Hospital Visits after Orthopedic Ambulatory Surgical Center Procedures

Technical Report: Public Comment Draft

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Table of Contents

List of Tables

List of Figures

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1. Executive Summary

This report presents for public comment a quality measure of orthopedic ambulatory surgical center (ASC) procedures. The measure assesses the quality of orthopedic ASC procedures using the outcome of hospital visits – including emergency department (ED) visits, observation stays, and unplanned inpatient admissions – within 7 days of the surgery. Yale New Haven Health Services Corporation—Center for Outcomes Research and Evaluation (CORE) is developing the measure for the Centers for Medicare & Medicaid Services (CMS). This ASC-level measure will inform patient choice and help providers and ASCs improve quality of care.

This report presents the measure specifications and analytic results. Included are the rationale for the measure, the specific proposed technical approach to the measure, and information on model performance and measure scores across ASC facilities. As part of the development process, CMS invites public comment on all aspects of the measure. Instructions on how to submit comments are available at the following webpage: https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/MMS/CallforPublicComment.html. During the public comment period, CMS especially invites comments on the following:

1. Adjusting for surgical procedural complexity. As detailed in Section 3.5.2, work relative value units (work RVUs) are used to adjust for procedural complexity, an approach that is well established in the literature and is used in the American College of Surgeons (ACS) National Surgical Quality Improvement Program (NSQIP). Comments on additional approaches to risk adjusting for procedural complexity using Medicare claims data are welcomed.

2. Identifying treatments that routinely start at an ASC and are followed within 7 days by planned inpatient care. As detailed in Section 3.4.5, the measure intends to exclude "planned" hospital admissions from the outcome because variation in planned admissions may not reflect quality differences. Such admissions are identified using a "planned admission" algorithm presented in Appendix B. Thus, identifying any additional planned procedures not captured by the algorithm that would routinely be done on an inpatient basis within 7 days of an orthopedic ASC procedure as part of the care plan is important for the measure.

1.1 Rationale for Assessing Hospital Visits after Ambulatory Surgery

Ambulatory surgery is increasingly common in the United States (US). Nearly 70% of all surgeries in the US are performed in an outpatient setting with an expanding number and variety of procedures being performed at stand-alone ASCs.[1] While ambulatory surgery is

considered low-risk for complications, there are well described and potentially preventable adverse events that can occur after ambulatory surgery leading to unplanned care in a hospital. These events include uncontrolled pain, urinary retention, infection, bleeding, and venous thromboembolism.

Hospital visits following same-day surgery are an important and accepted patient-centered outcome reported in the literature.[2-9] Estimates of hospital visit rates following outpatient surgery vary from 0.5-9.0%, based on the type of surgery, outcome measured (admissions alone or admissions and ED visits), and timeframe for measurement after surgery. Such events also vary among ASCs, suggesting possible variation in surgical and discharge quality of care.[6,10-18] Providers at ASCs are often unaware of patients' subsequent acute care visits given that patients tend to present to the ED or to hospitals unaffiliated with the ASC.[19] For these reasons, a quality measure of hospital visits following ASC surgery would serve to improve transparency, to inform patients and providers, and to foster quality improvement efforts.

1.2   Measure Development

This measure is being developed consistent with CMS's measure development guidance. The primary measure developers, a multidisciplinary team of CORE clinicians, health services researchers, and statisticians, are supported and informed by a national technical expert panel (TEP) consisting of patients, surgeons, methodologists, researchers, and providers. With input from our experts and CMS, the Project Team has defined the measure cohort and specified the outcome and risk-adjustment model. At this time, CMS is seeking public comment to further inform measure development.

1.3   Measure Specifications

The population of interest for the measure is Medicare Fee-for-Service (FFS) patients aged 65 years and older undergoing outpatient orthopedic surgery at ASCs.

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

The measure is risk-adjusted. In order to help ensure that differences in the measure score do not reflect differences in the mix of patients and procedures across ASCs, the model adjusts for patient demographics, clinical characteristics, and surgical procedural complexity. We adjust for these characteristics because they vary across ASC patient populations, are unrelated to quality, and influence the outcome.

The measure score will be an ASC-level risk-adjusted (risk-standardized) hospital visit rate (RSHVR). The RSHVR is calculated as the ratio of the predicted to the expected number of post-

surgical unplanned hospital visits among the ASC's patients, multiplied by the national observed rate of unplanned hospital visits. For each ASC, the numerator of the ratio is the number of hospital visits predicted for the ASC's patients, accounting for its observed rate, the number of orthopedic surgeries performed at the ASC, and the case mix. The denominator is the expected number of hospital visits given the ASC's case mix. This approach is analogous to an observed-to-expected ratio, but accounts for clustering and sample size variation across ASCs. A ratio less than one indicates that the ASC's patients have fewer post-surgical visits than expected compared to ASCs with similar surgical procedures and patients. A ratio greater than greater indicates that the ASC's patients have more visits than expected compared to ASCs with similar surgical procedures and patients.

To calculate an ASC's predicted-to-expected (P/E) ratio, the measure uses a two-level hierarchical logistic regression model (see Appendix C). The log-odds of the outcome for an index procedure are modeled as a function of the patient demographic, clinical, and procedure characteristics, and a random ASC-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 ASCs lead to systematic differences in outcomes. An ASC's P/E ratio is then multiplied by the overall national rate of unplanned hospital visits to calculate the ASC-level RSHVR.

1.4   Measure Testing and Results

The CORE Project Team has assessed the specifications against the National Quality Forum's (NQF's) criteria for importance, including evaluating the measure score variation. Using a 20% Sample of Medicare FFS data (20% FFS Sample) from 2013, the national observed rate of unplanned hospital visits following orthopedic ASC procedures was 2.4%. In addition, using 2012-2013 data from the Agency for Healthcare Research and Quality (AHRQ) Healthcare Cost and Utilization Project (HCUP) for Florida and New York, variation in risk-standardized scores across ASCs was found. The median RSHVR was 2.0%, ranging from 1.4% to 3.0% (the 25th and 75th percentiles were 1.9% and 2.1%, respectively.

1.5   Summary

This report describes the measure specifications and preliminary results for a risk-standardized quality measure of 7-day unplanned hospital visits following orthopedic ASC procedures. Stakeholder and expert input has informed measure development throughout. The measure reveals variation across facilities. The purpose of this measure is to illuminate variation in performance as a possible indication of variation in quality of care for orthopedic surgeries across ASCs, inform patient choice, and drive quality improvement. CMS invites comments on the measure's purpose, design, and potential application.

2. Introduction and Call for Public Comment

2.1 Background

National efforts to measure the quality of ambulatory surgical care are essential given the increasing number of ambulatory surgical centers (ASCs) in the United States (US) and the increasing variety of procedures performed at ASCs. ASCs have become the preferred setting for the provision of low-risk surgical and medical procedures in the US, including the provision of many types of orthopedic surgical care.[1] ASCs have gained favor among patients given their tendency toward shorter wait times, decreased need for hospitalization, and more rapid return to work when compared with patients managed in hospital settings.[1] In 2014 alone, more than 3.4 million Medicare Fee-for-Service (FFS) beneficiaries were treated at ASCs. Using a 20% national sample of Medicare FFS claims (20% FFS Sample), we estimate that, in 2013, 186,930 outpatient orthopedic surgeries of the type included in this proposed measure (see [Section 3.3](#) for cohort definition) were performed at 2,144 ASCs and that 1,433 ASCs are estimated to have at least 30 such cases. Associated spending on ASC services by Medicare and its beneficiaries amounted to $3.7 billion in 2013, an increase of more than 10% since 2007.[20] Due to advances in surgical and anesthetic techniques, nearly 70% of all surgical procedures in the US are performed in ambulatory settings, with many of these procedures taking place as same-day surgeries at ASCs.[1] The resultant shift in ASC utilization has led to an increase not only in ASC operative volume, but also in the average age and complexity of patients managed at ASCs.[21,22]

2.2 Definition of an Ambulatory Surgical Center (ASC)

Medicare defines ASCs as healthcare facilities that operate "exclusively for the purpose of providing surgical services to patients not requiring hospitalization and in which the expected duration of services [does] not exceed 24 hours following an admission" (42 CFR 416.2). Of interest for the measure under consideration, the types of orthopedic procedures performed at ASCs range from very minor procedures, such as setting of a facture, to more major operations, such as reconstruction of an elbow joint. These procedures typically have less than 90-minute operating times and 4- to 6-hour same-day recovery periods. The surgeries performed usually do not (1) involve major or prolonged invasion of body cavities; (2) require active medical monitoring and care overnight; (3) result in extensive blood loss; (4) directly involve major blood vessels; or (5) involve care that is either emergent or life-threatening (42 CFR 416.65).

Eligible ASCs vary in their organizational and financial structures. Many ASCs are hospital-owned; most are run by groups of physicians in the same specialty area and are limited to a single type of procedure, such as eye or orthopedic surgery. Other ASCs conduct procedures in two or more specialty areas.

2.3   Importance of Assessing Hospital Visits after ASC Procedures

Despite increasing availability of ASCs and their use by patients, there are few quality measures to gauge ASC performance. Existing ASC quality measures tend to focus on very rare, patient-safety related events. For example, one measure counts cases in which wrong site, wrong side, wrong patient, wrong procedure, and wrong implant events occurred.[23] Understanding that such rare, patient safety-related events are important to assess, generally lacking at this time are measures designed to capture more common adverse outcomes that patients experience, such as pain, bleeding, urinary retention, and other complications prompting acute care hospital visits or admissions.

Measuring ASC outcomes is an important strategy for improving transparency and fostering quality improvement. Facilities and surgical teams are often unaware of their patients' adverse events and hospitalizations following ASC procedures because separate providers (for example, emergency department [ED] physicians) tend to provide post-surgical care when it is required.

For this reason, consideration of unanticipated hospital visits following ASC procedures offers an important means of more broadly reflecting the quality of ASC care. Such visits are an unexpected and potentially preventable outcome for patients with a low anticipated perioperative risk. In the literature, hospital visit rates following outpatient surgery vary from 0.5-9.0%, based on the type of surgery, outcome measured (admissions alone or admissions and ED visits), and timeframe for measurement after surgery.[2-9] These hospital visits can occur due to a range of well-described adverse events, including major adverse events, such as bleeding, wound infection, septicemia, and venous thromboembolism. Patients also frequently report minor adverse events – for example, uncontrolled pain, nausea, and vomiting – that may result in unplanned acute care visits following surgery.

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

Given that ASCs vary widely in their focus and the number of procedures that they perform, focusing on a specific surgical subspecialty area, such as orthopedic surgery, will enable use of a quality measure to make fair comparisons of outcome rates across facilities that perform similar procedures.

