Atherosclerosis of the Extremities with Ulceration or Gangrene	CC 106
Vascular Disease with Complications	CC 107
Vascular Disease	CC 108
Other Circulatory Disease	CC 109
Urinary Tract Infection	CC 144
Cellulitis, Local Skin Infection	CC 164
Hip Fracture/Dislocation	CC 170
Major Fracture, Except of Skull, Vertebrae, or Hip	CC 171

### 4.3. Outcome

#### Hospital Visit Outcome

##### 1. Inpatient admissions directly following surgery

Rationale: We measure admissions directly after surgery because an admission is typically unexpected for the surgeries and procedures included in the measure, and our overall goal is to illuminate variation in admissions following these same-day outpatient surgeries to improve quality.

##### 2. Any ED visit, observation stay, or unplanned inpatient admission occurring after discharge from the HOPD

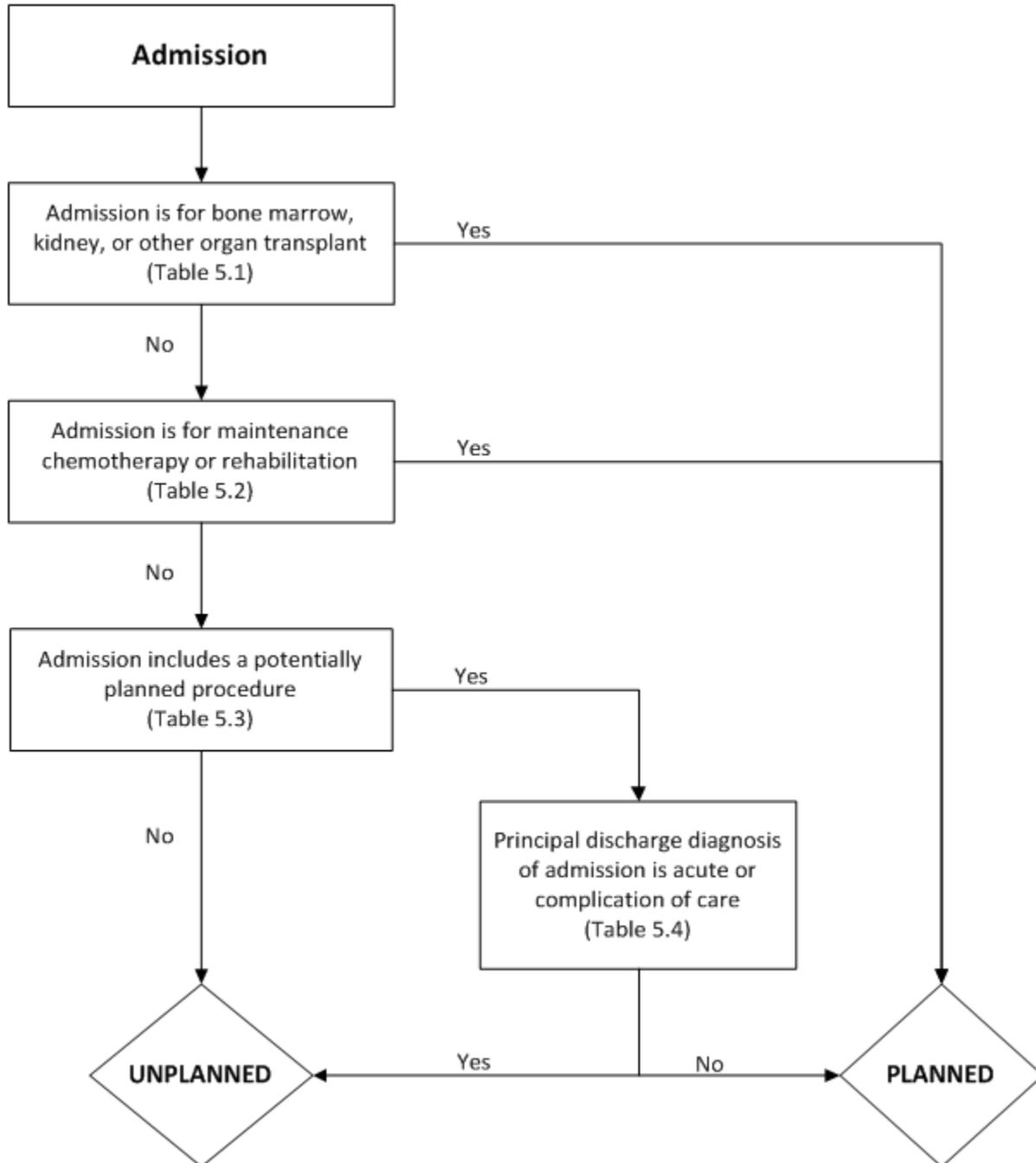
Rationale: Major and minor adverse events, such as uncontrolled pain, urinary retention, infection, bleeding, and venous thromboembolism, are well documented to occur post-discharge and result in unanticipated hospital visits. Please see the original technical report, Appendix B in Part 1 of this document, for a listing of the specific codes used to define ED visits and observation stays considered as outcomes in the measure.

