Technical Review 5

Measures of Patient Safety Based on Hospital Administrative Data—The Patient Safety Indicators

Prepared for:

Agency for Healthcare Research and Quality
Department of Health and Human Services
U.S. Public Health Service
2101 East Jefferson Street
Rockville, MD 20852
www.ahrq.gov

Contract No. 290-97-0013

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AHRQ Publication No. 02-0038
August 2002

Acknowledgments

The investigators would like to acknowledge the following individuals and organizations for their aid in this report: Doug Staiger, Dept. of Economics, Dartmouth College for his help in developing statistical methods; Ros McNally, National Primary Care Research and Development Centre, University of Manchester, who aided in the EMBASE® literature search; American Health Information Management Association for providing ICD-9-CM coding expertise; the various professional organizations listed in this report and their staff for submitting nominations for the clinical review panels; the clinical panelists, listed in Appendix B. The investigators also acknowledge the contributions of Anne Elixhauser, Ph.D., and Marlene Miller, M.D., M.Sc., Agency for Healthcare Research and Quality (AHRQ), and Margaret Coopey, R.N., M.G.A., M.S.A., AHRQ Task Order Officer.

McDonald K, Romano P, Geppert J, et al. Measures of Patient Safety Based on Hospital Administrative Data—The Patient Safety Indicators. Technical Review 5 (Prepared by the University of California San Francisco–Stanford Evidence-based Practice Center under Contract No. 290-97-0013). AHRQ Publication No. 02-0038 . Rockville, MD: Agency for Healthcare Research and Quality. August 2002.

ISBN 1-58763-121-0

Structured Abstract

Objectives. Concerns have mounted about the complexities of the health care system potentially causing significant unintended adverse effects. With a major national interest in addressing patient safety issues, a wide spectrum of individuals and organizations are working toward developing methods and systems to detect, characterize, and report potentially preventable adverse events. One approach is to develop screening measures based on routinely collected administrative data, such as the patient safety indicators (PSIs) reported here. The purpose of the PSI project is to report 1) literature-based evidence on potential PSIs, 2) clinician panel review results of potential indicators, 3) empirical analyses on a subset of indicators, and 4) recommendations regarding potential PSIs.

Methods. A four-pronged strategy to collect validation data and descriptive information was used: 1) background literature review, 2) structured clinical panel reviews of candidate PSIs, 3) expert review of ICD-9-CM codes in candidate PSIs, and 4) empirical analyses of the potential candidate PSIs. Evidence from these four sources was used to modify and select the most promising indicators for use as a screening tool to provide an accessible and low-cost approach to identifying potential problems in the quality of care related to patient safety.

Main results. A review of previously reported measures in the literature, and of medical coding manuals, resulted in identification of over 200 ICD-9-CM codes representing potential patient safety problems. Most of these codes were grouped into clinically meaningful indicators either based on previous indicator definitions or on clinical and coding expertise. Based on literature review of the published evidence related to their validity, several potential PSIs were eliminated. Because of the limited validation literature available on PSIs and complications indicators from which many PSIs were derived, the research team conducted a clinical panel review process to assess the face validity and to guide refinements to the initial definitions of the 34 most promising PSIs. Response to a questionnaire by clinicians (i.e., physicians from a number of specialties, nurses, and pharmacists) for each indicator, augmented by coding review and initial empirical testing, provided the basis for selecting the indicators expected to be most useful for screening for potentially preventable adverse events. Twenty *hospital level* PSIs are recommended for implementation as the initial AHRQ PSI set (designated Accepted indicators).

Conclusions and future research. Future validation work should focus on the sensitivity and specificity of these indicators in detecting the occurrence of a complication; the extent to which failures in processes of care at the system or individual level are detected using these indicators; the relationship of these indicators with other measures of quality, such as mortality; and further explorations of bias and risk adjustment. Enhancements to administrative data are worth exploring in the context of further validation studies that utilize data from other sources. The current development and evaluation effort will best be augmented by a continuous communication loop between users of these measures,

researchers interested in improving these measures, and policy makers with influence over the resources aimed at data collection and patient safety measurement.

Contents

List of Tables, Figures, and Flow Diagrams

Summary Tables

Text Tables

Figures

Flow Diagrams

Summary

Introduction

The longstanding cornerstone of medicine "first, do no harm" exists because of the fragility of life and health during medical care encounters, and represents the medical profession's understanding that patient safety has always been an important part of quality health care. Recently, however, concerns and evidence have mounted about the complexities of the health care system potentially causing patient deaths and significant unintended adverse effects. With a major national interest in addressing patient safety issues, a wide spectrum of individuals and organizations are working toward developing methods and systems to detect, characterize, and report potentially preventable adverse events. These activities are crucial precursors to prioritizing areas for action and for studying the effects of approaches to reduce sources of medical error.

As part of this activity, the Evidence-based Practice Center (EPC) at the University of California San Francisco and Stanford University (UCSF-Stanford), with collaboration from the University of California Davis, was commissioned by the Agency for Healthcare Research and Quality (AHRQ) to review and improve the evidence base related to potential patient safety indicators (PSIs) that can be developed from routinely collected administrative data. For the purposes of this report, PSIs refer to measures that screen for potential problems that patients experience resulting from exposure to the health care system, and that are likely amenable to prevention by changes at the level of the system.

Reporting the Evidence

The primary goal of this report is to document the evidence from a variety of sources on potential measures of patient safety suitable for use based on hospital discharge abstract data. The approach to identification and evaluation of PSIs presented in this report serves as the basis for development of a third module for the AHRQ QI tool set (referred to as the HCUP II in previous work by the UCSF-Stanford EPC reporting on the research underpinning the refinement of the initial AHRQ HCUP QIs, available on AHRQ's web site at http://www.achq.gov/data/hcup/qirefine.htm). This third module will be the *Patient Safety Indicators (PSIs)*, which focus on potentially preventable instances of harm to patients, such as surgical complications and other iatrogenic events. The two other modules are the *Prevention Quality Indicators*, based on hospital admissions that might have been avoided through high-quality outpatient care; and the *Inpatient Quality Indicators*, consisting of inpatient mortality, utilization of procedures for which there are questions of overuse, underuse, or misuse; as well as volume of procedures for which higher volume is consistently associated with lower mortality.

Purpose of the PSIs

Like the companion AHRQ Quality Indicators (QIs) screening tool set refined by the UCSF-Stanford EPC, the PSIs are a starting point for further analysis to reduce preventable errors through system or process changes. Additionally, these measures are

likely to support the public mandate for aggregate statistical reporting to monitor trends over time, as planned for the National Quality Report.

Scope of the Project

This report reviews previous studies and presents new empirical evidence for identifying potential patient safety problems based on one potentially important source of data: computerized hospital discharge abstracts from the AHRQ Healthcare Cost and Utilization Project (HCUP). Therefore, the measures considered needed to be defined using variables that are available from most state-level hospital administrative data. Data elements in these sets include International Classification of Disease, Clinical Modification (ICD-9-CM) discharge diagnosis and procedure codes; dates of admission, discharge and major procedures; age; gender; and diagnostic related group (DRG). Data from outside the hospital stay (e.g., post-hospital mortality or readmissions) were not used because most state databases do not accommodate linkages between datasets. The HCUP State Inpatient Databases (SID) is an example of such a common denominator hospital discharge dataset, and was used for the development of the AHRQ PSIs, reported here. The PSIs presented in this report therefore relate to inpatient care, and the adverse events that have either a high likelihood or at least a reasonable possibility of being iatrogenic. These two constraints – the data source and the location of care—guided the development and evaluation of a promising set of patient safety indicators.

Following from these constraints, the PSIs by necessity capture adverse events that may, but possibly are not, related to medical care. They do not capture "near misses" or other undocumented adverse events. They also do not include adverse events related to a number of important patient safety concerns that are not reliably specified using ICD-9-CM, the official codes assigned to diagnoses and procedures associated with hospital utilization in the United States. Based on previous validation work and the limitations inherent in the data source, PSIs derived from discharge data capture a mixture of adverse events, including those that are almost certainly preventable and those that current best practices and error-mitigating systems of care have not been able to prevent. However, the evidence is presented for their promise as a low-cost screen for potential quality concerns to guide further investigations with additional data gathering and information collection.

Methodology

Following the previous refinement of quality indicators described in a companion technical report from the EPC, and published by AHRQ, an evaluation framework for validity testing (i.e., face validity, precision, minimum bias, and construct validity) was applied to each candidate PSI. Specifically, a four pronged strategy to collect validation data and descriptive information included two aspects of the previous work: a background literature review, and empirical analyses of the potential candidate PSIs using the HCUP SID. In addition to these approaches of the previous project, expert coders from the American Health Information Management Association (AHIMA) were consulted, and clinical panel reviews of potential indicators were conducted based on a process adapted from the RAND organization and University of California Los Angeles (RAND/UCLA) Appropriateness Method.

Evidence from these four sources was used to modify and select the most promising indicators for use as a screening tool to provide an accessible and low-cost approach to identifying potential problems in the quality of care related to patient safety. The methods applied provide baseline information on the ability of a fairly broad range of discharge-based PSIs to identify systematic differences across hospitals, and potentially to monitor trends on a national or regional basis.

Results

A review of previously reported measures in the literature (e.g. Complications Screening Program by Iezzoni et al, Patient Safety Indicators by Miller et al), and of medical coding manuals, resulted in identification of over 200 ICD-9-CM codes representing potential patient safety problems. Most of these codes were grouped into clinically meaningful indicators either based on previous indicator definitions or on clinical and coding expertise. Based on literature review of the published evidence related to their validity, several potential PSIs were eliminated. Because of the limited validation literature available on PSIs and complications indicators from which many PSIs were derived, the research team conducted a clinical panel review process to assess the face validity and to guide refinements to the initial definitions of the 34 most promising PSIs. Response to a questionnaire by clinicians (i.e., physicians from a number of specialties, nurses, and pharmacists) for each indicator, augmented by coding review and initial empirical testing, provided the basis for selecting the indicators expected to be most useful for screening for potentially preventable adverse events. Tables 1S and 2S summarize the strength of the evidence literature, definitions, and key findings for the set of 20 *hospital level* PSIs that are recommended for implementation as the initial AHRQ PSI set (designated Accepted indicators).