2.4   Related Measures Under Development

This measure of 7-day unplanned hospital visits following orthopedic procedures performed at ASCs is being developed in conjunction with two additional quality measures - one that focuses on urology and one that focuses on general surgery ASC procedures - that utilize the same hospital visits outcome. This hospital visits outcome is also the focus of two existing, National Quality Forum (NQF)-endorsed CMS quality measures: (1) Facility 7-Day Risk-Standardized Hospital Visit Rate after Outpatient Colonoscopy (NQF #2539) and (2) Hospital Visits after Hospital Outpatient Surgery (NQF #2687).

3. Measure Development Methods

3.1 Overview of Measure Development Process

CORE is leading the development of the orthopedic ASC measure under the guidance of CMS. The CORE Project Team consists of a multidisciplinary group of clinicians, health services researchers, and statisticians with expertise in outcome measure development. We are obtaining clinical input from an orthopedic consultant and have 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, a public comment period is now being held to solicit stakeholder input on the measure methodology.

3.2 Data Sources

The measure requires a data source that allows us to link patient data across care settings in order to identify appropriate surgical procedures for inclusion, comorbidities for risk adjustment, and the outcome of hospital visits. Therefore, claims data are used, as they support these linkages and are available for the patient population of interest.

We are using two sets of claims data for measure development.

1. To develop and test the patient-level model, we use 2013 claims data from the Medicare Inpatient, Outpatient, and Carrier (Part B Physician) Standard Analytical Files (SAF). Outpatient orthopedic procedures performed at ASCs are identified using the 20% FFS Sample of beneficiaries' claims from the Carrier SAF, which includes the ASC facility claim (with a unique facility identifier). The outcomes of ED visits and observation stays after orthopedic ASC surgery are identified from the hospital Outpatient SAF, and inpatient hospital admissions from the Medicare Provider Analysis and Review (MedPAR) file. The measure cohort includes patients who underwent orthopedic ASC procedures in 2013, and inpatient and outpatient claims data from 2012 and 2013 are then used to identify comorbidities for risk adjustment for these patients. For measure development and testing, we randomly split the 2013 data into Development and Validation Samples. The Development Sample includes 70% of orthopedic ASC surgeries contained in the 2013 data and the Validation Sample includes 30% of orthopedic ASC surgeries contained in the 2013 data.

2. Testing ASC-level variation in the measure score required a larger number of orthopedic procedures per facility than was available in the 20% FFS Sample. Therefore, we used 2012-2013 Healthcare Cost and Utilization Project (HCUP) data from two states (Florida and New York) that provide linked records from the State Ambulatory Surgery Database

(SASD), the State Emergency Department Database (SEDD), and the State Inpatient Database (SID). These datasets provide 100% of the claims for outpatient surgeries performed at ASCs, linked to ED visits and hospital admissions after the index procedure. A limitation of this dataset is that HCUP data do not consistently include observation stay visits.

3.3   Cohort Definition

The target population for this measure is Medicare FFS patients aged 65 years and older undergoing outpatient orthopedic surgeries, typically performed by an orthopedist, at ASCs. The Medicare FFS population was chosen because of the availability of a national dataset (Medicare claims) that could be used to develop, test, and publicly report the measure. The target population is defined based on the following inclusion and exclusion criteria.

3.3.1 Inclusion Criteria

Included patients

- Medicare FFS patients aged 65 years and older.

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

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

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

Included procedures

- Surgical procedures that (1) are routinely performed at ASCs, (2) involve some increased risk of post-surgery hospital visits, and (3) are routinely performed by orthopedists.

   o   Procedures performed at ASCs were identified using Medicare's list of covered ASC procedures for 2013. This list of surgeries is publicly available at: https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/ASCPayment/ASC-Regulations-and-Notices-Items/CMS-1589-FC.html (download Addendum AA). Surgeries on the ASC list of covered procedures do not involve or require major or prolonged invasion of body cavities, extensive blood

loss, major blood vessels, or care that is emergent or life-threatening.[1]

- o To focus the measure on "major" and "minor" surgeries that impose a meaningful risk of post-procedure hospital visits, we use the Medicare Physician Fee Schedule global surgery indicator (GSI) values of 090 and 010, respectively. The GSI code reflects the number of post-operative days that are included in a given procedure's global surgical payment and identifies surgical procedures of greater complexity and follow-up care. Minor/non-surgical procedures coded GSI 000 are not included in the measure cohort.

- o To identify the subset of ASC procedures typically performed by orthopedic surgeons, we use the Clinical Classifications Software (CCS) developed by the Agency for Healthcare Research and Quality (AHRQ) and its "operations on the musculoskeletal system" group of procedures.[24] Procedures to treat a facial fracture or dislocation (defined by AHRQ clinical category CCS 144) were removed because our experts indicated that these procedures are typically performed by plastic surgeons; ear, nose, and throat surgeons; and oral maxillofacial surgeons.

With the exception of CC 144, the orthopedic ASC measure cohort includes all other major and minor surgical procedures in AHRQ's "operations on the musculoskeletal system" group. See accompanying Microsoft Excel file for a complete listing of all Current Procedural Terminology (CPT®) procedure codes included in the measure cohort. This Microsoft Excel file is available within the same zipped folder as this report at: https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/MMS/CallforPublicComment.html.

3.3.2 Exclusion Criteria

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

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

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

3.4 Outcome

3.4.1 Definition of Outcome

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

A hospital visit is defined as any ED visit, observation stay, or unplanned inpatient admission occurring after the ASC procedure; "planned" admissions for follow-up care are not included, as these hospital visits do not reflect quality differences (see Section 3.4.5). Hospital acute care visits and admissions are well-described and recognized indicators of quality for outpatient surgery at ASCs (see Section 2.3).

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

- Facility 7-Day Risk-Standardized Hospital Visit Rate after Outpatient Colonoscopy (NQF #2539)

- Hospital Visits after Hospital Outpatient Surgery (NQF #2687)

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

3.4.2 Outcome Timeframe

The outcome of hospital visits is limited to 7 days since existing literature suggests that the vast majority of adverse events after outpatient surgery occur within the first 7 days following the surgery.[4,25] In addition, our data analysis showed the highest rates of hospital visits occurring within 7 days of outpatient orthopedic surgery. As the results in Figure 1 show, the daily rate of unplanned hospital visits was highest immediately following the procedure and leveled off to a baseline rate of approximately 3.0 visits per 1,000 procedures after 7 days. Based on empiric analyses and expert input from our orthopedic consultant and TEP members, we conclude that unplanned hospital visits within 7 days is the optimal timeframe to ensure capture of surgery-related adverse events and to minimize capture of hospital visits unrelated to the surgery.

3.4.3 Multiple Qualifying Procedures within a 7-Day Period

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

3.4.4 All-Cause Hospital Visits

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

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

3.4.5 Removal of Planned Admissions from the Outcome

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

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

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

3.5   Model Development

3.5.1 Overview

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

The measure score is an ASC-level risk-standardized hospital visit rate (RSHVR). The RSHVR is calculated as the ratio of the predicted to the expected number of post-surgical hospital visits among the ASC's patients, multiplied by the national observed rate of unplanned hospital visits. For each ASC, the numerator of the ratio is the number of hospital visits predicted for the ASC's patients, accounting for its observed rate, the number of orthopedic surgeries performed at the ASC, and the case mix. The denominator is the expected number of hospital visits given the ASC's case mix. This approach is analogous to an observed-to-expected ratio but accounts for clustering and sample size variation across ASCs. A ratio less than 1 indicates that the ASC's patients have fewer post-surgical visits than expected compared to ASCs with similar surgical procedures and patients. A ratio greater than 1 indicates that the ASC's patients have more visits than expected compared to ASCs with similar surgical procedures and patients.

To calculate an ASC's predicted-to-expected (P/E) ratio, the measure uses a two-level hierarchical logistic regression model (see [Appendix C](#)). The log-odds of the outcome for an index procedure are modeled as a function of the patient demographic, clinical, and procedure characteristics, and a random ASC-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 ASCs lead to systematic differences in outcomes. An ASC's P/E ratio is then multiplied by the overall national rate of unplanned

hospital visits to calculate the ASC-level RSHVR. This approach is tailored to, and appropriate for, a publicly reported outcome measure as articulated in published scientific guidelines.[23–25]

3.5.2 Candidate Risk Factors for Patient-Level Risk Adjustment

The measure adjusts for differences across facilities in patient demographic and clinical factors and in procedure-related risk. Potential candidate risk factors were identified from related quality measures and the literature; a preliminary list of risk factors was developed and then revised based on TEP and expert clinical input.

The initial list of candidate risk factors included those evaluated in the development of several related claims-based measures: (1) Hospital Visits after Hospital Outpatient Surgery (NQF #2687); (2) Hospital-Level 30-day, All-Cause Risk-Standardized Readmission Rate following Elective Primary Total Hip Arthroplasty and/or Total Knee Arthroplasty (NQF #1551); and (3) Hospital-Level Risk-Standardized Complication Rate following Elective Primary Total Hip Arthroplasty and/or Total Knee Arthroplasty (NQF #1550).

To identify additional clinical and procedural risk factors, the Project Team conducted a focused literature search. Specifically, relevant peer-reviewed publications of claims-based variables predicting hospital visits after outpatient surgery were identified by searching Ovid MEDLINE. The search yielded a total of two studies relevant to the orthopedic measure. We added variables from the literature to our list of candidate risk factors if they were significantly associated with the outcome of interest (unplanned hospital visits) in bivariate or multivariable analyses at the 0.05 level. From the two studies, two variables not included in any of the related measures were identified: prior hospital inpatient admission[4] and Deyo modification of the Charlson Comorbidity Index.[26]

To operationalize the candidate risk factors, we defined the clinical risk factors in claims data using Version 22 of CMS's hierarchical condition categories (HCC) model, which classifies over 14,000 ICD-9 diagnosis codes into 189 clinically coherent condition categories. In some cases (for example, morbid obesity), individual ICD-9 codes were used to define the risk factor. To address surgical procedural complexity, we used the work relative values units (work RVUs) of the procedure, an approach employed by the American College of Surgeons National Surgical Quality Improvement Program (NSQIP).[27]

The Project Team reviewed the candidate risk factors with TEP members. None of the clinical experts suggested removing any of the candidate risk factors from the list. One of the TEP members suggested considering additional clinical risk factors that the American Association of Hip and Knee Surgeons (AAHKS) has recommended for risk adjusting inpatient hip and knee arthroplasty outcome measures, including smoking, chronic anticoagulant use, previous intra-

articular infection, congenital hip deformity, angular knee deformity greater than 15 degrees, and previous open reduction and internal fixation (ORIF) of hip and knee. We were not able to include chronic narcotic use as a candidate risk factor because drug/alcohol-related diagnoses were redacted from the 20% FFS Sample research dataset per CMS policy. CMS will have the opportunity to further evaluate the variable for inclusion in national testing when re-estimating the risk model using Medicare data that contains substance use diagnoses. Workers' compensation status was not included. Although it may be correlated with the outcome, the relationship is affected by a number of factors that we may not want to adjust for in this quality measure, including variation in eligibility for workers' compensation by state. Therefore, we do not plan to use workers' compensation as a risk-adjustment variable.