As previously discussed, we remove “planned” hospital visits from the outcome using an algorithm that identifies planned visits for specific procedures and surgeries that do not reflect quality (see original technical report, Section 3.4.2 in Part 1 of this document, as

well as [Section 5](#) of this addendum below for details about the planned admission algorithm).

## 5. PLANNED ADMISSION ALGORITHM FOR SURGERY MEASURE VERSION 1.1

Figure 5.1. Planned Admission Algorithm Flowchart



**Table 5.1. Procedure Categories that are Always Planned (Planned Readmission Algorithm Version 4.0 – adapted for HOPD Surgery Measure Version 1.1)**

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 5.2. Diagnosis Categories that are Always Planned (Planned Readmission Algorithm Version 4.0 – adapted for HOPD Surgery Measure Version 1.1)**

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

**Table 5.3. Procedure Categories that are Potentially Planned (Planned Readmission Algorithm Version 4.0 – adapted for HOPD Surgery Measure Version 1.1)**

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
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

<b>Code</b>	<b>Description</b>
52	Aortic resection; replacement or anastomosis
53	Varicose vein stripping; lower limb
55	Peripheral vascular bypass
56	Other vascular bypass and shunt; not heart
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 cystocele 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

Code	Description
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
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

<b>Code</b>	<b>Description</b>
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
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
0GTG0ZZ	Resection of Left Thyroid Gland Lobe, Open Approach
0GTG4ZZ	Resection of Left Thyroid Gland Lobe, Percutaneous Endoscopic Approach
0GTH0ZZ	Resection of Right Thyroid Gland Lobe, Open Approach
0GTH4ZZ	Resection of Right Thyroid Gland Lobe, Percutaneous Endoscopic Approach
0GTK0ZZ	Resection of Thyroid Gland, Open Approach
0GTK4ZZ	Resection of Thyroid Gland, Percutaneous Endoscopic Approach
0WB60ZZ	Excision of Neck, Open Approach
0WB63ZZ	Excision of Neck, Percutaneous Approach
0WB64ZZ	Excision of Neck, Percutaneous Endoscopic Approach
0WB6XZZ	Excision of Neck, External Approach
0BW10FZ	Revision of Tracheostomy Device in Trachea, Open Approach
0BW13FZ	Revision of Tracheostomy Device in Trachea, Percutaneous Approach
0BW14FZ	Revision of Tracheostomy Device in Trachea, Percutaneous Endoscopic Approach
0WB6XZ2	Excision of Neck, Stoma, External Approach
0WQ6XZ2	Repair Neck, Stoma, External Approach
0B5N0ZZ	Destruction of Right Pleura, Open Approach
0B5N3ZZ	Destruction of Right Pleura, Percutaneous Approach
0B5N4ZZ	Destruction of Right Pleura, Percutaneous Endoscopic Approach
0B5P0ZZ	Destruction of Left Pleura, Open Approach
0B5P3ZZ	Destruction of Left Pleura, Percutaneous Approach
0B5P4ZZ	Destruction of Left Pleura, Percutaneous Endoscopic Approach
04CK0ZZ	Extirpation of Matter from Right Femoral Artery, Open Approach
04CK3ZZ	Extirpation of Matter from Right Femoral Artery, Percutaneous Approach
04CK4ZZ	Extirpation of Matter from Right Femoral Artery, Percutaneous Endoscopic Approach
04CL0ZZ	Extirpation of Matter from Left Femoral Artery, Open Approach