Table 1S. Strength of Evidence Literature for PSIs

Indicator	Coding	Construct Explicit Process	Construct Implicit Process	Construct Staffing
Complications of anesthesia	0	0	0	0
Death in low mortality DRGs	+	0	+	0
Decubitus ulcer	-	0	0	±
Failure to rescue	+	0	0	++
Foreign body left in during procedure	0	0	0	0
Iatrogenic penumothorax	0	0	0	0
Infection due to medical care	0	0	0	0
Postoperative hip fracture	+	+	+	0
Postoperative hemorrhage or hematoma	±	±	+	0
Postoperative physiologic and metabolic derangements	-	0	0	-
Postoperative respiratory failure	+	±	+	±
Postoperative PE or DVT	+	+	+	±
Postoperative sepsis	±	0	0	-
Technical difficulty with procedure	±	0	0	0
Transfusion reaction	0	0	0	0
Postoperative wound dehiscence	0	0	0	0
Birth trauma	-	0	0	0
Obstetric trauma – vaginal delivery with instrumentation	+	0	0	0
Obstetric trauma – vaginal delivery without instrumentation	+	0	0	0
Obstetric trauma – cesarean delivery	+	0	0	0

[a] Level of evidence
(-) Published evidence suggests that the indicator lacks validity in this domain (i.e., less than 50% sensitivity or predictive value; explicit or implicit process failure rates no more frequent than among control patients).
(0) No published evidence regarding this domain of validity.
(±) Published evidence suggests that the indicator may be valid in this domain, but different studies offer conflicting results (although study quality may account for these conflicts).
(+) Published evidence suggests that the indicator IS valid, or is likely to be valid, in this domain (i.e., one favorable study).
(++) There is strong evidence supporting the validity of this indicator in this domain (i.e., multiple studies with consistent results, or studies showing both high sensitivity and high predictive value).
[b] *Coding:* Sensitivity is the proportion of patients who suffered an adverse event, based on detailed chart review or prospective data collection, for whom that event was coded on a discharge abstract or Medicare claim. Predictive value is the proportion of patients with a coded adverse event who were confirmed as having suffered that event, based on detailed chart review or prospective data collection.
Construct, explicit process: Adherence to specific, evidence-based or expert-endorsed processes of care, such as appropriate use of diagnostic modalities and effective therapies. Our construct is that hospitals that provide better processes of care should experience fewer adverse events.
Construct, implicit process: Adherence to the "standard of care" for similar patients, based on global assessment of quality by physician chart reviewers. Our construct is that hospitals that provide better overall care should experience fewer adverse events.
Construct, staffing: Our construct is that hospitals that offer more nursing hours per patient day, better nursing skill mix, better physician skill mix, or more experienced physicians, should have fewer adverse events.
[c] Note that when content validity is exceptionally high, as for transfusion reaction or iatrogenic pneumothorax, construct validity becomes less important.

Table 2S. Summary of Evidence for Accepted Hospital Level PSIs

		Panel concerns of validity[a]									Empirical performance		
Indicator name	**Definition**	**Rare**	**Condition definition varies**	**Under-reporting/ screening**	**Adverse consequences**	**Stratification suggested**	**Unclear preventability**	**Heterogeneous severity**	**Case mix bias**	**Denominator unspecific**	**Rate (per 1000 population at risk)[e]**	**Standard deviation[e]**	**Bias detected[b]**
Complications of anesthesia	**Cases of anesthetic overdose, reaction, or endotrachial tube misplacement per 100 surgery discharges. Excludes codes for drug use and self-inflicted injury.**		**X**	**X**						**X**	**0.80**	**7.15**	
Death in low mortality DRGs[d]	**In-hospital deaths per 100 patients in DRGs with less than 0.5% mortality.[c] Exclude trauma, immunocompromised and cancer patients.**							**X**			**1.14**	**11.94**	**X+**
Decubitus ulcer	**Cases of decubitus ulcer per 100 discharges with a length of stay greater than 4 days. Exclude patients with paralysis or in MDC 9,[d] or patients admitted from a long term care facility.**			**X**				**X**	**X**		**20.5**	**20.7**	**X+**
Failure to rescue	**Deaths per 100 patients having developed specified complications of care during hospitalization. Exclude patients admitted from long term care facility and patients transferred to or from other acute care facility.**				**X**	**X**	**X**	**X**			**170.3**	**80.9**	**X+**
Foreign body left during procedure	**Discharges with foreign body accidentally left in during procedure per 100 discharges.**	**X**				**X**				**X**	**0.08**	**0.18**	**N/A**
Iatrogenic pneumothorax	**Cases of iatrogenic pneumothorax per 100 discharges. Exclude trauma, thoracic surgery, lung or pleural biopsy or cardiac surgery patients.**									**X**	**0.86**	**1.35**	**X**
Infection due to medical care	**Cases of secondary ICD-9-CM codes 999.3 or 996.62 per 100 discharges. Exclude patients with immunocompromised state or cancer.**			**X**	**X**						**1.37**	**1.75**	**X**
Postoperative hemorrhage or hematoma	**Cases of hematoma or hemorrhage requiring a procedure per 100 surgical discharges. Excludes obstetric admissions.**					**X**			**X**	**X**	**1.83**	**3.66**	
Postoperative hip fracture	**Cases of in-hospital hip fracture per 100 surgical discharges. Exclude patients in MDC 8, with conditions suggesting fracture present on admission.**								**X**	**X**	**1.12**	**5.94**	**X**
Postoperative physiological and metabolic derangement	**Cases of specified physiological or metabolic derangement per 100 elective surgical discharges. Exclude patients with principle dx of diabetes and with diagnoses suggesting increased susceptibility to derangement. Exclude obstetric admissions.**		**X**								**0.92**	**11.1**	**X**

		Panel concerns of validity[a]									Empirical performance		
Indicator name	**Definition**	**Rare**	**Condition definition varies**	**Under-reporting/ screening**	**Adverse consequences**	**Stratification suggested**	**Unclear preventability**	**Heterogeneous severity**	**Case mix bias**	**Denominator unspecific**	**Rate (per 1000 population at risk)[e]**	**Standard deviation[e]**	**Bias detected[b]**
Postoperative PE or DVT	**Cases of deep vein thrombosis or pulmonary embolism per 100 surgical discharges. Exclude obstetric patients.**			X		X					**6.95**	**12.3**	**X+**
Postoperative respiratory failure	**Cases of acute respiratory failure per 100 elective surgical discharges. Exclude MDC 4 and 5 and obstetric admissions.**						X		X		**2.68**	**5.01**	**X+**
Postoperative septicemia	**Cases of septicemia per 100 elective surgery patients, with length of stay more than 3 days. Exclude principle dianosis of infection, or any dx of immunocompromised state or cancer, and obstetric admissions.**		X		X						**10.0**	**29.6**	**X+**
Postoperative wound dehiscence	**Cases of reclosure of post-operative disruption of abdominal wall per 100 cases of abdominopelvic surgery. Excludes obstetric admissions.**								X		**2.43**	**8.77**	**X**
Technical difficulty with procedure	**Cases of technical difficulty (e.g. accidental cut or laceration during procedure) per 100 discharges. Excludes obstetric admissions.**			X			X				**2.42**	**2.64**	**X+**
Transfusion reaction	**Cases of transfusion reaction per 100 discharges**	X				X					**0.01**	**0.06**	**N/A**
Birth trauma – injury to neonate	**Cases of birth trauma per 100 liveborn births. Excludes some preterm infants, and infants with osteogenic imperfecta.**		X				X	X			**9.36**	**31.4**	**N/A**
Obstetric trauma – cesarean delivery	**Cases of obstetric trauma (4th degree lacerations, other obstetric lacerations) per 100 cesarean deliveries.**						X		X		**6.13**	**16.12**	**N/A**
Obstetric trauma – vaginal delivery with instrument	**Cases of obstetric trauma (4th degree lacerations, other obstetric lacerations) per 100 instrument assisted vaginal deliveries.**						X		X		**203.6**	**142.4**	**N/A**
Obstetric trauma – vaginal delivery w/o instrument	**Cases of obstetric trauma (4th degree lacerations, other obstetric lacerations) per 100 vaginal deliveries without instrument assistance.**						X		X		**75.6**	**57.9**	**N/A**

a Concerns raised by panels included the following:

Rare: Some events are relatively rare, and thus may not have adequate statistical power for some providers.

Condition definition varies: Conditions covered by this indicator include conditions for which diagnosis may be subjective, depending on the threshold of the physician. Thus patients with the same clinical state may not have the same diagnosis.
Under-reporting/screening: These conditions may not be systematically reported leading to an artificially low rate, or may be routinely screened for, leading to a higher rate in facilities that screen as compared to those that do not.
Adverse consequences: Use of these indicators may have undesirable effects, such as increasing inappropriate antibiotic use.
Stratification suggested: Indicator includes some high risk patient groups which should be stratified when examining rates.
Unclear preventability: As compared to other PSIs these conditions may be less subject to the control of the health system, and thus less preventable.
Heterogeneous severity: These indicators include codes that encompass several levels of severity of that condition that cannot be ascertained by the codes.
Case mix bias: These indicators were felt to be particularly subject to systematic bias due to the case mix of the provider. DRG and comorbidity risk adjustment may or may not adequately address the concern.
Denominator unspecific: The denominators for these indicators are less than ideal, because the true population at risk could not be identified completely clearly using ICD-9-CM codes, and thus some patients are likely included that are not truly at risk, or some patients that are at risk are not included.
[b] Bias ratings are based on a series of tests of bias using DRG and comorbidity risk adjustment. Those indicators flagged with 'X+' demonstrated substantial bias, and should be risk adjusted. Those indicators flagged with 'X' also demonstrated some bias. Those without a flag did not demonstrate substantial bias in empirical tests, but may nonetheless be substantially biased in a manner not detectable by the bias tests. Those with marked with N/A did not undergo empirical testing of bias due to lack of systematic variation.
[c] DRGs that are divided into "with complications and comorbidities" and "without complications and comorbidities" are only included if both divisions have mortality rates below 0.5%.
[d] DRG: Diagnostic Related Group; MDC: Major Diagnostic Category
[e] Rates represent the average rate of indicator for a nationwide sample of hospitals. Standard deviation is reported between providers.

Several accepted patient safety indicators were also modified into *area level indicators*, which were designed to assess the total incidence of the adverse event within geographic areas. For example, the transfusion reaction indicator can be specified at both the hospital and area level. Transfusion reactions that occur after discharge from a hospitalization would result in a readmission. The area level indicator includes these cases, while the hospital level restricts the number of transfusion reactions to only those that occur during the same hospitalization that exposed the patient to this risk. The five hospital level indicators that have area level analogs are Iatrogenic Pneumothorax, Transfusion Reaction, Infection Due to Medical Care, Wound Dehiscence, Foreign Body Left in During Procedure, and Technical Difficulty with Medical Care.