Finally, to consolidate like risk factors, we checked the bivariate direction and strength of association of the individual risk factors defined by CCs or ICD-9 codes and then combined risk factor diagnoses into clinically coherent comorbidity variables. For example, a "cancer" variable was created that combined several individual cancer diagnoses.

The list of candidate risk variables is in Appendix D, Table D1. The CCs that are not risk adjusted for if they occur only at the time of the procedure are in Appendix D, Table D2.

3.5.3 Final Risk-Adjustment Variable Selection

To select the final set of variables to include in the risk-adjustment model, risk variables were entered into logistic regression analyses predicting the outcome of hospital visits within 7 days in the 2013 Development Sample. The Development Sample is a randomly selected 70% sample of our 2013 Medicare cohort. To develop a parsimonious risk model, non-significant variables were iteratively removed from the model using a stepwise purposeful selection approach described by Hosmer and Lemeshow.[28] All variables significant at p<0.05 were retained in the final model. In addition, we retained in the model two variables (tobacco use disorder and morbid obesity) because experts advised that these were important risk predictors and expressed a strong preference for including them in the model.

3.5.4 Model Performance and Validation

To assess performance of the patient-level risk-adjustment model in the 2013 Development Sample, the area under the receiver operating characteristic curve as measured by the c-statistic was calculated. Observed hospital visit rates were compared to predicted hospital visit probabilities in the lowest and highest deciles, and the range of predicted probabilities compared to the range of observed rates was evaluated to examine model discrimination.

Several analyses to validate the patient-level risk-adjustment model were performed. First, we compared model performance in the 2013 Development Sample with its performance in the

2013 Validation Sample. The c-statistic, model information criteria (Akaike Information Criteria [AIC], Bayesian Information Criteria [BIC]), and model discrimination (predictive ability) were compared.[29] Second, we examined the stability of the risk variable frequencies and regression coefficients across the development and validation datasets. Third, we calculated over-fitting indices in the 2013 Validation Sample. Over-fitting refers to the phenomenon in which a model describes the relationship between predictive variables and outcome well in the development dataset but fails to provide valid predictions in new patients. Estimated calibration values of γ_0 far from 0 and estimated values of γ_1 far from 1 provide evidence of over-fitting.

3.5.5 Calculation of ASC-Level Measure Score

ASCs' measure scores were estimated by fitting the hierarchical logistic regression model to the combined 2012-2013 HCUP data for Florida and New York. As noted above in Section 3.5.1, we calculated the risk-standardized hospital visit rate (RSHVR) for each ASC by computing the ratio of the number of predicted unplanned hospital visits to the number of expected unplanned hospital visits and then multiplying the ratio by the overall national outcome rate.

3.5.6 Statistical Software

All statistical analyses were performed using Statistical Analysis System (SAS) version 9.4 (SAS Institute Inc., Cary, NC). The hierarchical logistic regression model was estimated using the GLIMMIX procedure in SAS.

4. Results

4.1 Overall Summary

After applying all inclusion and exclusion criteria, the 2013 20% FFS Sample included 37,386 outpatient orthopedic surgeries performed at 2,144 ASCs. The 2013 Development and Validation Samples consisted of 26,171 and 11,215 orthopedic procedures performed at 2,058 and 1,771 ASCs, respectively. In the Development and Validation Samples, the average age of patients was 73.3 and 73.2 years, respectively, and the comorbidity frequencies were similar (Table 1).

Table 2 presents the top 20 most common surgeries included in the 2013 orthopedic ASC measure cohort; they represent 64.7% of all surgeries in the cohort.

In the 2013 dataset, the overall national 7-day unplanned hospital visit rate was 2.4%. Of these hospital visits, 74.6% were ED or observation stay visits and 25.4% were unplanned inpatient admissions (Table 3).

Across ASCs in the 2013 20% FFS Sample, the average number of orthopedic surgery cases was 11, with the volume of cases ranging from 1 to 201 procedures per ASC (the 25th and 75th percentiles were 4 and 23 procedures, respectively).

These results show that there were many small-volume ASCs in the 2013 Medicare FFS 20% Sample; 1,740 (81.2%) ASCs had fewer than 30 cases. Among the 404 ASCs with at least 30 patients in the 2013 20% FFS Sample, the unadjusted rate of unplanned hospital visits across ASCs ranged from 0.0% to 12.9%. Of these ASCs, 29.7% had a hospital visit rate of 0.0%; however, the top 10% of ASCs with 30 or more cases had rates exceeding 5.3%. The results show variation in performance across ASC facilities. While many ASCs achieve very low rates, there is a wide range of outcome rates, suggesting room for improvement. Note: For public reporting, CMS will use complete data files and may combine 2 years of data to ensure reliable estimates.

Patients visited hospitals after orthopedic ASC surgery for a diverse array of reasons. However, potentially preventable causes, such as urinary retention, pain, nausea, vomiting, syncope, and other surgery-related complications, were common diagnoses associated with unplanned hospital visits across the AHRQ clinical categories included in the measure cohort (Table 4).

4.2 Patient-Level Risk-Adjustment Model

4.2.1 Candidate and Final Variables

Candidate variables for risk adjustment included patient demographic, clinical, and procedure characteristics (see Appendix D, Table D1). After performing the stepwise variable selection procedure described in Section 3.5.3 above, the final risk-adjustment model included age, 13 comorbidities, a variable (work RVUs) to adjust for surgical procedural complexity, and one interaction term (see Table 1). Table 1 shows the frequency of the final risk-adjustment variables in the Development and Validation Samples.

4.2.2 Model Performance and Validation

As the results in Table 5 show, the c-statistic in the 2013 Development Sample final model was 0.670, which indicated good model discrimination; the c-statistic was in the 2013 Validation Sample was slightly higher (0.698). Additionally, the risk decile plots showed good discrimination; the model performed well in each of the risk deciles in both the Development Sample (Figure 2) and the Validation Sample (Figure 3). The mean observed unplanned hospital visit rate in the 2013 Development Sample ranged from 0.85% in the lowest decile of predicted orthopedic surgery hospital visit rate to 6.60% in the highest predicted risk decile, a range of 5.75%; comparable results were found in the Validation Sample (Table 5).

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

4.3 ASC-Level Measure Score

4.3.1 ASC-Level Measure Score Variation

Using the 2012-2013 HCUP data for Florida and New York (which included 57,505 orthopedic surgeries from 243 ASCs), we found variation in the risk-adjusted measure score among ASCs (Figure 4). The median RSHVR was 2.0%, ranging from 1.4% to 3.0% (the 25th and 75th percentiles were 1.9% and 2.1%, respectively).

4.4 Additional Testing to be Performed

To finalize the model, additional model testing will be performed.

Facility-level measure score reliability testing

- Reliability of the facility measure score will be tested by calculating the intra-class correlation coefficient (ICC) of the measure score. To calculate the ICC, multiple years of

HCUP data for ASCs with ≥2 orthopedic surgeries will be combined and then randomly split into two samples within each facility. The ICC evaluates the agreement between the RSHVR calculated in the two randomly selected samples.[30]

<u>Facility-level measure score disparities testing</u>

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

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

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

5. Summary and Discussion

Outpatient orthopedic surgery is commonly performed on Medicare beneficiaries. Using a national Medicare FFS 20% sample, it is estimated that 186,930 outpatient orthopedic surgeries were performed in 2013 at ASCs using the cohort definition for the measure under consideration. Our analysis suggests that 2.4% of orthopedic surgical procedures at ASCs among Medicare FFS patients aged 65 years and older are followed by unplanned hospital visits within 7 days. Hospital visits often occur due to potentially preventable adverse events, such as urinary retention, bleeding, postoperative pain, and nausea and vomiting. Our results also showed variation in unplanned hospital visits among ASCs after adjusting for case mix, which suggests variation in quality of care.

The many small-volume ASCs make using outcome measures to assess quality of care challenging. ASCs with few cases in a given year provide unreliable information about quality for statistical estimation purposes. It should be noted that the measure testing presented in this report is based upon a 20% sample of Medicare FFS claims, whereas, for public reporting, CMS will use complete administrative claims data files and may use more than 1 year of data to ensure reliable estimates. Hospital visits following outpatient 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 orthopedic surgery.

6. References

1.   Cullen KA, Hall MJ, Golosinskiy A, National Center for Health Statistics. *Ambulatory surgery in the United States, 2006.* US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics; 2009.

2.   Majholm BB. Is day surgery safe? A Danish multicentre study of morbidity after 57,709 day surgery procedures. *Acta anaesthesiologica Scandinavica.* 2012;56(3):323-331.

3.   Whippey A, Kostandoff G, Paul J, Ma J, Thabane L, Ma HK. Predictors of unanticipated admission following ambulatory surgery: a retrospective case-control study. *Canadian Journal of Anesthesia/Journal canadien d'anesthésie.* 2013;60(7):675-683.

4.   Fleisher LA, Pasternak LR, Herbert R, Anderson GF. Inpatient hospital admission and death after outpatient surgery in elderly patients: importance of patient and system characteristics and location of care. *Arch Surg.* 2004;139(1):67-72.

5.   Coley KC, Williams BA, DaPos SV, Chen C, Smith RB. Retrospective evaluation of unanticipated admissions and readmissions after same day surgery and associated costs. *Journal of clinical anesthesia.* 2002;14(5):349-353.

6.   Hollingsworth JMJM. Surgical quality among Medicare beneficiaries undergoing outpatient urological surgery. *The Journal of urology.* 2012;188(4):1274-1278.

7.   Bain J, Kelly H, Snadden D, Staines H. Day surgery in Scotland: patient satisfaction and outcomes. *Quality in Health Care.* 1999;8(2):86-91.

8.   Fortier J, Chung F, Su J. Unanticipated admission after ambulatory surgery--a prospective study. *Canadian journal of anaesthesia = Journal canadien d'anesthesie.* 1998;45(7):612-619.