Code	Description
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
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

Code	Description
OT9040Z	Drainage of Right Kidney with Drainage Device, Percutaneous Endoscopic Approach
OT9130Z	Drainage of Left Kidney with Drainage Device, Percutaneous Approach
OT9140Z	Drainage of Left Kidney with Drainage Device, Percutaneous Endoscopic Approach
OTC03ZZ	Extirpation of Matter from Right Kidney, Percutaneous Approach
OTC04ZZ	Extirpation of Matter from Right Kidney, Percutaneous Endoscopic Approach
OTC13ZZ	Extirpation of Matter from Left Kidney, Percutaneous Approach
OTC14ZZ	Extirpation of Matter from Left Kidney, Percutaneous Endoscopic Approach
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 5.4. Diagnosis Categories that are Acute (Planned Readmission Algorithm Version 4.0 – adapted for HOPD Surgery Measure Version 1.1)**

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

<b>Code</b>	<b>Description</b>
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
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

<b>Code</b>	<b>Description</b>
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
165	Inflammatory conditions of male genital organs
168	Inflammatory diseases of female pelvic organs
172	Ovarian cyst
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 nonmedicinal substances
244	Other injuries and conditions due to external causes
245	Syncope
246	Fever of unknown origin

<b>Code</b>	<b>Description</b>
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")
653	Delirium, dementia, and amnesic 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	Candidal endocarditis
11503	Histoplasma capsulatum pericarditis
11504	Histoplasma capsulatum endocarditis
11513	Histoplasma duboisii pericarditis
11514	Histoplasma duboisii endocarditis
11593	Histoplasmosis pericarditis

<b>Code</b>	<b>Description</b>
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
4200	Acute pericarditis in other disease
42090	Acute pericarditis nos
42091	Acute idiopath 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
A3953	Meningococcal pericarditis
A3951	Meningococcal endocarditis
A3952	Meningococcal myocarditis

Code	Description
B3320	Viral carditis, unspecified
B3323	Viral pericarditis
B3321	Viral endocarditis
B3322	Viral myocarditis
B376	Candidal endocarditis
B394	Histoplasmosis capsulati, unspecified
I32	Pericarditis in diseases classified elsewhere
B394	Histoplasmosis capsulati, unspecified
I39	Endocarditis and heart valve disorders in diseases classified elsewhere
B395	Histoplasmosis duboisii
I32	Pericarditis in diseases classified elsewhere
B395	Histoplasmosis duboisii
I39	Endocarditis and heart valve disorders in diseases classified elsewhere
B399	Histoplasmosis, unspecified
I32	Pericarditis in diseases classified elsewhere
I39	Endocarditis and heart valve disorders in diseases classified elsewhere
B399	Histoplasmosis, unspecified
B5881	Toxoplasma myocarditis
I010	Acute rheumatic pericarditis
I011	Acute rheumatic endocarditis
I012	Acute rheumatic myocarditis
I018	Other acute rheumatic heart disease
I019	Acute rheumatic heart disease, unspecified
I020	Rheumatic chorea with heart involvement
I090	Rheumatic myocarditis
I099	Rheumatic heart disease, unspecified
I0989	Other specified rheumatic heart diseases
I32	Pericarditis in diseases classified elsewhere
I309	Acute pericarditis, unspecified
I300	Acute nonspecific idiopathic pericarditis
I308	Other forms of acute pericarditis
I330	Acute and subacute infective endocarditis
I339	Acute and subacute endocarditis, unspecified
I41	Myocarditis in diseases classified elsewhere
I409	Acute myocarditis, unspecified