In addition to the accepted PSIs, another 17 indicators show promise, though have more concerning limitations. These were designated "experimental" and examined empirically. They performed empirically somewhat less well than the accepted indicators empirically. In addition, the concerns raised about various aspects of these indicators during the clinical panel discussions limit their potential usefulness. However, with possible further refinements to the underlying coding of data and to the indicator definitions, these indicators have the potential to measure what they purport to identify. For example, Reopening of Surgical Wound, while conceptually a useful PSI, requires further information to exclude cases that are planned during staged operations for example, and requires coding changes in order to capture only similarly serious reopening procedures.

Conclusions

This project took a four pronged approach to the identification, development and evaluation of PSIs that included use of literature, clinician panels, expert coders and empirical analyses. For the best-performing subset of PSIs, this project has demonstrated that rates of adverse events differ substantially and significantly across hospitals. The literature review and the findings from the clinical panels combined with data analysis provide evidence to suggest that a number of discharge-based PSIs may be useful screens for organizations, purchasers, and policymakers to identify safety problems at the hospital level, as well as to document systematic area level differences in patient safety problems.

Few adverse events captured by administrative data are unambiguous enough for a great deal of certainty that every case identified reflects medical error. Most adverse events identified by the PSIs have a variety of causes in addition to potential medical error leading to the adverse event, including underlying patient health and factors that do not vary systematically. Clinician panelists rated only two of the accepted indicators as very likely to reflect medical error: 1.) "Transfusion reaction" and 2.) "Foreign body left in during a procedure." As is expected for indicators of this case-finding type, these indicators proved to be very rare with less than 1 per 10,000 cases at risk. All other accepted indicators identify adverse events which represent a spectrum of likelihood of reflecting either medical error or potentially preventable complications of care, but cannot be expected to identify only cases in these categories.

Potential Uses of PSIs

Because the PSIs are intended for use as an initial, efficient screen to target areas for further data exploration, the primary goal is to find indicators that guide those interested in quality improvement and patient safety to areas where there are systematic differences between hospitals or geographic areas. These systematic differences may relate to underlying processes or structures that an organization could change to improve patient care and safety. These errors may be attributed to human error on the part of physicians or nurses, or system deficiencies. On the other hand, the systematic differences will sometimes correspond to coding practices, patient characteristics not captured by administrative data, or other factors. These will be dead ends to some degree. In the application of these PSIs, users will be determining how well patient safety problems are identified at the level of groups of patients. Sharing experiences about application of these PSIs, researchers and health care practitioners will build on the information highlighted in this report about each indicator, as well as the set of PSIs.

At the national or state level, these indicators could be used to monitor the frequency of potential patient safety problems, to determine whether the rates are increasing or decreasing over time, and to explore large variations among settings of care. While the indicators were primarily developed at the hospital level, some were also implemented to provide an analogous area level measure, and analyses show that additional cases are in fact identified that correspond to care received at one institution, and the potentially iatrogenic complication addressed in another hospital. Clearly, the locus of control and the ability to study the potential underlying causes for an adverse event is simpler in the case of the hospital level PSIs. However, trends over time in area rates, as well as aggregations of the hospital level rates are likely to reveal points of leverage outside of individual institutions. No measure is perfect. Each is suited to its designed purpose. Methods of aggregating across groups of PSIs still need to be tested. This report provides the background for "safe" use of a tool that has the potential to guide prevention of medical error, reductions of potentially preventable complications, and quality improvement in general. Table 3S provides examples of potential uses and potentially inappropriate uses.

Table 3S. Use of patient safety indicators

User	Potential Uses	Potential Inappropriate Uses
Case-finding indicators		
Provider	**Identification of events for further investigation.**	**Identification of cases for disciplinary action. Comparison of rates.**
Public Health	**Surveillance of events.**	**Use of indicators in formal evaluation of providers.**
Research	**Flagging of cases for use in research studies.**	**Comparison of rates.**
Rate-based indicators		
Provider	**Surveillance of rates for internal quality improvement investigations.**	**Physician-level investigation. Use of rates for disciplinary action or formal evaluation.**
Public Health	**Surveillance of rates. Examination of area rates over time, by region, by hospital type.**	**Public reporting of provider level rates.**
Research	**Use with other measures of quality to determine relationships of PSIs with structural, process or other aspects of care.**	**Use in research as a definitive measure of quality of care.**

Limitations and Future Research

Many important concerns cannot currently be monitored well using administrative data, such as adverse drug events. Just as administrative data limited specific indicators chosen, the use of administrative data tends to favor specific types of indicators. The PSIs evaluated in this report contain a large proportion of surgical indicators, rather than medical or psychiatric. Medical complications are often difficult to distinguish from comorbidities that are present on admission. In addition medical populations tend to be more heterogeneous than surgical, especially elective surgical populations, making it difficult to account for case-mix. Panelists often expressed that indicators were more applicable to patient safety when limited to elective surgical admissions.

The initial validation evaluations reviewed and performed for the PSIs leave substantial room for further research with detailed chart data and other data sources. Future validation work should focus on the sensitivity and specificity of these indicators in detecting the occurrence of a complication; the extent to which failures in processes of care at the system or individual level are detected using these indicators; the relationship of these indicators with other measures of quality, such as mortality; and further explorations of bias and risk adjustment.

Enhancements to administrative data are worth exploring in the context of further validation studies that utilize data from other sources. For example, as with other quality indicators, the addition of timing variables may prove particularly useful in order to identify whether or not a complication was present on admission, or occurred during the hospitalization. While some of the complications that are present on admission may indeed reflect adverse events of care in a previous hospitalization or outpatient care, many may reflect comorbidities instead of complications. A second example area, linking of hospital data over time and with outpatient data and other hospitalizations, would allow inclusion of complications that occur after discharge, and likely would increase the sensitivity of the PSIs.

The current development and evaluation effort will best be augmented by a continuous communication loop between users of these measures, researchers interested in improving these measures, and policy makers with influence over the resources aimed at data collection and patient safety measurement.

Technical Review

Chapter 1. Introduction

The often cited Institute of Medicine Report, To Err is Human: Building a Safer Health System[1] crystallized widespread public concern about the need to take action to reduce the occurrence of apparently common, serious medical errors. Achieving this goal involves identifying errors in practice, and undertaking initiatives to avoid and prevent them. It also requires national and regional attention to monitor and report to the public about patient safety. Widespread consensus exists that health care organizations can reduce patient injuries by learning from successful safety-improvement initiatives in other industries. Such initiatives have focused on systematically reducing opportunities for errors to occur, by improving the environment for safety. These diverse steps range from technical changes, such as implementing electronic medical record systems, to cultural ones, such as improving staff awareness of patient safety risks. Clinical process interventions also have strong evidence for reducing the risk of adverse events related to a patient's exposure to hospital care.[2] However, local and national initiatives may be better prioritized and evaluated through the use of adequate data on patient safety problems. This report reviews previous studies and presents new empirical evidence on one potentially important source of such data: computerized hospital discharge abstracts from the Agency for Healthcare Research and Quality (AHRQ) Healthcare Cost and Utilization Project (HCUP). Analyses of these and similar inexpensive, readily available administrative data sets may provide a screen for potential medical errors, and a method for monitoring trends over time.

Using Administrative Data

Although prior studies of the utility of routinely available administrative data sets, like the HCUP Nationwide Inpatient Sample (NIS), leave many questions unanswered and raise some important concerns, the careful use of these sources of information holds promise for screening in order to target further data collection and analysis. The ability to assess all patients at risk for a particular patient safety problem, along with the relative low cost, are particular strengths of these data sets. However, two broad areas of concern also hold true for these data sets. First, questions about the clinical accuracy of discharge-based diagnosis coding lead to concerns about the interpretation of reported diagnoses that may represent safety problems. Specifically, administrative data are unlikely to capture all cases of a complication, regardless of the preventability, without false positives and false negatives (sensitivity and specificity). Further, when the codes are accurate in defining an event, the clinical vagueness inherent in the description of the code itself (e.g., "hypotension"), may lead to a highly heterogeneous pool of clinical states represented by that code. A final issue in accuracy of any data source used for identifying patient safety problems is the possibility of incomplete reporting, as medical providers might fear adverse consequences to reputation, disciplinary action, and lawsuits as a result of "full disclosure" in potentially public records such as discharge abstracts.

A second area of concern relates to the limited information about the ability of these data to distinguish adverse events in which no error occurred from true medical errors. A number of factors, such as the heterogeneity of clinical conditions included in some codes, lack of information about event timing available in these data sets, and

limited clinical detail for risk adjustment, contribute to the difficulty in identifying complications that represent medical error or may be at least in some part preventable. These factors may exist for other sources of patient safety data as well. For example, they have been raised in the context of the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) implementation of a "sentinel event" program geared at identifying serious adverse events that may be related to underlying safety problems.

Given the importance of patient safety, it is perhaps surprising that only a relatively limited literature exists related to the potential use of discharge data and other widely-used data sources in documenting patient safety problems and improving patient safety. While these limited studies have identified some discharge-based measures applicable to addressing patient safety problems that seem highly predictive of true errors, many discharge-based measures appear to have relatively low sensitivity and specificity for identifying potentially preventable complications or true errors.

However, virtually all of these studies failed to account for many potentially avoidable limitations of discharge data, including measurement error ("noise") and bias. Moreover, most of these studies have been conducted at the patient level, and have focused on answering the question: does the discharge information identify a patient safety problem in this particular case? Despite the fact that most initiatives to improve patient safety focus on organizational or process change, almost no studies have addressed the question: can discharge data be used to identify systematic patient safety problems, and thereby target areas for opportunity at the level of groups of patients?

Patient Safety Indicators Evidence Project

The Evidence-based Practice Center (EPC) at the University of California San Francisco and Stanford University (UCSF-Stanford), with collaboration from the University of California Davis, contracted with the AHRQ to review and improve the evidence base related to potential patient safety indicators (PSIs) that can be developed from administrative data. The term "patient safety indicator," for the purposes of this report, refers to measures that screen for potential problems that patients experience resulting from exposure to the health care system, and that are likely amenable to prevention by changes at the level of the system. The key intent of the PSIs are thus as a "screening tool" or "starting point" for further analysis to reduce "potentially preventable errors" through system or process changes.

In addition to the need for data to guide quality improvement initiatives, there is a public mandate to monitor patient safety as part of quality in general. Measures are needed for aggregate statistical reporting, as planned for the National Quality Report. The PSIs developed and evaluated by the EPC will be shared with the AHRQ directed task force charged to develop this national report regarding national, regional (e.g., Northeast, South, Midwest,West) and state statistics about health care quality and patient safety.