9.   Aldwinckle R, Montgomery J. Unplanned admission rates and postdischarge complications in patients over the age of 70 following day case surgery. *Anaesthesia.* 2004;59(1):57-59.

10.   Baugh RR. Safety of outpatient surgery for obstructive sleep apnea. *Otolaryngology--head and neck surgery.* 2013;148(5):867-872.

11.   Bhattacharyya N. Ambulatory sinus and nasal surgery in the United States: Demographics and perioperative outcomes. *The Laryngoscope.* 2010;120(3):635-638.

12.   Bhattacharyya NN. Unplanned revisits and readmissions after ambulatory sinonasal surgery. *The Laryngoscope.* 2014;124(9):1983-1987.

13.   Bhattacharyya NN. Revisits and postoperative hemorrhage after adult tonsillectomy. *The Laryngoscope.* 2014;124(7):1554-1556.

14.   Hansen DGDG. Variation in hospital-based acute care within 30 days of outpatient plastic surgery. *Plastic and reconstructive surgery (1963).* 2014;134(3):370e-378e.

15.   Mahboubi HH. Ambulatory laryngopharyngeal surgery: evaluation of the national survey of ambulatory surgery. *JAMA otolaryngology-- head & neck surgery.* 2013;139(1):28-31.

16.   Menachemi. Quality of care differs by patient characteristics: outcome disparities after ambulatory surgical procedures. *American journal of medical quality.* 2007;22(6):395-401.

17.   Orosco RKRK. Ambulatory thyroidectomy: a multistate study of revisits and complications. *Otolaryngology--head and neck surgery.* 2015;152(6):1017-1023.

18.   Owens PLPL. Surgical site infections following ambulatory surgery procedures. *JAMA : the journal of the American Medical Association.* 2014;311(7):709-716.

19.   Mezei G, Chung F. Return hospital visits and hospital readmissions after ambulatory surgery. *Ann Surg.* 1999;230(5):721-727.

20.   Medicare Payment Advisory Commission (MedPAC). Report to Congress: Medicare Payment Policy. March 2016; http://www.medpac.gov/documents/reports/march-2016-report-to-the-congress-medicare-payment-policy.pdf.

21.   Bettelli G. High risk patients in day surgery. *Minerva anestesiologica.* 2009;75(5):259-268.

22.   Fuchs K. Minimally invasive surgery. *Endoscopy.* 2002;34(2):154-159.

23.   Centers for Medicare & Medicaid Services. Ambulatory Surgical Center Quality Reporting Specifications Manual Release Notes Version: 6.0. 2016; http://qualitynet.org/dcs/BlobServer?blobkey=id&blobnocache=true&blobwhere=1228890589535&blobheader=multipart%2Foctet-stream&blobheadername1=Content-Disposition&blobheadervalue1=attachment%3Bfilename%3DASC_Full_Manual_V6.0.pdf&blobcol=urldata&blobtable=MungoBlobs Accessed July 13, 2016.

24.   Agency for Healthcare Research and Quality. HCUP CCS-Services and Procedures. Healthcare Cost and Utilization Project (HCUP). March 2016; www.hcup-us.ahrq.gov/toolssoftware/ccs_svcsproc/ccssvcproc.jsp. Accessed July 26, 2016.

25.   Mattila K, Toivonen J, Janhunen L, Rosenberg PH, Hynynen M. Postdischarge symptoms after ambulatory surgery: first-week incidence, intensity, and risk factors. *Anesthesia and analgesia.* 2005;101(6):1643-1650.

26.   Sherman SL, Lyman S, Koulouvaris P, Willis A, Marx RG. Risk factors for readmission and revision surgery following rotator cuff repair. *Clin Orthop.* 2008;466(3):608-613.

27.   Raval MV, Cohen ME, Ingraham AM, et al. Improving American College of Surgeons National Surgical Quality Improvement Program risk adjustment: incorporation of a novel procedure risk score. *Journal of the American College of surgeons.* 2010;211(6):715-723.

28.   Hosmer DW, Lemeshow S. Introduction to the logistic regression model. *Applied Logistic Regression, Second Edition.* 2000:1-30.

29.   DeLong ER, DeLong DM, Clarke-Pearson DL. Comparing the areas under two or more correlated receiver operating characteristic curves: a nonparametric approach. *Biometrics.* 1988:837-845.

30.   Landis JR, Koch GG. The Measurement of Observer Agreement for Categorical Data. *Biometrics.* 1977;33(1):159-174.

31.   Horwitz LI, Grady JN, Cohen DB, et al. Development and Validation of an Algorithm to Identify Planned Readmissions From Claims Data. *Journal of hospital medicine.* 2015;10(10):670-677.

7. Tables

Table 1. Frequency of risk model variables in the Medicare Development and Validation Samples

Variable (definition)	2013 Development Sample		2013 Validation Sample	
	#	%	#	%
N	26,171		11,215	
Age: mean (standard deviation [SD])	73.3	5.8%	73.2	5.8%
Relative Value Units: mean (SD)	7.7	3.6%	7.8	3.6%
Comorbidities				
Tobacco use (ICD-9-CM diagnosis code 3051)	1,022	3.9%	474	4.2%
Morbid obesity (ICD-9-CM codes 27801, V8541, V8542, V8543, V8544, V8545)	646	2.5%	281	2.5%
Chronic ulcers (CC 157, 158, 159, 160, 161)	1,580	6.0%	691	6.2%
Minor symptoms, signs, findings (CC 179)	21,947	83.9%	9,419	84.0%
Major symptoms, abnormalities (CC 178)	15,753	60.2%	6,659	59.4%
Psychiatric disorders (CC 57, 58, 59, 60, 61, 62, 63)	5,780	22.1%	2,477	22.1%
Dementia (CC 51, 52, 53)	1,352	5.2%	543	4.8%
Other and unspecified heart disease (CC 98)	2,264	8.7%	981	8.7%
Multiple sclerosis (CC 77)	78	0.3%	31	0.3%
Major traumatic fracture or internal injury (CC 170, 171, 172)	1,204	4.6%	558	5.0%
History of infection (CC 1, 3, 4, 5, 6, 7)	6,480	24.8%	2,764	24.6%
Other gastrointestinal disorders (CC 38)	12,847	49.1%	5,502	49.1%
Chronic lung disease (CC 111, 112, 113)	4,963	19.0%	2,229	19.9%

Table 2. Top 20 procedures in the orthopedic cohort (data source: Medicare 20% FFS Sample, 2013)

CPT® code	CPT® code short description	Number of procedures	% of all surgeries
26055	incise finger tendon sheath	3,872	10.4%
29881	knee arthroscopy/surgery	3,288	8.8%
29880	knee arthroscopy/surgery	3,093	8.3%
29827	arthroscopic rotator cuff repair	2,959	7.9%
28285	repair of hammertoe	1,802	4.8%
25447	repair wrist joints	1,154	3.1%
20680	removal of support implant	1,027	2.8%
26160	remove tendon sheath lesion	958	2.6%
28296	correction of bunion	903	2.4%

CPT® code	CPT® code short description	Number of procedures	% of all surgeries
23412	repair rotator cuff chronic	879	2.4%
26123	release palm contracture	674	1.8%
29879	knee arthroscopy/surgery	484	1.3%
29824	shoulder arthroscopy/surgery	473	1.3%
28292	correction of bunion	459	1.3%
29876	knee arthroscopy/surgery	446	1.2%
25000	incision of tendon sheath	399	1.1%
29823	shoulder arthroscopy/surgery	368	1.0%
28750	fusion of big toe joint	318	0.9%
27570	fixation of knee joint	317	0.9%
25609	treat fx radial 3+ frag	313	0.8%

Table 3. Number and frequency of emergency department visits, observation stays, and unplanned inpatient admissions (data source: Medicare 20% FFS Sample, 2013)

Number of orthopedic procedures	Number with unplanned hospital visits outcome	Overall 7-day unplanned hospital visit rate
37,386	907	2.4
Outcome type	**#**	**%**
Emergency department or observation stay visit	677	1.8
Unplanned inpatient admission	230	0.6

Table 4. Top hospital visit diagnoses for any hospital visit within 7 days of orthopedic procedures (data source: Medicare 20% FFS Sample, 2013)

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary diagnoses at hospital	ICD-9 diagnosis description	Frequency of diagnosis
142 - Partial excision bone	2,142	46	2.2%	33818	Acute postop pain NEC	3
				99811	Hemorrhage complic proc	3
				78659	Chest pain NEC	2
				5609	Intestinal obstruct NOS	2
				78650	Chest pain NOS	1
				51884	Acute & chronc resp fail	1
				41519	Pulm embol/infarct NEC	1
				7802	Syncope and collapse	1
				49392	Asthma NOS w (ac) exac	1
				7840	Headache	1
143 - Bunionectomy or repair of toe deformities	4,257	71	1.7%	56400	Constipation NOS	6
				99811	Hemorrhage complic proc	5
				7295	Pain in limb	4
				33818	Acute postop pain NEC	4
				99859	Other postop infection	3
				42731	Atrial fibrillation	2
				7840	Headache	2
				78650	Chest pain NOS	2
				49121	Obs chr bronc w (ac) exac	2
				78097	Altered mental status	2
145 - Treatment, fracture or dislocation of radius and ulna	998	42	4.2%	81341	Colles' fracture-closed	5
				33818	Acute postop pain NEC	2
				78701	Nausea with vomiting	2
				56400	Constipation NOS	2

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary diagnoses at hospital	ICD-9 diagnosis description	Frequency of diagnosis
				79902	Hypoxemia	2
				7295	Pain in limb	2
				5849	Acute kidney failure NOS	2
				42731	Atrial fibrillation	2
				95901	Head injury NOS	1
				99811	Hemorrhage complic proc	1
146 - Treatment, fracture or dislocation of hip and femur	5	3	60.0%	83500	Dislocat hip NOS-closed	1
				71916	Hemarthrosis-l/leg	1
				99642	Dislocate prosthetic jt	1
				49121	Obs chr bronc w(ac) exac	1
				V5849	Postop oth specfd aftrcr	1
				7295	Pain in limb	1
				78659	Chest pain NEC	1
147 - Treatment, fracture or dislocation of lower extremity (other than hip or femur)	439	13	3.0%	9895	Toxic effect venom	1
				99811	Hemorrhage complic proc	1
				78702	Nausea alone	1
				78701	Nausea with vomiting	1
				99649	Mech com orth dev NEC	1
				V5489	Orthopedic aftercare NEC	1
				7242	Lumbago	3
				7245	Backache NOS	2
				78906	Abdmnal pain epigastric	2
148 - Other fracture and dislocation procedure	677	40	5.9%	7802	Syncope and collapse	2
				49121	Obs chr bronc w(ac) exac	2
				7804	Dizziness and giddiness	2
				42833	Ac on chr diast hrt fail	1