<b>Code</b>	<b>Description</b>
I400	Infective myocarditis
I401	Isolated myocarditis
I400	Infective myocarditis
I408	Other acute myocarditis
I312	Hemopericardium, not elsewhere classified
I310	Chronic adhesive pericarditis
I311	Chronic constrictive pericarditis
I314	Cardiac tamponade
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
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

<b>Code</b>	<b>Description</b>
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
R000	Tachycardia, unspecified
I498	Other specified cardiac arrhythmias
R001	Bradycardia, unspecified
I499	Cardiac arrhythmia, unspecified
I4949	Other premature depolarization
<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

<b>Code</b>	<b>Description</b>
42833	Acute on chronic diastolic heart failure
42840	Unspec combined syst & dias 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>	
10981	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	Unsp combined systolic and diastolic (congestive) hrt fail
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 cholecystitis
57400	Calculus of gallbladder with acute cholecystitis without mention of obstruction
57401	Calculus of gallbladder with acute cholecystitis with obstruction
5743	Calculus of bile duct with acute cholecystitis
57430	Calculus of bile duct with acute cholecystitis without mention of obstruction
57431	Calculus of bile duct with acute cholecystitis with obstruction
5746	Calculus of gallbladder and bile duct with acute cholecystitis
57460	Calculus of gallbladder and bile duct with acute cholecystitis without mention of obstruction
57461	Calculus of gallbladder and bile duct with acute cholecystitis with obstruction
5748	Calculus of gallbladder and bile duct with acute and chronic cholecystitis
57480	Calculus of gallbladder and bile duct with acute and chronic cholecystitis without mention of obstruction
57481	Calculus of gallbladder and bile duct with acute and chronic cholecystitis with obstruction
5750	Acute cholecystitis
57512	Acute and chronic cholecystitis
5761	Cholangitis

<b>Code</b>	<b>Description</b>
<b>Acute ICD-10 codes within Diagnosis CCS 149: Biliary tract disease</b>	
K8000	Calculus of gallbladder w acute cholecyst w/o obstruction
K8001	Calculus of gallbladder w acute cholecystitis w obstruction
K8042	Calculus of bile duct w acute cholecystitis w/o obstruction
K8043	Calculus of bile duct w acute cholecystitis with obstruction
K8062	Calculus of GB and bile duct w acute cholecyst w/o obst
K8063	Calculus of GB and bile duct w acute cholecyst w obstruction
K8066	Calculus of GB and bile duct w ac and chr cholecyst w/o obst
K8067	Calculus of GB and bile duct w ac and chr cholecyst w obst
K810	Acute cholecystitis
K812	Acute cholecystitis with chronic cholecystitis
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

## 6. COMPARISON OF VARIABLES AS DEFINED IN VERSION 12 AND VERSION 22 OF THE HIERARCHICAL CONDITION CATEGORY MODEL

**Table 6.1. Comparison of Variables as Defined in Version 12 and Version 22 of the Hierarchical Condition Category System**

Description	Current Specifications Variable specified in ICD-10 and ICD-9 (HCC Version 22)	Original Specifications Variable specified in only ICD-9 (HCC Version 12)
Age > 65	n/a	n/a
<b>Comorbidities:</b>		
Cancer	CC 8 Metastatic Cancer and Acute Leukemia	CC 7 Metastatic Cancer and Acute Leukemia
	CC 9 Lung and Other Severe Cancers	CC 8 Lung, Upper Digestive Tract, and Other Severe Cancers
	CC 10 Lymphoma and Other Cancers	CC 9 Lymphatic, Head and Neck, Brain, and Other Major Cancers
	CC 11 Colorectal, Bladder, and Other Cancers	CC 10 Breast, Prostate, Colorectal and Other Cancers and Tumors
	CC 12 Breast, Prostate, and Other Cancers and Tumors	CC 11 Other Respiratory and Heart Neoplasms
	CC 13 Other Respiratory and Heart Neoplasms	CC 12 Other Digestive and Urinary Neoplasms
	CC 14 Other Digestive and Urinary Neoplasms	-
Diabetes and DM Complications	CC 17 Diabetes with Acute Complications	CC 15 Diabetes with Renal Manifestation
	CC 18 Diabetes with Chronic Complications	CC 16 Diabetes with Neurologic or Peripheral Circulatory Manifestation
	CC 19 Diabetes without Complication	CC 17 Diabetes with Acute Complications
	CC 122 Proliferative Diabetic Retinopathy and Vitreous Hemorrhage	CC 18 Diabetes with Ophthalmologic Manifestation
	CC 123 Diabetic and Other Vascular Retinopathies	CC 19 Diabetes with No or Unspecified Complications
	-	CC 119 Proliferative Diabetic Retinopathy and Vitreous Hemorrhage
	-	CC 120 Diabetic and Other Vascular Retinopathies
Disorders of Fluid/ Electrolyte/ Acid-Base	CC 24 Disorders of Fluid/Electrolyte/Acid-Base Balance	CC 23 Disorders of fluid/electrolyte/acid-base