This report follows the approach of a previous quality indicator development and evaluation project described in a companion technical report from the EPC, and published by AHRQ (available at: http://www.achq.gov/data/hcup/qirefine.htm).[3] Similarly, this report takes a multifaceted approach to evaluating the validity of potential indicators, applying the same validation framework. This report documents the background literature review and empirical analyses performed to develop

recommendations for and provide information about AHRQ PSIs. In addition, the project included consultation with expert coders from the American Health Information Management Association (AHIMA), and clinical panel reviews based on a process adapted from RAND and the University of California Los Angeles (RAND/UCLA) Appropriateness Method. We present new evidence on the ability of a broad range of discharge-based PSIs to identify systematic differences across hospitals, and potentially to monitor trends on a national or regional basis. The research reported here reflects an examination of the face validity of these indicators, and as such is subject to limitations. Primarily, due to the paucity of evidence available in the literature, this review relied on the expert opinion of clinician panels. The limitations are fully discussed in the final chapter of this report. Further research will be needed to establish the validity of these indicators in identifying potential patient safety concerns.

The PSIs developed here follow some of the same goals as the refined quality indicators (QIs) reviewed in the companion report. AHRQ QIs (referred to as HCUP II Quality Indicators in the companion report)[3] were developed as a screening tool to provide an accessible and low-cost approach to identifying potential problems in quality of care for organizations that lack the resources to develop their own quality assessment program. The initial version of the QI software was based mostly on quality measures already reported in the literature. The principal requirement was that the measures could be derived from common denominator discharge data sets comprised of variables that are available from most state-level hospital administrative data. Data elements in these sets include, but may not be limited to, International Classification of Disease, Clinical Modification (ICD-9-CM) discharge diagnosis and procedure codes; dates of admission, discharge and major procedures; age; gender; and diagnostic related group (DRG). In addition, the measures could not require linkages outside the hospital stay (e.g., post-hospital mortality or readmissions) because most state databases do not accommodate such linkages. The HCUP State Inpatient Databases (SID) is an example of such a common denominator discharge data set, and was used for the development of the AHRQ PSIs, reported here. While similar goals for the development of the previous AHRQ QIs apply to the PSIs reported here, the relevant literature is considerably less extensive. Consequently, we review the literature in a more general way for indicators as a whole, and for specific indicators we only review those studies validating the indicator use, rather than the clinical soundness of the concept of the indicator. As a result, we devote more attention to the development and validation of the most promising PSIs.

The report reviews the methods applied in our survey of discharge-based patient safety indicators, further development and selection of indicators, detailed clinician panel review, and empirical analysis of the most promising indicators. The bulk of the report then presents the results of these activities. We conclude with recommendations about how the most promising discharge-based PSIs can be applied and improved.

Anticipated Uses of Evidence Report

The approach to identification and evaluation of PSIs presented in this report serves as the basis for development of Version 1.0 of AHRQ PSI software. The primary goal of the report is to document the evidence, both from the literature, clinician review and data analysis, on suitable PSIs that can be derived from hospital discharge abstract

data. By transparently inventorying and evaluating potential indicators and risk adjustment strategies, we anticipate that this report will provide detailed context for users who apply these measures to facilitate identifying promising areas for researching and improving patient safety in a number of settings. The clear message throughout this report is that these indicators are developed for use as an initial screen that can target promising areas for in-depth review.

The discharge-based PSIs may be useful screens for organizations, purchasers, and policymakers to identify problems at the hospital level, as well as to document systematic area level differences in potentially preventable adverse events or patient safety problems. Additionally, PSI rates would be amenable to monitoring over time by region (e.g., geographical area, nation), setting (e.g., urban vs. rural) or specific hospital type (e.g., teaching vs. community, large vs. small). The PSI rates calculated at the state or national level would also be useful to individual hospitals seeking to compare their own performance to a benchmark. However, these measures are not designed, nor are they suitable for public reporting for the purpose of comparing providers because of the limitations of discharge-based data sources, although public reporting at the aggregate level (e.g., state or national) may be appropriate. Further discussion of the appropriate uses of these indicators is included in Chapter 4, Conclusions.

Finally, this report may also serve as a reference for background material on patient safety measurement using routinely collected administrative data, and as a summary for the current state of discharge-based patient safety indicators and risk adjustment methods. In addition to the companion technical report on quality indicators, it documents a novel integration of evidence-based methods with other approaches to develop and evaluate health care measures related to patient safety.

Chapter 2. Methodology

Section 2A. Conceptual Framework and Definitions

In approaching the task of evaluating patient safety indicators based on administrative data, we developed a conceptual framework and standardized definitions of commonly used terms. In the literature, the distinctions between medical error, adverse events, complications of care, and other terms pertinent to patient safety are not well established and are often used interchangeably. In this report, the terms medical error, adverse events or complications, and similar concepts are defined as follows:

- **Quality:** "Quality of care is the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge." In this definition, "the term *health services* refers to a wide array of services that affect health…(and) applies to many types of health care practitioners (physicians, nurses, and various other health professionals) and to all settings of care…"[4]

- **Quality indicators:** Screening tools for the purpose of identifying potential areas of concern regarding the quality of clinical care. For the purpose of this report, we focus on indicators that reflect the quality of care inside hospitals. Quality indicators may assess any of the four system components of health care quality, including patient safety (see below), effectiveness (i.e., "providing services based on scientific knowledge to all who could benefit, and refraining from providing services to those not likely to benefit), patient centeredness, and timeliness (i.e., "minimizing unnecessary delays").[4]

- **Patient safety:** "Freedom from accidental injury," or "avoiding injuries or harm to patients from care that is intended to help them." Ensuring patient safety "involves the establishment of operational systems and processes that minimize the likelihood of errors and maximizes the likelihood of intercepting them when they occur." [5]

- **Patient safety indicators:** Specific quality indicators which also reflect the quality of care inside hospitals, but focus on aspects of patient safety. Specifically, PSIs screen for problems that patients experience as a result of exposure to the healthcare system, and that are likely amenable to prevention by changes at the system or provider level.

- **Medical error:** "The failure of a planned action to be completed as intended (i.e., error of execution) or the use of a wrong plan to achieve an aim (i.e., error of planning)."[1] The definition includes errors committed by any individual, or set of individuals, working in a health care organization.

- **Complication or adverse event:** "An injury caused by medical management rather than by the underlying disease or condition of the patient."[6] In general, adverse events prolong the hospitalization, produce a disability at the time of discharge, or both. Used in this report, complication does not refer to the sequelae of diseases, such as neuropathy as

a "complication" of diabetes. Throughout the report, "sequelae" is used to refer to these conditions.

- **Preventable adverse event:** An adverse event attributable to error is a "preventable adverse event."[6] A condition for which reasonable steps may reduce (but not necessarily eliminate) the risk of that complication occurring.

- **Case finding indicators:** Indicators for which the primary purpose is to identify specific cases in which a medical error *may* have occurred, for further investigation.

- **Rate based indicators:** Indicators for which the primary purpose is to identify the rate of a complication rather than to identify specific cases.

While the definitions above are intended to distinguish between events that are less preventable, from those that are more preventable, the difference is best described as a spectrum. To conceptualize this spectrum we developed the following three categories of conditions:

1. Conditions which could be either a comorbidity or a complication. These conditions, inasmuch as they are present on admission, and not caused by medical management, but rather due to the patient's underlying disease, include conditions such as congestive heart failure. It is extremely difficult to distinguish complications from comorbidities for these conditions using administrative data. As a result, these conditions were not considered in this report.

2. Conditions which are likely to reflect medical error. These conditions, such as foreign body accidentally left during a procedure, are likely to have been caused by medical error. Most of these conditions appear infrequently in administrative data, and thus rates of events lack the precision to allow for comparisons between providers. However, these conditions may be the subject of case finding indicators.

3. Conditions which conceivably, but not definitively reflect medical error. These conditions represent a spectrum of preventability between the previous two categories from those which are mostly unpreventable to those which are mostly preventable (i.e., category 2 above). Because of the uncertainty regarding the preventability of these conditions and the likely heterogeneity of cases with the condition, indicators utilizing these conditions are less useful as case finding indicators. However, examining the rate of these conditions may highlight potential areas of concern.

Evaluation Framework

To evaluate the soundness of each indicator we applied the same framework as was applied in the companion QI report.[3] This included six areas of evidence:

Framework for Evaluating the Quality Indicators

1. ***Face validity: Does the indicator capture an aspect of quality that is widely regarded as important and subject to provider or public health system control? Consensual validity expands face validity beyond one person to the opinion of a panel of experts.***
2. ***Precision: Is there a substantial amount of provider or community level variation that is not attributable to random variation?***
3. ***Minimum bias: Is there either little effect on the indicator of variations in patient disease severity and comorbidities, or is it possible to apply risk adjustment and statistical methods to remove most or all bias?***
4. ***Construct validity: Does the indicator perform well in identifying true (or actual) quality of care problems?***
5. ***Fosters real quality improvement: Is the indicator insulated from perverse incentives for providers to improve their reported performance by avoiding difficult or complex cases, or by other responses that do not improve quality of care?***
6. ***Application: Has the measure been used effectively in practice? Does it have potential for working well with other indicators?***

A full discussion of this framework is available in the companion QI report.[3] Since the literature surrounding PSIs is sparse, this report uses a variety of techniques to evaluate each indicator. Specifically, face validity (consensual validity) was evaluated using a structured panel review (Section 2D. Clinician Panel Review Methods), minimum bias was explored empirically (Section 3E. Comparative Empirical Results) and briefly during the panel review, and construct validity was evaluated using the limited literature available (Section 3A. Literature Review Results).

The relative importance of each of these evaluation areas may differ for the PSIs as compared to the QIs. For indicators which are primarily designed to screen only for medical error, precision and minimum bias may be less important, since these events are relatively rare, and in general are better utilized as case-finding indicators. For these indicators comparisons between rates are less relevant. However, for rate-based indicators, concerns of precision and minimum bias remain, if indicators are used in any comparison of rates (comparison to national averages, peer group, etc.).

Section 2B. Literature Review Methods

The literature searches performed in connection with assessing potential HCUP QIs in previous work[3] identified many references relevant to potential PSIs. In addition, we performed the electronic searches outlined below for articles published before February 2002 followed by hand searching the bibliographies of identified references. Members of the project team were queried to supplement this list, based on their personal

knowledge of recent work in the field. Because Iezzoni et al.'s Complications Screening Program (CSP)[7] included numerous candidate indicators, we also performed an author search using her name. Forthcoming articles and Federal reports in press, but not published, were also included when identified through personal contacts. The search strategy is shown in Table 1.