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary diagnoses at hospital	ICD-9 diagnosis description	Frequency of diagnosis
				78904	Abdmnal pain lt lwr quad	1
				5849	Acute kidney failure NOS	1
				81612	Fx distal phal, hand-opn	1
149 - Arthroscopy	59	1	1.7%	8920	Open wound of foot	1
150 - Division of joint capsule, ligament or cartilage	291	2	0.7%	7242	Lumbago	1
				71946	Joint pain-l/leg	1
151 - Excision of semilunar cartilage of knee	6,408	134	2.1%	33818	Acute postop pain NEC	16
				99811	Hemorrhage complic proc	9
				71946	Joint pain-l/leg	8
				7295	Pain in limb	5
				42731	Atrial fibrillation	5
				78659	Chest pain NEC	4
				6929	Dermatitis NOS	3
				71906	Joint effusion-l/leg	3
				7802	Syncope and collapse	3
				99812	Hematoma complic proc	3
152 - Arthroplasty knee	127	8	6.3%	56400	Constipation NOS	3
				5849	Acute kidney failure NOS	1
				462	Acute pharyngitis	1
				33818	Acute postop pain NEC	1
				99812	Hematoma complic proc	1
				99859	Other postop infection	1
153 - Hip replacement, total and partial	17	0	0.0%			
154 - Arthroplasty other than hip or knee	1,434	57	4.0%	33818	Acute postop pain NEC	6
				7295	Pain in limb	6
				99859	Other postop infection	3

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary diagnoses at hospital	ICD-9 diagnosis description	Frequency of diagnosis
				0389	Septicemia NOS	2
				V5489	Orthopedic aftercare NEC	2
				72981	Swelling of limb	2
				5362	Persistent vomiting	2
				53021	Ulcer esophagus w bleed	1
				78605	Shortness of breath	1
				78650	Chest pain NOS	1
156 - Injections and aspirations of muscles, tendons, bursa, joints and soft tissue	0					
157 - Amputation of lower extremity	571	27	4.7%	33818	Acute postop pain NEC	2
				99859	Other postop infection	2
				44024	Ath ext ntv art gngrene	2
				25080	DMII oth nt st uncntrld	2
				99811	Hemorrhage complic proc	2
				68110	Cellulitis, toe NOS	1
				34982	Toxic encephalopathy	1
				5609	Intestinal obstruct NOS	1
				42781	Sinoatrial node dysfunct	1
				72610	Rotator cuff synd NOS	1
159 - Other diagnostic procedures on musculoskeletal system	120	4	3.3%	99811	Hemorrhage complic proc	1
				7802	Syncope and collapse	1
				27651	Dehydration	1
				7820	Skin sensation disturb	1
160 - Other therapeutic procedures on muscles and tendons	14,042	305	2.2%	33818	Acute postop pain NEC	22
				78820	Retention urine NOS	14
				78659	Chest pain NEC	14

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary diagnoses at hospital	ICD-9 diagnosis description	Frequency of diagnosis
				71941	Joint pain-shlder	13
				78609	Respiratory abnorm NEC	11
				7802	Syncope and collapse	10
				78701	Nausea with vomiting	9
				56400	Constipation NOS	7
				42789	Cardiac dysrhythmias NEC	5
				7823	Edema	5
161 - Other OR therapeutic procedures on bone	1,463	36	2.5%	33818	Acute postop pain NEC	3
				99811	Hemorrhage complic proc	3
				41401	Crnry athrscl natve vssl	2
				7080	Allergic urticaria	1
				92411	Contusion of knee	1
				34690	Migrne unsp wo ntrc mgrn	1
				78703	Vomiting alone	1
				88100	Open wound of forearm	1
				5693	Rectal & anal hemorrhage	1
				99812	Hematoma complic proc	1
162 - Other OR therapeutic procedures on joints	3,976	106	2.7%	7295	Pain in limb	5
				78701	Nausea with vomiting	4
				42731	Atrial fibrillation	3
				78791	Diarrhea	3
				56400	Constipation NOS	3
				7851	Palpitations	3
				7804	Dizziness and giddiness	3
				33818	Acute postop pain NEC	3
				99859	Other postop infection	3

AHRQ clinical category	Number of procedures in clinical category	Number of unplanned hospital visits	Rate of unplanned hospital visits (%)	Top 10 primary diagnoses at hospital	ICD-9 diagnosis description	Frequency of diagnosis
				78650	Chest pain NOS	2
163 - Other non-OR therapeutic procedures on musculoskeletal system	4	0	0.0%			
164 - Other OR therapeutic procedures on musculoskeletal system	356	12	3.4%	99811	Hemorrhage complic proc	2
				43491	Crbl art ocl NOS w infrc	1
				27651	Dehydration	1
				0389	Septicemia NOS	1
				4589	Hypotension NOS	1
				99673	Comp-ren dialys dev/grft	1
				V5831	Attn rem surg dressing	1
				8850	Amputation thumb	1
				33818	Acute postop pain NEC	1
				486	Pneumonia, organism NOS	1

Table 5. Risk-adjustment model performance summaries in the Medicare Development and Validation Samples

Characteristic	2013 Development Sample	2013 Validation Sample
N	26,171	11,215
# of hospital visits in 7 days	677 (2.6%)	230 (2.1%)
Calibration (γ_0, γ_1)	(0, 1)	(-0.13, 1.03)
c-statistic	0.670	0.698
Predictive ability (lowest-highest risk decile)	0.85%-6.6%	0.53%-5.8%

Table 6. Model parameter estimates and odds ratios in the Medicare Development and Validation Samples

	2013 Development Sample		2013 Validation Sample	
	Estimate	**Odds ratio (95% CI)**	**Estimate**	**Odds ratio (95% CI)**
Intercept	-5.605		-6.224	
Age > 65	0.023	1.02 (1.01-1.04)	0.038	1.04 (1.01-1.07)
Work relative value units (work RVUs) - Mean (SD)	0.107	1.11 (1.09-1.14)	0.117	1.12 (1.09-1.16)
Comorbidities				
Tobacco use	0.225	1.25 (0.89-1.77)	0.219	1.25 (0.71-2.20)
Morbid obesity	0.108	1.11 (0.71-1.75)	-0.197	0.82 (0.33-2.03)
Chronic ulcers	0.419	1.52 (1.16-2.00)	0.321	1.38 (0.84-2.25)
Minor symptoms, signs, findings	0.366	1.44 (1.10-1.89)	0.387	1.47 (0.92-2.37)
Major symptoms, abnormalities	0.258	1.29 (1.08-1.56)	0.266	1.30 (0.95-1.80)
Psychiatric disorders	0.245	1.28 (1.07-1.52)	0.329	1.39 (1.03-1.87)
Dementia	0.414	1.51 (1.16-1.98)	0.383	1.47 (0.93-2.31)
Other and unspecified heart disease	0.297	1.35 (1.07-1.69)	0.330	1.39 (0.95-2.04)
Multiple sclerosis	1.101	3.01 (1.35-6.67)	Unable to Estimate	
Major traumatic fracture or internal injury	0.338	1.40 (1.05-1.88)	0.357	1.43 (0.89-2.31)
History of infection	0.190	1.21 (1.02-1.44)	0.015	1.02 (0.75-1.38)
Other gastrointestinal disorders	0.170	1.19 (1.01-1.40)	0.433	1.54 (1.15-2.06)
Chronic lung disease	-0.106	0.90 (0.65-1.25)	0.354	1.43 (0.83-2.44)
Age > 65 x Chronic Lung Disease Interaction:	0.030		-0.012	
Among those with chronic lung disease				
70 v. 65	0.263	1.30 (1.16-1.46)	0.134	1.14 (0.94-1.39)
75 v. 65	0.526	1.69 (1.34-2.13)	0.267	1.31 (0.89-1.93)
80 v. 65	0.789	2.20 (1.56-3.11)	0.401	1.49 (0.83-2.68)
85 v. 65	1.052	2.86 (1.80-4.55)	0.535	1.71 (0.78-3.72)
Among those without chronic lung disease				
70 v. 65	0.115	1.12 (1.04-1.21)	0.192	1.21 (1.07-1.37)
75 v. 65	0.231	1.26 (1.09-1.46)	0.383	1.47 (1.14-1.89)
80 v 65	0.346	1.41 (1.13-1.77)	0.575	1.78 (1.22-2.59)
85 v 65	0.462	1.59 (1.18-2.14)	0.766	2.15 (1.30-3.56)