Description	Current Specifications Variable specified in ICD-10 and ICD-9 (HCC Version 22)	Original Specifications Variable specified in only ICD-9 (HCC Version 12)
Intestinal Obstruction/ Perforation	CC 33 Intestinal Obstruction/Perforation	CC 31 Intestinal Obstruction/Perforation
Inflammatory Bowel Disease	CC 35 Inflammatory Bowel Disease	CC 33 Inflammatory Bowel Disease
Bone/ Joint/ Muscle Infections/ Necrosis	CC 39 Bone/Joint/Muscle Infections/Necrosis	CC 37 Bone/Joint/Muscle Infections/Necrosis
Hematological Disorders Including Coagulation Defects and Iron Deficiency	CC 46 Severe Hematological Disorders	CC 44 Severe Hematological Disorders
	CC 48 Coagulation Defects and Other Specified Hematological Disorders	CC 46 Coagulation Defects and Other Specified Hematological Disorders
	CC 49 Iron Deficiency and Other/Unspecified Anemias and Blood Disease	CC 47 Iron Deficiency and Other/Unspecified Anemias and Blood Disease
Dementia or Senility	CC 51 Dementia With Complications	CC 49 Dementia
	CC 52 Dementia Without Complication	CC 50 Senility, Nonpsychotic Organic Brain Syndromes/Conditions
	CC 53 Nonpsychotic Organic Brain Syndromes/Conditions	-
Psychiatric Disorders	CC 57 Schizophrenia	CC 54 Schizophrenia
	CC 58 Major Depressive, Bipolar, and Paranoid Disorders	CC 55 Major Depressive, Bipolar, and Paranoid Disorders
	CC 59 Reactive and Unspecified Psychosis	CC 56 Reactive and Unspecified Psychosis
	CC 60 Personality Disorders	CC 57 Personality Disorders
	CC 61 Depression	CC 58 Depression
	CC 62 Anxiety Disorders	CC 59 Anxiety Disorders
	CC 63 Other Psychiatric Disorders	CC 60 Other Psychiatric Disorders
Hemiplegia, Paraplegia, Paralysis, Functional Disability	CC 70 Quadriplegia	CC 67 Quadriplegia, Other Extensive Paralysis
	CC 71 Paraplegia	CC 68 Paraplegia
	CC 73 Amyotrophic Lateral Sclerosis and Other Motor Neuron Disease	CC 69 Spinal Cord Disorders/Injuries
	CC 74 Cerebral Palsy	CC 100 Hemiplegia/Hemiparesis
	CC 103 Hemiplegia/Hemiparesis	CC 101 Diplegia (Upper), Monoplegia, and Other Paralytic Syndromes
	CC 104 Monoplegia, Other Paralytic Syndromes	CC 102 Speech, Language, Cognitive, Perceptual