Table 1. Electronic Search Strategy for Articles Pertaining to Patient Safety Indicators

MEDLINE® Search String	EMBASE® Search String
1) medical error [mh] OR iatrogenic disease [mh] OR sentinel surveillance [mh] OR safety [mh]	1) iatrogenic disease [em] OR health survey [em] OR danger, risk, safety & related phenomenon[em] OR drug safety [em] OR error[em]/all exploded
2) (adverse [ti] AND events [ti]) OR complications [ti] OR iatrogenesis [ti] OR iatrogenic [ti]	2) (adverse AND events).ti OR complication$.ti OR iatrogen$.ti OR mistake$.ti OR error$.ti
3) epidemiologic studies [mh] OR quality of health care [mh] OR comparative study [mh] OR disease/classification [mh]	3) health care quality[em] OR epidemiology[em]
4) (#1 OR #2) AND #3	4) (#1 OR #2) AND #3
5) health services research [mh] OR abstracting and indexing [mh] OR medical records [mh] OR medical audit [mh] OR hospitalization [mh] OR patient readmission [mh] OR patient discharge [mh]	5) health services research[em] OR documentation[em] OR medical record[em] OR medical audit[em] OR hospitalization[em] OR child hospitalization[em] OR hospital admission[em]
6) reproducibility of results [mh] OR sensitivity and specificity [mh]	6) reproducibility[em] OR reproducib$.kw OR (sensitive$ or specific$).kw
7) #4 AND #5 AND #6	7) #4 AND #5 AND #6
8) #7 BUTNOT (case report [mh] OR case* [ti] OR report [ti] OR editorial [pt] OR comment [pt] OR letter [pt]) Limits: English Language	

MEDLINE® and EMBASE® database search from January, 1990 to February, 2002.
Abbreviations: [mh] = [MeSH terms], [ti] = [Title word]

Three-hundred twenty six articles were identified from the MEDLINE® search. Articles were screened using both the titles and abstracts. To qualify for abstraction, an article must have described, evaluated, or validated a potential indicator of medical errors, patient safety, or potentially preventable complications based on International Classification for Diseases -Ninth Revision-Clinical Modifications (ICD-9-CM) coded administrative (hospital discharge or claims) data. Some indicators were also considered if they appeared to be readily translated into ICD-9-CM, even if the original authors did not use ICD-9-CM codes.

This search was adapted slightly and repeated using the OVID interface with EMBASE®[8], limited to articles published from January 1990 through the end of first

quarter 2002. Our EMBASE® search identified 463 references. These articles were screened in the same manner, after elimination of articles that had already been identified using MEDLINE®[9] and the other approaches described above. Only 9 additional articles met criteria for abstraction.

Section 2C. Development of Initial Candidate List of Indicators

Indicators that measured rates of complications at both the hospital level and area level were considered. A flow diagram outlining the selection of indicators is included in Section 3B. Indicator Selection. Two types of indicators were considered: hospital level and area level. The intent of a *hospital level indicator* is to provide a measure of the potentially preventable complication for patients who received their initial care and the complication of care within the same hospitalization. On the other hand, the intent of an *area level indicator* is to capture all cases of the potentially preventable complication that occur in a given area (e.g., metropolitan service area or county). Thus, hospital level measures typically include only cases where a secondary diagnosis code flags a potentially preventable complication since the patient was being hospitalized for a different principal diagnosis. In contrast, area level measures would be specified to include principal diagnosis, as well as secondary diagnoses, for the complications of care, thereby adding cases where a patient's risk of the complication occurred in a separate hospitalization. The denominator specification for these two types of indicators is described in Section 2E. Empirical Methods.

The literature search located relatively few indicators amenable to identifying patient safety concerns (see Appendix A) that could be defined using unlinked administrative data. The majority of such indicators were from the Complications Screening Program (described below).[7] Several similar, but less comprehensive, measures of potentially preventable complications were identified from other sources in the literature.

Identifying Potential Indicators

Complications Screening Program

The Complications Screening Program (CSP) was developed by Lisa Iezzoni et al.[7] for the purpose of identifying potentially preventable complications of adult medical and surgical hospital care, using commonly available administrative data. The algorithm utilizes discharge abstract data, specifically, ICD-9-CM diagnosis and procedure codes, patient age, sex, DRG, and date of procedure, to identify 28 complications "that raise concern about the quality of care based on the rate of such occurrence at individual hospitals." [7] The CSP was initially developed using the clinical judgment of the developers, complemented by "detailed consideration of the ICD-9-CM codebook, and an extensive review" of the literature on health services research, quality assurance, and clinical indicators.[7] Each of the complications is applied to some or all of the following specified "risk pools" separately: major surgery, minor surgery, invasive cardiac procedure, endoscopy, medical patients, all patients. In addition, specified inclusion and

exclusion criteria are applied to each complication. These criteria are aimed at ensuring that the complication developed in-hospital, as opposed to being present on admission, and that the complication was potentially preventable.

Iezzoni and colleagues published a series of four papers in the mid 1990s on the face validity and construct validity of the CSP.[7, 10-12] First, they asked each of 29 physicians who were not involved in the development of the CSP to review 100 randomly selected hospital discharge abstracts, including 53 flagged and 47 not flagged by the algorithm. These physicians were asked whether "on the basis of your review, is there anything about this summary that would make you want to review the care rendered at hospitals with high rates of this type of case for potentially avoidable quality-of-care problems." Of the 30 cases targeted by a majority of physicians, the CSP flagged 28 (sensitivity=93%); of the 70 cases not targeted by a majority of physicians, the CSP screens also did not flag 45 (specificity=64%). Second, they reported relationships between the CSP and hospital characteristics, patient characteristics, and utilization. Using California discharge abstract data, researchers found that patients with CSP-defined complications were more likely to be older, to die before discharge, to have longer lengths of stay, and to incur higher hospital charges, than cases with none of these complications. Having a chronic condition raised the probability of experiencing a complication (after adjusting for age), especially among major surgery patients, but the predictive power of models that used these chronic conditions to predict complications was relatively poor. More surprisingly, larger and major teaching hospitals, including hospitals equipped to perform open heart surgery, appeared to have higher complication rates than smaller and non-teaching hospitals. However, all findings appeared to be dependent on the risk pool being examined.[7, 10-12] It was also notable that hospital ranks based on indirectly standardized CSP complication rates were not significantly correlated with hospital ranks based on indirectly standardized Medicare mortality rates (with the exception of medical cases, among whom the correlation was inverse). Intra-hospital correlations across the six risk pools were weak.

Four later studies were designed to test criterion and construct validity by validating the data used to construct CSP screens, validating the screens as a flag for actual quality problems, and validating the replicability of hospital-level results using different data sources.[13-16] First, Iezzoni et al. trained expert coders to re-abstract ICD-9-CM diagnosis and procedure codes on a random sample of hospital records from Connecticut and California, and then assessed how often CSP trigger codes were corroborated by re-review of the medical record.[13] The predictive value of medical complications was relatively poor, because 58% of the flagged complications in this risk pool were actually present at admission. Corroboration rates were often even lower when Iezzoni et al. used objective clinical criteria, abstracted by nurses, to diagnose complications.[14] The last two studies in this series utilized implicit physician review and explicit nurse review to identify potential quality-of-care problems and process-of-care failures, respectively, among CSP-flagged cases and unflagged controls. These studies also raised concerns about the validity of the CSP, as for most indicators flagged cases were no more likely than unflagged controls to have suffered explicit process failures.[15, 16] It should be noted that potential process failures were perhaps undetectable by this study, because of limitations in medical record documentation. Details of the

performance of the individual complications are contained in Section 3A. Literature Review Results.

The Complications Screening Program has been purchased by HCIA-Sachs (now Solucient), although additional development and research completed by this company was not available to the researchers of this report.

Miller et al. PSIs

Researchers at AHRQ reviewed all ICD-9-CM codes implemented in or before 1999 identifying codes that possibly describe medical errors or reflect the consequences of such errors.[17] Examples of codes identified by AHRQ include iatrogenic pneumothorax, iatrogenic hypotension, and several "external cause-of-injury codes" (E-codes). In addition, AHRQ researchers reviewed all codes included in the CSP indicators. AHRQ investigators applied clinical and coding knowledge to identify those codes most likely to identify medical error. These codes included foreign body left in during a procedure, suture of laceration codes, and several other sentinel event codes. These efforts at AHRQ provided the foundation for the candidate list of potential PSIs for this report. This initial set of PSIs will be referred to in this report as the Miller et al. PSIs.[17]

UCSF-Stanford EPC Development

The EPC team reviewed and updated the Miller et al. PSIs. Additions included relevant codes from the 2000 and 2001 revisions of ICD-9-CM, and selected codes from the CSP, such as those not clearly reflective of medical error, but representing a potentially preventable complication. This process was guided principally by conceptual considerations. For example, postoperative acute myocardial infarction was included since recent evidence suggests that it is a potentially preventable complication.[2] A few codes were also deleted from the initial list based on a review of ICD-9-CM coding guidelines, described in *Coding Clinics for ICD-9-CM* and the *American Hospital Association's ICD-9-CM Coding Handbook*. For example, the code 259.3 for hypoglycemic coma specifically excludes patients with diabetes mellitus, the population for which this complication is most preventable. This process of updating the Miller et al. PSIs resulted in a list of over 200 ICD-9-CM codes (valid in 2001) potentially related to medical error.

Codes were then grouped into indicators. Where feasible, codes were compiled as they were in the CSP, or in some cases the Miller et al. PSIs,[17] depending on which grouping yielded more clinically homogeneous groups. In most cases the resulting indicators were not identical to the CSP indicators, although they were closely related, as some of the specific codes included in the original CSP had been eliminated after our review of coding guidelines. Five indicators were identical to the CSP indicators. The remaining codes were then incorporated into the most appropriate CSP-based indicator, or were grouped into clinically meaningful concepts to define novel indicators. Exclusion criteria were added based on CSP methods and clinical judgment. As a result, over 40 patient safety indicators were defined that, while building on prior work, reflected significantly changed measures to focus more narrowly on the most preventable complications.