8. Figures

Figure 1. Timing of hospital visits within 30 days of orthopedic ASC procedures (event rate per day post discharge for 0- through 30-day period; data source: Medicare 20% FFS Sample, 2013)
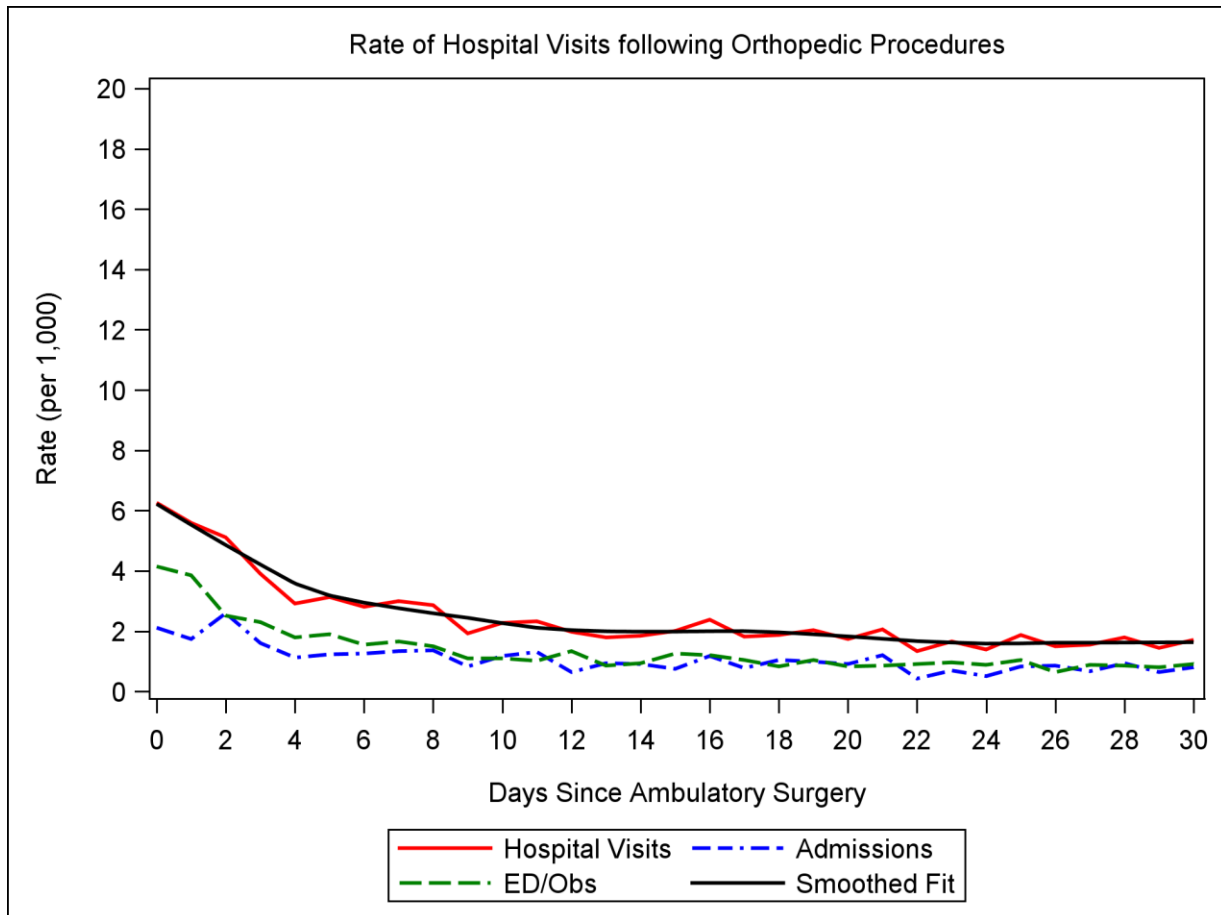
Figure 2. Calibration plot of predicted versus observed outcomes across deciles of patient risk in the 2013 Development Sample (data source: Medicare 20% FFS Sample, 2013)
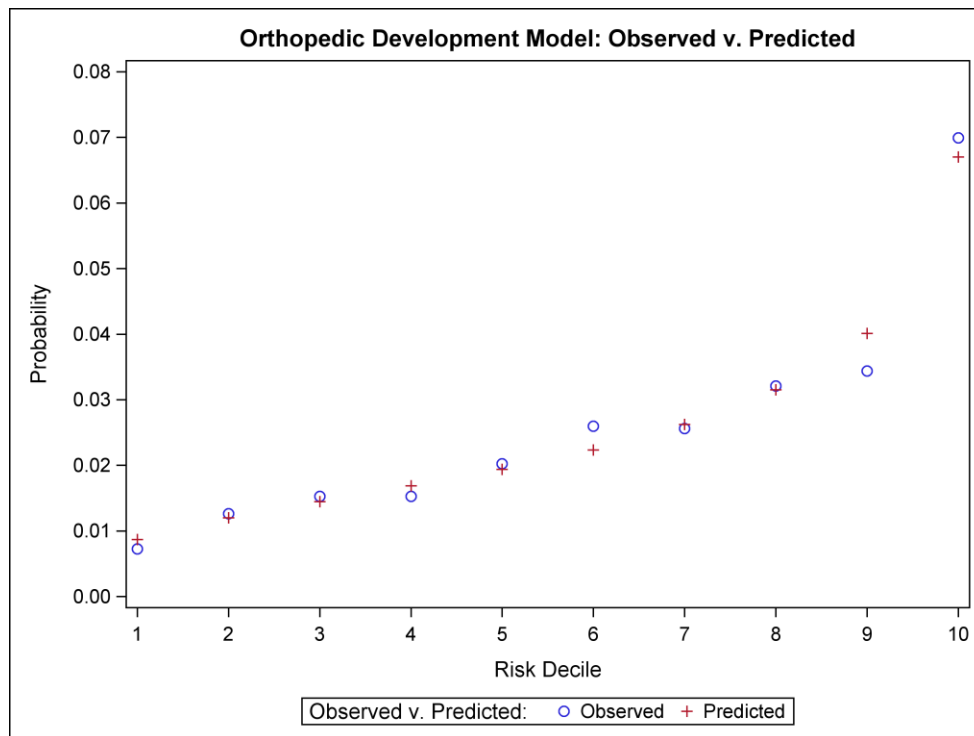
Figure 3. Calibration plot of predicted versus observed outcomes across deciles of patient risk in the 2013 Validation Sample (data source: Medicare 20% FFS Sample, 2013)
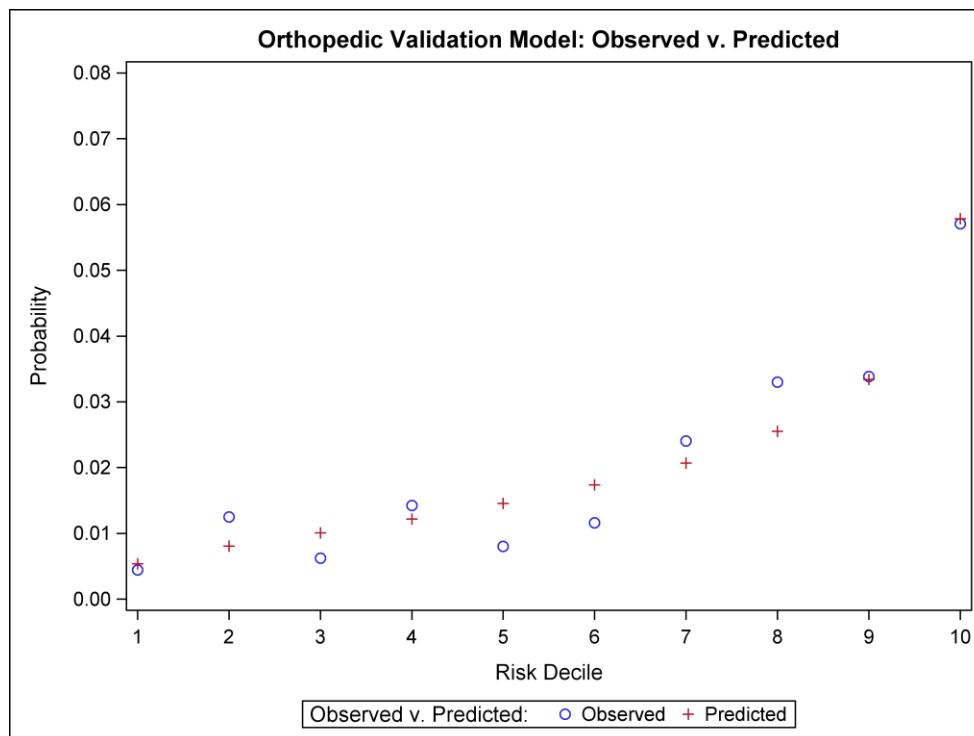
Figure 4. Distribution of risk adjusted hospital visit rates following orthopedic ASC procedures (data source: 2012-2013 HCUP, FL & NY; age ≥65 years; Medicare Advantage & FFS; includes 243 ASCs)

Distribution of Risk-Standardized Hospital Visit Rates: HCUP NY/FL 2012-13

$\tau^2 = .065$

Min	1.4
1st %	1.6
5th %	1.7
10th %	1.8
25th %	1.9
Median	2.0
75th %	2.1
90th %	2.3
95th %	2.5
99th %	2.8
Max	3.0
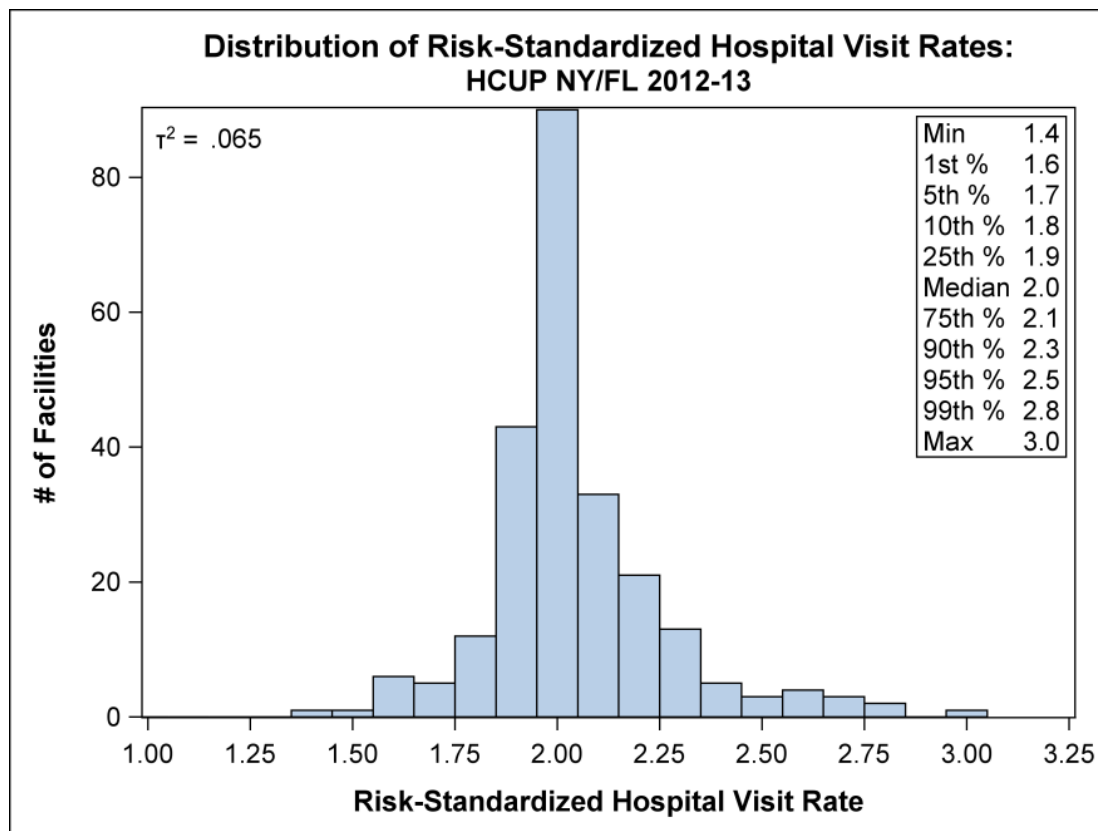
9. Appendices

Appendix A: Emergency Department Visits and Observation Stays Definition

Table A1. HCPCS codes or revenue center codes that define emergency department visits and observation stays

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

*Identified in Medicare Part B Outpatient hospital claims.