Description	Current Specifications	Original Specifications
	Variable specified in ICD-10 and ICD-9 (HCC Version 22)	Variable specified in only ICD-9 (HCC Version 12)
	CC 105 Late Effects of Cerebrovascular Disease, Except Paralysis	CC 103 Cerebrovascular Disease Late Effects, Unspecified
	CC 189 Amputation Status, Lower Limb/Amputation	CC 177 Amputation Status, Lower Limb/Amputation
	CC 190 Amputation Status, Upper Limb	CC 178 Amputation Status, Upper Limb
Other Significant CNS Disease	CC 77 Multiple Sclerosis	CC 72 Multiple Sclerosis
	CC 78 Parkinson's and Huntington's Diseases	CC 73 Parkinson's and Huntington's Diseases
	CC 79 Seizure Disorders and Convulsions	CC 74 Seizure Disorders and Convulsions
	CC 80 Coma, Brain Compression/Anoxic Damage	CC 75 Coma, Brain Compression/Anoxic Damage
Cardiorespiratory Arrest, Failure and Respiratory Dependence	CC 82 Respirator Dependence/Tracheostomy Status	CC 77 Respirator Dependence/Tracheostomy Status
	CC 83 Respiratory Arrest	CC 78 Respiratory Arrest
	CC 84 Cardio-Respiratory Failure and Shock	CC 79 Cardio-Respiratory Failure and Shock
Chronic Heart Failure	CC 85 Congestive Heart failure	CC 80 Congestive Heart failure
Ischemic Heart Disease	CC 86 Anterior Myocardial Infarction	CC 81 Anterior Myocardial Infarction
	CC 87 Unstable Angina and Other Acute Ischemic Heart Disease	CC 82 Unstable Angina and Other Acute Ischemic Heart Disease
	CC 88 Angina Pectoris	CC 83 Angina Pectoris/Old Myocardial Infarction
	CC 89 Coronary Atherosclerosis/Other Chronic Ischemic Heart Disease	CC 84 Coronary atherosclerosis/other chronic ischemic heart disease
Hypertension and Hypertensive Disease	CC 94 Hypertensive Heart Disease	CC 89 Hypertensive Heart and Renal Disease or Encephalopathy
	CC 95 Hypertension	CC 90 Hypertensive Heart Disease
	-	CC 91 Hypertension
Arrhythmias	CC 96 Specified Heart Arrhythmias	CC 92 Specified Heart Arrhythmias
	CC 97 Other Heart Rhythm and Conduction Disorders	CC 93 Other Heart Rhythm and Conduction Disorders
Vascular Disease	CC 106 Atherosclerosis of the Extremities with Ulceration or Gangrene	CC 104 Vascular Disease with Complications
	CC 107 Vascular Disease with Complications	CC 105 Vascular Disease
	CC 108 Vascular Disease	CC 106 Other Circulatory Disease
	CC 109 Other Circulatory Disease	-
Chronic Lung Disease	CC 111 Chronic Obstructive Pulmonary Disease	CC 108 Chronic Obstructive Pulmonary Disease
	CC 112 Fibrosis of Lung and Other Chronic Lung Disorders	CC 109 Fibrosis of lung and other chronic lung disorders

Description	Current Specifications	Original Specifications
	Variable specified in ICD-10 and ICD-9 (HCC Version 22)	Variable specified in only ICD-9 (HCC Version 12)
	CC 113 Asthma	CC 110 Asthma
UTI and other Urinary Tract Disorders	CC 144 Urinary Tract Infection	CC 135 Urinary Tract Infection
	CC 145 Other Urinary Tract Disorders	CC 136 Other Urinary Tract Disorders
Pelvic Inflammatory Disease and Other Specified Female Genital Disorders	CC 147 Pelvic Inflammatory Disease and Other Specified Female Genital Disorders	CC 138 Pelvic Inflammatory Disease and Other Specified Female Genital Disorders
Chronic Ulcers	CC 157 Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	CC 148 Decubitus Ulcer of Skin
	CC 158 Pressure Ulcer of Skin with Full Thickness Skin Loss	CC 149 Chronic Ulcer of Skin, Except Decubitus
	CC 159 Pressure Ulcer of Skin with Partial Thickness Skin Loss	-
	CC 160 Pressure Pre-Ulcer Skin Changes or Unspecified Stage	-
	CC 161 Chronic Ulcer of Skin, Except Pressure	-
Cellulitis, Local Skin Infection	CC 164 Cellulitis, Local Skin Infection	CC 152 Cellulitis, Local Skin Infection
Prior Significant Fracture	CC 169 Vertebral Fractures without Spinal Cord Injury	CC 157 Vertebral Fractures
	CC 170 Hip Fracture/Dislocation	CC 158 Hip Fracture/Dislocation
	CC 171 Major Fracture, Except of Skull, Vertebrae, or Hip	CC 159 Major Fracture, Except of Skull, Vertebrae, or Hip
Morbid Obesity	ICD-9-CM code 278.01 ICD-10-CM code E66.01 (Morbid [severe] obesity due to excess calories)	ICD-9-CM code 278.01
<b>Procedural Information:</b>		
Work Relative Value Units	CMS assigns work RVUs to each CPT procedure code. The RVUs approximate surgical procedural complexity by incorporating elements of physician time and effort. For patients with multiple concurrent CPT procedure codes, we risk adjust for the CPT code with the highest work RVU value.	
Body System Operated On	Anatomical body system groups are defined using AHRQ CCSs and are maintained by AHRQ.	