Indicators were defined with both a numerator (complication of interest) and a denominator (population at risk). Different patient subpopulations have inherently

different risks for developing a complication, with some patients having almost no risk. Thus, for each indicator a specified population at risk was specified as a denominator. The intention was to restrict the complication (and consequently the rate) to a more homogeneous population who are actually at risk for that complication. The population at risk for the candidate indicators tended to be narrower than the combination of all risk pools available in the CSP definitions, and was intended to reflect the population for which the complication is more likely to reflect a potentially preventable complication. In general, the population at risk corresponded to one risk pool (e.g., major surgery) from the CSP, if applicable, or was defined more narrowly.

Initial Selection of Indicators

After the development of this list of potential indicators, a subset of indicators was selected to undergo face validity testing by clinician panels (see Section 2D. Clinician Panel Review Methods). Two sources of information guided the selection process.

First, validation data from previous studies were reviewed and thresholds were set for indicator retention of CSP based indicators. Four studies were identified that evaluated the CSP indicators. Three of these studies,[13-15] examined the predictive value of each indicator in identifying a complication that occurred in-hospital, regardless of whether this complication was due to medical error or was preventable. Coder, physician and nurse reviewers examined medical charts and used specified criteria to judge whether or not the flagged complication had indeed occurred during the hospitalization (as opposed to being present on admission, or not having occurred at all). In a fourth study,[16] nurses identified specific process failures that may have contributed to complications. In order to be retained as a potential PSI, at least one of the first three studies corroborating the ICD-9-CM code with an actual in-hospital complication needed to demonstrate a positive predictive value of at least 75%, meaning that 3 out of 4 patients identified by the measure did indeed have the complication of interest. In addition, the positive predictive value of a "process failure" identified in the fourth study needed to reach or exceed 46%, which was the average rate for surgical cases that were not flagged by any of the CSP indicators. In other words, by this criterion, potential PSIs must have demonstrated that approximately half or more of the patients flagged received care where a process failure contributed to a complication, indicating a potentially preventable error. As a result, we only retained CSP-derived indicators that were at least somewhat predictive of objectively defined process failures, or medical errors.

Second, specific changes to previous definitions or constructs of indicators fell into the following general categories that were considered for the initial selection by the team of this candidate set for face validity testing, as well as discussed during the clinician panel review process (see Section 2D. Clinician Panel Review Methods):

1. Changes to the denominator definitions (inclusion or exclusion criteria), intended to reduce bias due to the inclusion of atypical patients or to improve generalizability to a broader set of patients at risk.

2. Elimination of selected ICD-9-CM codes from numerator definitions, intended to focus attention on more clinically significant complications, or complications more likely to result from medical errors.
3. Addition of selected ICD-9-CM codes to numerator definitions, intended to capture related complications that could result from the same or similar medical errors.
4. Division of a single indicator into two or more related indicators, intended to create more clinically meaningful and conceptually coherent indicators.
5. Stratification or adjustment by relevant patient characteristics, intended to reflect fundamental clinical differences among procedures (e.g., vaginal delivery with or without instrumentation) and the complications that result from them, or fundamental differences in patient risk (e.g., decubitus ulcer in lower-risk versus high-risk patients).

A total of 34 indicators, intended to be applied to all age groups, were retained for face validity testing by clinician panels (Appendix A). Because of the primary intent in the development of these indicators to detect potentially preventable complications related to health care exposure, the final definitions for this set of indicators represented mostly new measures that built upon previous work.

Coding Review

Concurrent with clinician panel review, we contracted with a consultant from AHIMA to review each of the 34 indicators. The consultant, an expert in ICD-9-CM coding guidelines, reviewed each code for accuracy of capturing the questioned complication and population at risk, according to current coding guidelines. She consulted additional resources, including members of the central staff of ICD-9-CM, as appropriate. In some cases, additional codes or other refinements to the indicators were suggested, based on current coding guidelines. For example, clarification of the procedure codes included in the indicator "Reopening of a surgical site" revealed that the nature of these codes was substantially different than what the team and panels had assumed. This resulted in a change to the overall rating of this indicator.

Section 2D. Clinician Panel Review Methods

A structured review of each indicator was undertaken to evaluate the face validity (from a clinical perspective) of the indicators. Specifically, the panels approach sought to establish *consensual validity,* which “extends face validity from one expert to a panel of experts who examine and rate the appropriateness of each item….”[18] The methodology for the structured review was adapted from the RAND/UCLA Appropriateness Method[19] and consisted of an initial independent assessment of each indicator by clinician panelists using an initial questionnaire, a conference call among all panelists, followed by a final independent assessment by clinician panelists using the same questionnaire. The panel process served to refine definitions of some indicators, add new measures, and dismiss indicators with major concerns from further consideration.

This standardized panel approach, although differing somewhat from the approach used in this report, was used to evaluate potential indicators of primary care quality[20, 21] as well as ambulatory care sensitive conditions.[22]

Panel Selection

Twenty-one professional clinical organizations were invited to submit nominations. These organizations were selected based on the applicability of the specialty or subspecialty to our quality indicators. Organizations that represented general practitioners (e.g., general surgeons, internists, critical care physicians, perioperative nurses, and critical care nurses) were asked to nominate more panelists than those representing sub-specialties. Fifteen organizations submitted nominations: American Association of Critical-Care Nurses; American Academy of Family Physicians; American College of Cardiology; American College of Nurse-Midwives; American College of Obstetricians and Gynecologists; American College of Physicians/American Society of Internal Medicine; American College of Radiology; American College of Surgeons; American Geriatric Society; Association of Perioperative Nurses; American Society of Anesthesiologists; American Society of Health-system Pharmacists; American Thoracic Society; Association of Women's Health Obstetric and Neonatal Nurses; and National Association of Inpatient Physicians.

These professional organizations nominated a total of 162 clinicians. Each nominee was invited to participate in the evaluation. In order to be eligible to participate, nominees were required to spend at least 30% of their work time on patient care, including hospitalized patients. Ninety-two nominees accepted this invitation. Five nominees were ineligible to participate. Nominees were asked to provide information regarding their practice characteristics, including specialty and subspecialty and setting (i.e., urban vs. rural location, region of country, and service to underserved populations), information regarding primary hospital of practice (i.e., funding source) and personal information (i.e., clinical education history, academic affiliation).

For assignments to each panel, a list of applicable specialties was identified for the indicators to be evaluated by a given panel. Panelists were selected so that each panel had diverse membership in terms of practice characteristics and setting. Thus, when a specific area was over-represented by the pool of eligible nominees, randomly drawn members from that specific sub-group were contacted first to fill the panels. In addition, conference call scheduling logistics influenced assignments. Fifty-seven of the eligible panelists accepted the invitation to participate on specific panels. Four did not participate in the conference call, and thus were removed from the panels. All other panelists (53) completed the evaluation in full.

Panel Composition

Eight panels were formed. Complications of medical care indicators were examined by two panels. Surgical complications indicators were reviewed by three panels. Another panel assessed indicators related to procedural complications. Finally, two panels examined obstetric complications indicators. Participants in the panels are listed in Appendix B. All panels had diversity in the geographic location of panelists, and the type of practice (see Table 2).

Table 2. Multi-specialty Panel Composition

Characteristic	% (N)
Gender	
Female	**38% (20)**
Academic Affiliation[a]	
Yes	**64% (34)**
No	**26% (14)**
Not reported	**9% (5)**
Geographic Region	
East	**26% (14)**
West	**21% (11)**
South	**21% (11)**
Midwest	**32% (17)**
Community	
Urban	**49% (26)**
Suburban	**19% (10)**
Rural	**16% (9)**
Not reported	**15% (8)**
Funding of Primary Hospital	
Private	**42% (22)**
Public	**32% (17)**
Both	**6% (3)**
Not Reported	**21% (11)**
Patient Population Served	
Underserved	**47% (25)**
General	**28% (15)**
Not reported	**25% (13)**

[1]Clinical and/or research affiliation

Initial Evaluation

After agreeing to evaluate each indicator, panelists were sent information (see Appendix C) regarding administrative data, ICD-9-CM coding, assignment of Diagnostic Related Groups (DRGs) and Major Diagnostic Categories (MDCs), and specific definitions for "adverse events or complications," "preventability," and "medical error." The definitions of these terms, including distinctions are available in Appendix C and in Section 2A. Framework and Definitions. Panelists were presented with four to five indicators. The standardized text used to describe each ICD-9-CM code was presented along with the specific numeric code. Exclusion and inclusion criteria were also given, as well as the clinical rationale for the indicator and the specification criteria. Panelists were provided potential questions regarding the indicator definition that the study team planned to explore during the conference call.

Each of the 5 to 9 panelists from a given panel provided input for a given indicator by completing a 10-item questionnaire (see Appendix C). This questionnaire asked panelists to consider the ability of this indicator to screen out conditions present on admission, the potential preventability of the complication and the ability of the indicator to identify medical error. In addition, the questionnaire asked panelists to consider the

potential bias, reporting or charting problems, potential for gaming the indicator, and adverse effects of implementing the indicator. Finally, panelists were invited to suggest changes to the indicator.

Conference Call

Following the submission of the initial evaluation questionnaires, all panelists participated in a 90-minute conference call for their panel to discuss the indicators. The purpose of each conference call was to allow panelists to discuss their opinions regarding each indicator. Following the instructions in the RAND/UCLA method where the primary goal of interaction between panelists is to allow room for varied opinions about the appropriateness of an indicator, panelists were explicitly told that consensus was not the goal of discussion. In some cases, panelists agreed on proposed changes to the indicator definitions, and such consensus was noted and the definition was modified accordingly before the final round of rating. Each call was moderated by a team member (KM), who directed the structure of the call, and ensured that all panelists had a chance to share their opinions. Also present was a technical expert, who answered questions regarding administrative data and coding (PR), and a silent observer, who maintained comprehensive notes of the call (SD). All team members refrained from offering opinion regarding indicators during the call. Each indicator was discussed for approximately 15 minutes. Agenda items were set based on the feedback received from the initial evaluation, and in general focused on points of disagreement among panelists. Panelists were prompted throughout the process to consider the appropriate population at risk for each indicator (specifically inclusion and exclusion criteria) in addition to the complication of interest. However, if panelists wished to discuss other aspects of the indicator, this discussion was allowed within the time allotted for that indicator. If time remained at the end of a call, topics that were not fully addressed previously were revisited.

Final Evaluation

Following each conference call, changes to each indicator were made where suggested by panelists. In each case, near consensus of the panelists must have been reached during the conference call for the change to be implemented. The indicators were then redistributed to panelists along with questionnaires used in the initial evaluation. Each indicator description included explication of any definition changes made and the reason. Panelists were asked to re-rate each indicator based on their current opinion. They were asked to keep in mind the discussion during the conference call.