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

Appendix B: Planned Admission Algorithm

B1. Planned Admission Algorithm Overview

The planned admission algorithm is adapted from the CMS Planned Readmission Algorithm Version 4.0. The algorithm is a set of criteria for classifying hospital inpatient admissions occurring after an orthopedic ASC 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.[31]

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

The algorithm uses the Agency for Healthcare Research and Quality's (AHRQ's) Clinical Classifications Software (CCS) (http://www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp) codes to group thousands of individual procedure and diagnosis ICD-9-CM codes into clinically coherent, mutually exclusive procedure CCS categories and mutually exclusive diagnosis CCS categories, respectively.

B2. Detailed Description of Planned Readmission Algorithm Version 4.0 – Orthopedic ASC Measure

The planned admission algorithm uses the flow chart (Figure PA1) and Table PA1–Table PA4, adapted for the orthopedic ASC procedure population, to identify specific procedure categories and discharge diagnosis categories to classify admissions as planned or unplanned. As illustrated in the flow chart (Figure PA1), admissions that include certain procedures (Table PA1) or are for certain diagnoses Table PA2 are always considered planned. If the admission does not include a procedure or diagnosis in Table PA1 or Table PA2 that is always considered planned, the algorithm checks whether the admission has at least 1 procedure that is considered potentially planned (Table PA3). If the admission has no procedures from Table PA3, the admission is considered unplanned. Table PA3 includes AHRQ procedure CCS categories and

individual ICD-9-CM procedure codes. Examples of potentially planned procedures are total hip replacement (Procedure CCS 153) and hernia repair (Procedure CCS 85).

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

Figure PA1. Planned admission algorithm flowchart
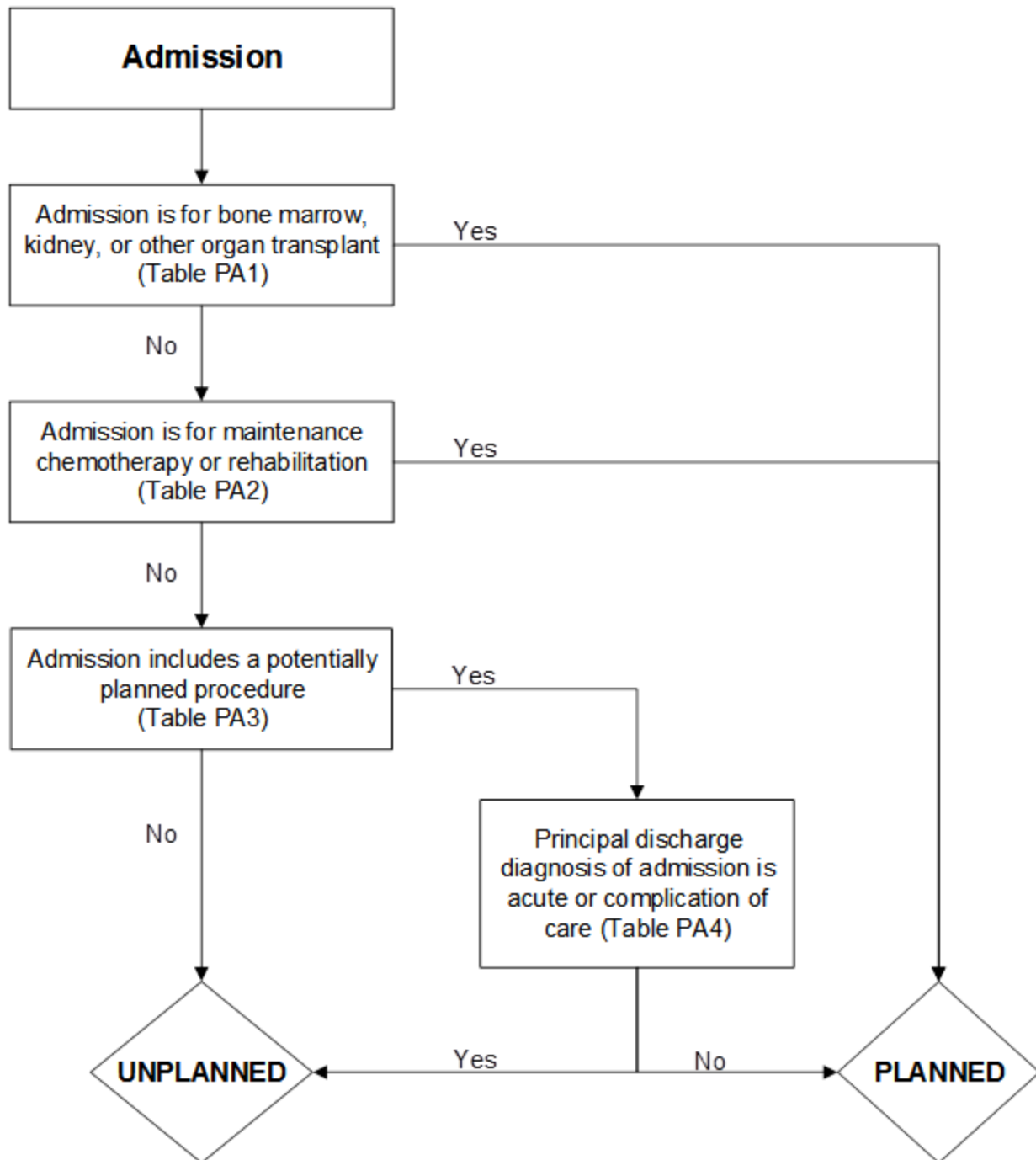
Table PA1. Procedure categories that are always planned (Planned Readmission Algorithm Version 4.0 – adapted for Orthopedic ASC Measure Version 1.0)

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

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

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

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

Code	Description
Procedure CCS (ICD-9 & ICD-10)	
1	Incision and excision of central nervous system (CNS)
3	Laminectomy; excision intervertebral disc (in ICD-10 version, description is: "Excision, destruction or resection of intervertebral disc")
5	Insertion of catheter or spinal stimulator and injection into spinal canal
9	Other OR therapeutic nervous system procedures
10	Thyroidectomy; partial or complete
12	Other therapeutic endocrine procedures (in ICD-10 version, description is: "Therapeutic endocrine procedures")
33	Other OR therapeutic procedures on nose; mouth and pharynx
36	Lobectomy or pneumonectomy
38	Other diagnostic procedures on lung and bronchus
40	Other diagnostic procedures of respiratory tract and mediastinum
43	Heart valve procedures
44	Coronary artery bypass graft (CABG)
45	Percutaneous transluminal coronary angioplasty (PTCA) (in ICD-10 version, description adds: "with or without stent")
49	Other OR heart procedures
51	Endarterectomy; vessel of head and neck
52	Aortic resection; replacement or anastomosis

Code	Description
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
0CTS8ZZ	Resection of Larynx, Via Natural or Artificial Opening Endoscopic

Code	Description
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
04CL3ZZ	Extirpation of Matter from Left Femoral Artery, Percutaneous Approach

Code	Description
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

Code	Description
0T9030Z	Drainage of Right Kidney with Drainage Device, Percutaneous Approach
0T9040Z	Drainage of Right Kidney with Drainage Device, Percutaneous Endoscopic Approach
0T9130Z	Drainage of Left Kidney with Drainage Device, Percutaneous Approach
0T9140Z	Drainage of Left Kidney with Drainage Device, Percutaneous Endoscopic Approach
0TC03ZZ	Extirpation of Matter from Right Kidney, Percutaneous Approach
0TC04ZZ	Extirpation of Matter from Right Kidney, Percutaneous Endoscopic Approach
0TC13ZZ	Extirpation of Matter from Left Kidney, Percutaneous Approach
0TC14ZZ	Extirpation of Matter from Left Kidney, Percutaneous Endoscopic Approach
0TF33ZZ	Fragmentation in Right Kidney Pelvis, Percutaneous Approach
0TF34ZZ	Fragmentation in Right Kidney Pelvis, Percutaneous Endoscopic Approach
0TF43ZZ	Fragmentation in Left Kidney Pelvis, Percutaneous Approach
0TF44ZZ	Fragmentation in Left Kidney Pelvis, Percutaneous Endoscopic Approach
GZB4ZZZ	Other Electroconvulsive Therapy
GZB0ZZZ	Electroconvulsive Therapy, Unilateral-Single Seizure
GZB1ZZZ	Electroconvulsive Therapy, Unilateral-Multiple Seizure
GZB2ZZZ	Electroconvulsive Therapy, Bilateral-Single Seizure
GZB3ZZZ	Electroconvulsive Therapy, Bilateral-Multiple Seizure
GZB4ZZZ	Other Electroconvulsive Therapy

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

Code	Description
Diagnosis CCS (ICD-9 & ICD-10)	
1	Tuberculosis
2	Septicemia (except in labor)
3	Bacterial infection; unspecified site
4	Mycoses
5	HIV infection
7	Viral infection
8	Other infections; including parasitic
9	Sexually transmitted infections (not HIV or hepatitis)
54	Gout and other crystal arthropathies
55	Fluid and electrolyte disorders
60	Acute posthemorrhagic anemia
61	Sickle cell anemia
63	Diseases of white blood cells
76	Meningitis (except that caused by tuberculosis or sexually transmitted disease)

Code	Description
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
139	Gastroduodenal ulcer (except hemorrhage)
140	Gastritis and duodenitis

Code	Description
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 non-medicinal substances
244	Other injuries and conditions due to external causes
245	Syncope
246	Fever of unknown origin
247	Lymphadenitis
249	Shock
250	Nausea and vomiting
251	Abdominal pain

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

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

Code	Description
B395	Histoplasmosis duboisii
B399	Histoplasmosis, unspecified
B5881	Toxoplasma myocarditis
I010	Acute rheumatic pericarditis
I011	Acute rheumatic endocarditis
I012	Acute rheumatic myocarditis
I018	Other acute rheumatic heart disease
I019	Acute rheumatic heart disease, unspecified
I020	Rheumatic chorea with heart involvement
I090	Rheumatic myocarditis
I0989	Other specified rheumatic heart diseases
I099	Rheumatic heart disease, unspecified
I300	Acute nonspecific idiopathic pericarditis
I308	Other forms of acute pericarditis
I309	Acute pericarditis, unspecified
I310	Chronic adhesive pericarditis
I311	Chronic constrictive pericarditis
I312	Hemopericardium, not elsewhere classified
I314	Cardiac tamponade
I32	Pericarditis in diseases classified elsewhere
I330	Acute and subacute infective endocarditis
I339	Acute and subacute endocarditis, unspecified
I39	Endocarditis and heart valve disorders in diseases classified elsewhere
I400	Infective myocarditis
I401	Isolated myocarditis
I408	Other acute myocarditis
I409	Acute myocarditis, unspecified
I41	Myocarditis in diseases classified elsewhere
I514	Myocarditis, unspecified
Acute ICD-9 codes within Diagnosis CCS 105: Conduction disorders	
4260	Atrioventricular
42610	Atrioventricular block NOS
42611	Atrioventricular block-1st degree
42612	Atrioventricular block-Mobitz II
42613	Atrioventricular block-2nd degree NEC
4262	Left bundle branch hemiblock
4263	Left bundle branch block NEC