**Table 6.2. Complication-of-Care Variables Not Used in Risk Adjustment if Occurring Only During Procedure**

Current Specifications Variable specified in ICD-10 and ICD-9 (HCC Version 22)	Original Specifications Variable specified in only ICD-9 (HCC Version 12)
CC 17 Diabetes with Acute Complications	CC 17 Diabetes with Acute Complications
CC 24 Disorders of Fluid/Electrolyte/Acid-Base Balance	CC 23 Disorders of Fluid/Electrolyte/Acid-Base
CC 33 Intestinal Obstruction/Perforation	CC 31 Intestinal Obstruction/Perforation
CC 48 Coagulation Defects and Other Specified Hematological Disorders	CC 46 Coagulation Defects and Other Specified Gastrointestinal Disorders
CC 80 Coma, Brain Compression/Anoxic Damage	CC 75 Coma, Brain Compression/Anoxic Damage
CC 82 Respirator Dependence/Tracheostomy Status	CC 77 Respirator Dependence/Tracheostomy Status
CC 83 Respiratory Arrest	CC 78 Respiratory Arrest
CC 84 Cardio-Respiratory Failure and Shock	CC 79 Cardio-Respiratory Failure and Shock
CC 85 Congestive Heart Failure	CC 80 Congestive Heart Failure
CC 86 Acute Myocardial Infarction	CC 81 Acute Myocardial Infarction
CC 87 Unstable Angina and Other Acute Ischemic Heart Disease	CC 82 Unstable Angina and Other Acute Ischemic Heart Disease
CC 96 Specified Heart Arrhythmias	CC 92 Specified Heart Arrhythmias
CC 97 Other Heart Rhythm and Conduction Disorders	CC 93 Other Heart Rhythm and Conduction Disorders
CC 103 Hemiplegia/Hemiparesis	CC 100 Hemiplegia/Hemiparesis
CC 104 Monoplegia, Other Paralytic Syndromes	CC 101 Diplegia (Upper), Monoplegia, and Other Paralytic Syndromes
CC 105 Late Effects of Cerebrovascular Disease, Except Paralysis	CC 102 Speech, Language, Cognitive, Perceptual
CC 106 Atherosclerosis of the Extremities with Ulceration or Gangrene	CC 104 Vascular Disease with Complications
CC 107 Vascular Disease with Complications	
CC 108 Vascular Disease	CC 105 Vascular Disease
CC 109 Other Circulatory Disease	CC 106 Other Circulatory Disease
CC 144 Urinary Tract Infection	CC 135 Urinary Tract Infection
CC 164 Cellulitis, Local Skin Infection	CC 152 Cellulitis, Local Skin Infection

<b>Current Specifications</b> Variable specified in ICD-10 and ICD-9 (HCC Version 22)	<b>Original Specifications</b> Variable specified in only ICD-9 (HCC Version 12)
CC 170 Hip Fracture/Dislocation	CC 158 Hip Fracture/Dislocation
CC 171 Major Fracture, Except of Skull, Vertebrae, or Hip	CC 159 Major Fracture, Except of Skull, Vertebrae, or Hip