Tabulation of Results

To examine the results of the panels, we applied a modified version of the "appropriateness" criteria outlined in the RAND/UCLA Appropriateness Method. Results from the final evaluation questionnaire were used to calculate median scores from the 9 point scale for each question and to categorize the degree of agreement among panelists (see Table 3). Median scores determined the level of acceptability of the indicator, and

dispersion of ratings across the panel for each applicable question determined the agreement status. Therefore the median and agreement status were independent measurements for each question. The following six criteria covered in the questionnaire were used to identify the panel opinions (i.e., median, agreement status category) on the following aspects of the indicator:

1. Overall usefulness of the indicator,
2. Likelihood that indicator measures a complication and not a comorbidity (specifically, present on admission),
3. Preventability of complication,
4. Extent to which complication is due to medical error,
5. Likelihood that complication is charted given that it occurs; and
6. Extent that indicator is subject to bias (systematic differences, such as case mix that could affect the indicator, in a way not related to quality of care).

These evaluations are included in the summary of results for each indicator (Section 3D. Detailed Panel Results by Indicator).

Table 3. Criteria for Agreement Status

Category	Panel size	Criteria
Agreement	**8-10 panelists**	**Two or fewer members rated indicator outside specific three-point range (1-3.9, 4-6.9, 7-9) in which the median falls.**
	5-7 panelists	**One or fewer panelists rated indicator outside specific three-point range (1-3.9, 4-6.9, 7-9) in which the median falls.**
Disagreement	**8-10 panelists**	**Three or more panelists rated indicator in each of the extreme three-point ranges (1-3.9, 7-9).**
	5-7 panelists	**Two or more panelists rated indicator in each of the extreme three point ranges (1-3.9, 7-9).**
Indeterminate Agreement	**All panel sizes**	**Any panel rating not qualifying as either "agreement" or "disagreement" by above criteria.**

We used the ratings regarding the overall appropriateness of the indicator (i.e., criterion number 1 above based on question #8 on questionnaire in Appendix C) to assess the overall usefulness as a screen for potential patient safety problems (see Table 4). The median score and agreement category for this usefulness question were combined into modified RAND groupings. Akin to the RAND "Appropriate" level, we created two categories, "Acceptable" and "Acceptable (-)." "Acceptable (-)" refers to indicators which were considered acceptable, but this distinction was not as clear as for those receiving a pure "Acceptable" rating. The RAND "Uncertain" level was likewise divided into two parts, "Unclear," and the slightly worse category, "Unclear (-)." The RAND "Inappropriate" level was defined identically but named "Unacceptable." These designations, along with some initial administrative data testing and subsequent coding clarifications, were used to triage indicators into three sets: Accepted Indicators,

Experimental Indicators, and Rejected Indicators (see Tables 11-13 in Section 3B. Indicator Selection).

Table 4. Definitions for Overall Appropriateness of Indicator

Acceptable	**Median falls between 7 and 9 (inclusive of both), agreement**
Acceptable (-):	**Median falls between 7 and 9 (inclusive of both), indeterminate agreement**
Unclear:	**Median falls between 7 and 9 (inclusive of both), disagreement, OR**
	Median falls between 5 and 7 (inclusive of neither), agreement or indeterminate agreement
Unclear (-):	**Median between 4 and 5 (inclusive of both), agreement, indeterminate agreement or disagreement, OR**
	Median falls between 1 and 3.9 with disagreement.
Unacceptable:	**Median falls between 1 and 3.9, agreement or indeterminate agreement.**

Surgical Panels

The multi-specialty panels had limited surgeon participation because of the need to include a variety of specialties without expanding the panel. No surgical subspecialties were represented, and each panel had at most two participating surgeons. As a result of panelists frequently requesting more surgical input for some of the indicators, we convened three additional panels consisting of only surgeons from various subspecialties to complete a second round of review. The method of review was identical to the previous panels. The surgeons reviewed the same indicators as were reviewed by the initial multi-specialty panels. Each panel received the same combinations of indicators, in their originally proposed form, with two exceptions. One panel received "Minor Perioperative Physical Injuries" and another "Malignant Hypertension" in addition to the group of four indicators originally reviewed as a packet by a multi-specialty panel. These two additional surgical indicators were created based on suggestions by the multi-specialty panels during the discussion of an indicator called “Complications of Anesthesia.”

Sixteen organizations representing surgical subspecialties were invited to nominate ten panelists. Nine organizations submitted at least one nomination, including: American Association of Hip and Knee Surgeons; American Association of Hand Surgeons; American Association of Neurological Surgeons; American Academy of Orthopedic Surgeons; American Society of Colon and Rectal Surgeons; American Urologic Association; North American Spine Society; Society of Thoracic Surgeons; and American Society of Transplant Surgeons. In addition to recruiting subspecialists, we contacted state chapters of the American College of Surgeons from the five most populous states, to obtain one or two nominations of general surgeons. Four of the 22 contacted chapters sent nominations: San Diego, Southern California, Metropolitan Chicago, and Central Pennsylvania. We received names of 79 nominees, forty-two of whom accepted our invitation to participate. Twenty-five were assigned to panels, based on their availability to participate and their subspecialty. Three panels were constructed

with a variety of specialties represented (see Appendix B). Two panelists did not complete the entire review.

The demographic composition of the surgical panel (see Table 5) differed significantly from that of the multi-specialty panels only by gender ($p<.05$), with more males on the surgical panels than on the multi-specialty panels. No other differences were significant.

Table 5. Surgical Panel Composition

Characteristic	% (N)
Gender	
Female	9% (2)
Academic Affiliation	
Yes	87% (20)
No	13% (3)
Geographic Region	
East	26% (6)
West	17% (4)
South	30% (7)
Midwest	26% (6)
Community	
Urban	39% (9)
Suburban	17% (4)
Rural	17% (4)
Not reported	26% (6)
Hospital Affiliation	
Private	52% (12)
Public	22% (5)
Both	9% (2)
Not Reported	17% (4)
Population	
Underserved	43% (10)
General	22% (5)
Not reported	35% (8)

Surgical panelists followed the same procedure as the multi-specialty panels in rating each indicator. In order to ensure that similar topics were discussed in the conference calls of both the multi-specialty and surgical panels, and to obtain surgeon feedback on changes suggested by the multi-specialty panels, agendas for the conference calls included those topics discussed by the multi-specialty panels (though the source of these topics was not noted). As with the multi-specialty panels, the agenda also included concerns and areas of disagreement based on panelists' responses to the first round questionnaire. Panelists then re-rated each indicator based on the suggestions of their own panel. In some cases the final definitions suggested by consensus in the surgical panel calls, and therefore proposed in the second-round questionnaire differed substantially from those rated by the multi-specialty panels. For these cases, the study team reviewed the reasons for differences in definitions proposed, and defined the indicator based on input from both panels if possible. Panel results for each indicator note any differences

between panels, and explain final decisions regarding indicator definitions and acceptability.

Section 2E. Empirical Methods

Purpose of Analyses

Empirical analyses were conducted to provide additional information about the indicators. These analyses were intended not as decision making tools, but rather explorations into the characteristics of the indicators. Specifically, these analyses explore the frequency and variation of the indicators, the potential bias, based on limited risk adjustment, and the relationship between indicators.

Analysis Approach

Data Sources

The data sources used in the empirical analyses were the 1997 Florida State Inpatient Database (SID) (for initial testing and development; 1995-1997 used for persistence analysis) and the 1997 State Inpatient Databases (SID) for 19 HCUP participating states, referred to in this report as the National SID, (for the final empirical analysis). The Florida SID consists of about 2,000,000 discharges from over 200 hospitals, and was chosen because it is a large diverse state. The National SID consists of about 19,000,000 discharges from over 2,300 hospitals. The National SID contains all-payer data on hospital inpatient stays from participating states (Arizona, California, Colorado, Connecticut, Florida, Illinois, Iowa, Kansas, Maryland, Massachusetts, Missouri, New Jersey, New York, Oregon, Pennsylvania, South Carolina, Tennessee, Washington, Wisconsin). All discharges from participating States' community hospitals are included in the SID database, which defines community hospitals as nonfederal, short-term, general, and other specialty hospitals, excluding long-term hospitals and hospital units of long-term care institutions, psychiatric hospitals, and alcoholism/chemical dependency treatment facilities. A complete description of the content of the SID, including details of the participating States' discharge abstracts, can be found on the Agency for Healthcare Research and Quality web site (www.ahrq.gov/data/hcup/hcupsid.htm). Because the Florida SID was used only for initial testing and development, the empirical results reported are from the National SID. Descriptive results from the Florida SID are reported for comparison to ensure that the hospital level results were similar in both data sources. Differences between Florida and national results are pointed out in the text. The National SID data were also used for the construction of area measures, with data from the U.S. Census Bureau used to construct the denominator of these rates.

Reported Patient Safety Indicators

Three sets of patient safety indicators were examined. First, the Accepted patient safety indicators met the face validity criteria established through the literature review and clinician panel review. Second, the Experimental patient safety indicators did not

meet those criteria, but appeared to warrant further testing and evaluation. Third, several Accepted patient safety indicators were modified into *area* indicators, which were designed to assess the total incidence of the adverse event within geographic areas. For example, we constructed an indicator for "Transfusion reaction" at both the hospital and area level. Transfusion reactions that occur after discharge from a hospitalization would result in a readmission. The area level indicator includes these cases, while the hospital level restricts the number of transfusion reactions to only those that occur during the same hospitalization that exposed the patient to this risk.