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

Code	Description
Acute ICD-10 codes within Diagnosis CCS 106: Dysrhythmia	
I479	Paroxysmal tachycardia, unspecified
I4949	Other premature depolarization
I498	Other specified cardiac arrhythmias
I499	Cardiac arrhythmia, unspecified
R000	Tachycardia, unspecified
R001	Bradycardia, unspecified
Acute ICD-9 codes within Diagnosis CCS 108: Congestive heart failure; non-hypertensive	
39891	Rheumatic heart failure
4280	Congestive heart failure
4281	Left heart failure
42820	Unspecified systolic heart failure
42821	Acute systolic heart failure
42823	Acute on chronic systolic heart failure
42830	Unspecified diastolic heart failure
42831	Acute diastolic heart failure
42833	Acute on chronic diastolic heart failure
42840	Unspecified combined systolic & diastolic heart failure
42841	Acute combined systolic & diastolic heart failure
42843	Acute on chronic combined systolic & diastolic heart failure
4289	Heart failure NOS
Acute ICD-10 codes within Diagnosis CCS 108: Congestive heart failure; non-hypertensive	
I0981	Rheumatic heart failure
I509	Heart failure, unspecified
I501	Left ventricular failure
I5020	Unspecified systolic (congestive) heart failure
I5021	Acute systolic (congestive) heart failure
I5023	Acute on chronic systolic (congestive) heart failure
I5030	Unspecified diastolic (congestive) heart failure
I5031	Acute diastolic (congestive) heart failure
I5033	Acute on chronic diastolic (congestive) heart failure
I5040	Unspecified combined systolic and diastolic (congestive) heart failure
I5041	Acute combined systolic (congestive) and diastolic (congestive) heart failure
I5043	Acute on chronic combined systolic (congestive) and diastolic (congestive) heart failure
I509	Heart failure, unspecified
Acute ICD-9 codes within Diagnosis CCS 149: Biliary tract disease	
5740	Calculus of gallbladder with acute cholecystitis

Code	Description
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
Acute ICD-10 codes within Diagnosis CCS 149: Biliary tract disease	
K8000	Calculus of gallbladder with acute cholecystitis w/o obstruction
K8001	Calculus of gallbladder with acute cholecystitis with obstruction
K8042	Calculus of bile duct with acute cholecystitis w/o obstruction
K8043	Calculus of bile duct with acute cholecystitis with obstruction
K8062	Calculus of GB and bile duct with acute cholecystitis w/o obstruction
K8063	Calculus of GB and bile duct with acute cholecystitis with obstruction
K8066	Calculus of GB and bile duct with acute and chronic cholecystitis w/o obstruction
K8067	Calculus of GB and bile duct with acute and chronic cholecystitis with obstruction
K810	Acute cholecystitis
K812	Acute cholecystitis with chronic cholecystitis
K830	Cholangitis
Acute ICD-9 codes with Diagnosis CCS 152: Pancreatic disorders	
5770	Acute Pancreatitis
Acute ICD-10 codes with Diagnosis CCS 152: Pancreatic disorders	
K859	Acute pancreatitis, unspecified

Appendix C: Measure Score Calculation and Reporting

C1. Risk-Standardized Measure Score Calculation Algorithm

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

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

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

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

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

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

C2. Provider Performance Reporting

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

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

Expected

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

Measure score

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

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

Appendix D: Risk-Adjustment Model Development

Table D1. Candidate variables considered for the risk-adjustment model

Patient demographic, comorbidity, and procedural complexity candidate variables for risk adjustment	
Variable category	**Definition**
Age	
Sex	
Number of qualifying procedures	Defined as 1, 2, or ≥3
Work relative value units (work RVUs)	Work RVUs are assigned to each CPT® procedure code and approximate procedure complexity by incorporating elements of physician time and effort
History of infection	CC 1, 3, 4, 5, 6, 7
Septic shock	CC 2
Cancer	CC 8, 9, 10, 11, 12, 13, 14
Diabetes and diabetes mellitus complications	CC 17, 18, 19, 122, 123
Protein-calorie malnutrition	CC 21
Disorders off fluid/electrolyte/acid-base	CC 23, 24
Other endocrine/metabolic/nutritional disorders	CC 26
Liver disease	CC 27, 28, 29, 30, 31, 32
Intestinal obstruction/perforation	CC 33
Inflammatory bowel disease	CC 35
Pancreatic disease; and peptic ulcer, hemorrhage, other specified gastrointestinal disorders	CC 34, 36
Other gastrointestinal disorders	CC 38
Bone/joint/muscle Infections/necrosis	CC 39
Rheumatoid and osteoarthritis	CC 40, 41, 42
Osteoporosis and other bone/cartilage disorders	CC 43
Hematological Disorders Including Coagulation Defects and Iron Deficiency	CC 46, 48, 49
Disorders of immunity	CC 47
Delirium and encephalopathy	CC 50
Dementia or senility	CC 51, 52, 53
Drug and alcohol abuse/dependence	CC 54, 55, 56 (remove ICD-9-CM diagnosis code 3051)
Psychiatric disorders	CC 57, 58, 59, 60, 61, 62, 63

Patient demographic, comorbidity, and procedural complexity candidate variables for risk adjustment	
Variable category	**Definition**
Hemiplegia, paraplegia, paralysis, functional disability	CC 70, 71, 73, 74, 103, 104, 189, 190
Multiple sclerosis	CC 77
Parkinson's and Huntington's diseases	CC 78
Seizure disorders and convulsions	CC 79
Coma, brain compression/anoxic damage	CC 80
Other significant central nervous system (CNS) disease	CC 77, 78, 79, 80
Cardiorespiratory arrest, failure and respiratory dependence	CC 82, 83, 84
Congestive heart failure	CC 85
Ischemic heart disease	CC 86, 87, 88, 89
Hypertension and hypertensive disease	CC 94, 95
Arrhythmias	CC 96, 97
Other and unspecified heart disease	CC 98
Polyneuropathy	CC 75, 81
Valvular and rheumatic heart disease	CC 91
Congenital cardiac/circulatory defect	CC 92, 93
Stroke	CC 99, 100
Precerebral arterial occlusion/transient ischemic attack (TIA)	CC 101
Cerebral atherosclerosis, aneurysm, and other cerebrovascular disease (CVD)	CC 102, 105
Vascular disease	CC 106, 107, 108, 109
Chronic lung disease	CC 111, 112, 113
Pneumonia	CC 114, 115, 116
Pleural effusion/pneumothorax	CC 117
Other Respiratory disorders	CC 118
Retinal detachments	CC 121
Retinal disorders, except detachment and vascular retinopathies	CC 125
Glaucoma	CC 126
Other eye disorders	CC 128
Significant ear, nose, and throat disorders	CC 129
Hearing loss	CC 130
Other ear, nose, throat, and mouth disorders	CC 131
Chronic renal disease	CC 132, 134, 135, 136, 137, 138, 139, 140
Nephritis	CC 141
Urinary obstruction and retention	CC 142
UTI and other urinary track disorders	CC 144, 145
Pelvic inflammatory disease and other specified female genital disorders	CC 147
Male genital disorders	CC 149

Patient demographic, comorbidity, and procedural complexity candidate variables for risk adjustment	
Variable category	**Definition**
Chronic ulcers	CC 157, 158, 159, 160, 161
Cellulitis, local skin infection	CC 164
Other dermatological disorders	CC 165
Head injury	CC 166, 167, 168
Major traumatic fracture or Internal Injury	CC 170, 171, 172
Poisonings and allergic reactions	CC 175
Complications of specified implanted device or graft	CC 176
Other complications of medical care	CC 177
Major symptoms, abnormalities	CC 178
Minor symptoms, signs, findings	CC 179
Organ transplant	CC 186, 187
Morbid obesity	ICD-9-CM codes 27801, V8541, V8542, V8543, V8544, V8545
Tobacco use	ICD-9-CM diagnosis code 3051 (tobacco use disorder)
Chronic anticoagulant use	ICD-9-CM diagnosis code V5861 (long-term (current) use of anticoagulants)

Table D2. Condition Categories (CCs) that are <u>not</u> risk adjusted for if they occur <u>only</u> at the time of the procedure

Condition Category (CC)	CC description
CC 2	Septicemia, Sepsis, Systemic Inflammatory Response Syndrome/Shock
CC 7	Other Infectious Diseases
CC 17	Diabetes with Acute Complications
CC 24	Disorders of Fluid/Electrolyte/Acid-Base
CC 30	Acute Liver Failure/Disease
CC 33	Intestinal Obstruction/Perforation
CC 36	Peptic Ulcer, Hemorrhage, Other Specified Gastrointestinal Disorders
CC 50	Delirium and Encephalopathy
CC 80	Coma, Brain Compression/Anoxic Damage
CC 82	Respirator Dependence/Tracheostomy Status
CC 83	Respiratory Arrest
CC 84	Cardio-Respiratory Failure and Shock
CC 85	Congestive Heart Failure
CC 86	Acute Myocardial Infarction
CC 87	Unstable Angina and Other Acute Ischemic Heart Disease
CC 96	Specified Heart Arrhythmias
CC 97	Other Heart Rhythm and Conduction Disorders
CC 98	Other and Unspecified Heart Disease
CC 99	Cerebral Hemorrhage
CC 100	Ischemic or Unspecified Stroke
CC 101	Precerebral Arterial Occlusion and Transient Cerebral Ischemia
CC 103	Hemiplegia/Hemiparesis
CC 104	Monoplegia, Other Paralytic Syndromes
CC 107	Vascular Disease with Complications
CC 114	Aspiration and Specified Bacterial Pneumonias
CC 115	Pneumococcal Pneumonia, Emphysema, Lung Abscess
CC 117	Pleural Effusion/Pneumothorax
CC 135	Acute renal failure
CC 140	Unspecified renal failure
CC 141	Nephritis
CC 142	Urinary Obstruction and Retention
CC 144	Urinary Tract Infection
CC 164	Cellulitis, Local Skin Infection
CC 168	Concussion or Unspecified Head Injury
CC 175	Poisonings and Allergic and Inflammatory Reactions
CC 176	Complications of Specified Implanted Device or Graft
CC 177	Other Complications of Medical Care