All potential indicators were examined empirically by developing and conducting statistical tests for precision, bias, and relatedness of indicators. For each indicator, we calculated five different estimates of hospital performance. First, we calculated the raw indicator rate using the number of adverse events in the numerator divided by the number of discharges in the population at risk by hospital. For the area indicators, the denominator is the population of the Metropolitan Statistical Area (MSA), New England County Metropolitan Area (for the New England states) or county (for non-MSA areas) of the hospital. Second, we adjusted the raw indicator using a logistic regression to account for differences among hospitals (and areas) in demographics (specifically, age and gender). Age was modeled using a set of dummy variables to represent 10-year categories except for young children whose age categories are narrower (i.e., less than 1, 1-4, 5-14, 15-24, 25-34, 35-44, 45-54, 55-64, 65-74, 75-84, and 85 or more years), along with a parallel set of age-gender interactions. Because of sparse cells, certain age categories were combined or omitted for selected indicators, such as the obstetric indicators. Third, we adjusted the raw indicator to account for differences among hospitals in age, gender and modified DRG category (as described below). Fourth, we adjusted the raw indicator to account for differences among hospitals in age, gender, modified DRG and comorbidities (defined using an adaptation of the AHRQ comorbidity software) of patients. Finally, we applied mutlivariate signal extraction (MSX) methods to adjust for reliability by estimating the amount of "noise" (i.e., variation due to random error) relative to the amount of "signal" (i.e., systematic variation in hospital performance or the 'reliability') for each indicator. This or similar "reliability adjustment" has been used in the literature for similar purposes.[23, 24] Mutlivariate methods (taking into account correlations among indicators in order to extract additional 'signal') were applied to most of the accepted indicators. The exceptions were Death in Low Mortality DRGs and Failure to Rescue. Only univariate signal extraction methods (smoothing) were applied to these two indicators and to the experimental indicators, because these indicators possibly cover broader clinical concepts. Correlations between these indicators and other indicators may not reflect correlations due to quality of care, and thus inclusion of these indicators may adversely affect the MSX approximations. For additional details on the empirical methods, refer to the companion EPC HCUP Quality Indicator Report, published by AHRQ (http://www.ahrq.gov/data/hcup/qirefine.htm). Additional details on the modifications made to the DRG and comorbidity categories are described below.

Hospital Fixed Effects

In our risk-adjustment models, we calculated hospital fixed effects using the standard method with logistic models of first estimating the predicted value for each discharge, then subtracting the actual outcome from the predicted, and averaging the

difference for each hospital to get the hospital fixed effect estimate. In the companion Quality Indicator Report,[3] we used linear regression models with hospital fixed effects included, arguing that the logistic approach yielded biased estimates due to the omission of a variable (the hospital) correlated with both the dependent (e.g., in-hospital mortality) and the independent (e.g., age, gender, APR-DRG) variables in the model. Given the rare occurrence of many of the PSI, however, the logistic approach may be more appropriate for this application. Linear methods assume that the distribution of the error term is normally distributed. This assumption is violated when the outcome is dichotomous. The QI means were generally an order of magnitude higher than the PSI means, so the assumption was not as problematic. However, the most appropriate method depends on the particular characteristics of each indicator, whether QI or PSI. To the extent that bias is a concern, accounting for the clustering of patients by using a hospital fixed effect is advantageous. To the extent that extreme values are a concern, then imposing structure on the error term with logistic methods is advantageous. In the end, the two approaches can be compared in terms of how much difference it makes in the relative assessment of provider performance. This is an issue that warrants further analysis, in order to better understand the trade-offs and limitations of each approach, and under what conditions and for what indicators each approach might best apply.

Specifically, the risk-adjusted "raw" estimate of a hospital's performance is constructed in two steps. In the first step, if we denote whether or not the event associated with a particular indicator Y^k (k=1,…,K) was observed for a particular patient i in year t (t=1,…,T), then the regression to construct a risk-adjusted "raw" estimate of a particular patient's performance on each indicator can be written as:

(1) $\quad Y^k_{it} = Z_{it}\ \Pi^k_t\ +\ \xi^k_{it}$, where

Y^k_{it} is the k^{th} PSI for patient i in year t (i.e., whether or not the event associated with the indicator occurred on that discharge);

Z_{it} is a vector of patient covariates for patient i in year t (i.e., the patient-level measures used as risk adjusters);

Π^k_t is a vector of parameters in each year t, giving the effect of each patient risk adjuster on indicator k (i.e., the magnitude of the risk adjustment associated with each patient measure); and

ε^k_{it} is the unexplained residual in this patient-level model.

In the second step, we estimated the hospital effect by subtracting the resulting predictions from this patient-level regression from the actual observed patient-level outcomes, and taking the mean of this difference for each hospital. That is, for each hospital j (j=1,…,J),

(2) $\quad M^k_{jt} = Y^k_{ijt} - (Z_{it}\ \Pi^k_t\ +\ \xi^k_{it})$, where

M^k_{jt} is the "raw" adjusted measure for indicator k for hospital j in year t (i.e., the hospital "fixed effect" in the patient-level regression); and

Z_{it} is the vector of patient covariates for patient i in year t estimated in Step 1.

In addition to age, sex, and age*sex interactions as adjusters in our model, we also included a modified DRG and comorbidity category for the admission.

Modified DRG Categories

We made two modifications to the Centers for Medicare and Medicaid Services (CMS, formerly Health Care Financing Administration) Diagnosis-Related Groups (DRGs). First, we collapsed adjacent DRG categories that were separated by the presence or absence of comorbidities or complications. For example, DRGs 076 (OTHER RESP SYSTEM OPERATING ROOM PROCEDURES W CC) and 077 (OTHER RESP SYSTEM OPERATING ROOM PROCEDURES W/O CC) were grouped into one category. The purpose was to avoid adjusting for the complication we were trying to measure. Appendix D Section 1 lists the categories that were grouped. Second, we excluded from the logistic models most of the super-MDC DRG categories. Excluding these categories also avoids adjusting for the complications we were trying to measure. For example, tracheostomies (DRG 482-483) often result from potentially preventable respiratory complications that require long-term mechanical ventilation. Similarly, operating room procedures unrelated to the principal diagnosis (DRG 468, 477) often result from potentially preventable complications that require surgical repair (i.e., fractures, lacerations). Appendix D Section 2 lists the super-MDC categories that were excluded and other DRGs that were excluded because they were no longer valid.

In the companion technical report on quality indicators, the risk adjustment method implemented All Patient Refined (APR)-DRGs, a refinement of DRGs to capture different levels of complications. However, patient safety indicators, designed to detect potentially preventable complications, require a risk adjustment approach that does not inherently remove the differences between patients based on their complications. The APR-DRGs could be modified to remove applicable complications, on an indicator by indicator basis, but implementation of such an approach was beyond the scope of the current project. In this report, APR-DRG risk adjustment was not implemented.

Modified Comorbidity Software

To adjust for comorbidities, we used an updated adaptation of AHRQ Comorbidity Software (http://www.ahrq.gov/data/hcup/comorbid.htm). The ICD-9-CM codes used to define the comorbidity categories were modified to address four main issues. First, we excluded comorbidity categories in the current software that include conditions likely to represent potentially preventable complications in certain settings, such as after elective surgery. Specifically, three DRG categories (cardiac arrhythmia, coagulopathy, and fluid/electrolyte disorders) were removed from the comorbidity adjustment. Second, most adaptations were designed to capture acute sequelae of chronic comorbidities, where both conditions are represented by a single ICD-9-CM code. For example, the definition of hypertension was broadened to include malignant hypertension, which usually arises in the setting of chronic hypertension. Unless these "acute on chronic" comorbidities are captured, some patients with especially severe comorbidities would be mislabeled as not having conditions of interest. Third, the comorbidity definitions did not include obstetric comorbidity codes, which are relevant for our obstetric indicators. Codes, when available, for these comorbidities in obstetric

patients were added. Fourth, slight updating was necessary based on recent ICD-9-CM code changes. Modifications made to the AHRQ comorbidity software are explained in detail in Appendix D, Section 3.

Low Mortality DRGs

In order to be included in the "Low Mortality DRG" indicator, the DRG had to have an overall in-hospital mortality rate (based on the National SID sample) of less than 0.5%. In addition, if a DRG category was split based on the presence of comorbidities or complications, then we only included the category if both DRGs (with and without comorbidities or complications) met the mortality threshold. Otherwise the category was not included in the "Low mortality DRG" PSI. The indicator is reported as a single measure and stratified into medical (adult and pediatric), surgical (adult and pediatric), neonatal, obstetric and psychiatric DRGs. The 126 DRGs included in the measure are listed in Appendix D, Section 4 by stratification category.

Empirical Analysis Statistics

Using these methods we constructed a set of statistical tests to examine precision, bias, and relatedness of indicators for all accepted hospital level indicators, and precision and bias for all accepted area level and experimental indicators. Each of the key statistical test results was summarized and explained in the overview section of the companion HCUP Quality Indicator report.[3] Tables 6-8 provide a summary of the statistical analyses and their interpretation.

Table 6. Precision Tests

Measure	Statistic/ Adjustments		Interpretation
Precision. Is most of the variation in an indicator at the level of the hospital? Do smoothed estimates of quality lead to more precise measures?			
a. Observed variation in indicator	• **Hospital Level Standard Deviation** • **Hospital Level Skew Statistic**	• **Unadjusted** • **Age-gender adjusted** • **Modified DRG adjusted** • **Modified AHRQ Comorbidity adjusted**	**Risk adjustment can either increase or decrease observed variation. If increase, then differences in patient characteristics mask provider differences. If decrease, then differences in patient characteristics account for provider differences.**
b. MSX methods	• **Signal Standard Deviation** • **Signal Share** • **Signal Ratio**	• **Reliability adjusted**	**Estimates what percentage of the observed variation between hospitals reflects systematic differences versus random noise. Signal share is a measure of how much of the total variation (patient and provider) is potentially subject to hospital control.**

Table 7. Bias Tests

Measure	Statistic	Interpretation
Bias. Does risk adjustment change our assessment of relative hospital performance, after accounting for reliability? Is the impact greatest among the best or worst performers, or overall? What is the magnitude of the change in performance?		
MSX methods: unadjusted vs. age, sex, Modified DRG, Comorbidity risk adjustment	Spearman Rank Correlation Coefficient (Before and After Risk Adjustment)	Risk adjustment matters to the extent that it alters the assessment of relative hospital performance. This test determines the impact overall.
	Average Absolute Value Of Change Relative To Mean (After Risk Adjustment)	This test determines whether the absolute change in performance was large or small relative to the overall mean.
	Percentage of The Top 10% Of Hospitals That Remains The Same (After Risk Adjustment)	This test measures the impact at the highest rates (in general, the worse performers).
	Percentage of The Bottom 10% Of Hospitals That Remains The Same (After Risk Adjustment)	This test measures the impact at the lowest rates (in general, the better performers).
	Percentage of hospitals that move more than two deciles in rank (up or down) (After Risk Adjustment)	This test determines the magnitude of the relative changes.

Table 8. Relatedness Tests

Measure	Statistic	Interpretation
3. Relatedness of indicators. Is the indicator related to other indicators in a way that makes clinical sense? Do methods that remove noise and bias make the relationship clearer?		
a. Correlation of indicator with other indicators	Spearman correlation coefficient	Are indicators correlated with other indicators in the direction one might expect?
b. Factor loadings of indicator	Factor loadings, based on Spearman correlation, Principal Component Analysis	Do indicators load on factors with other indicators that one might expect?

Chapter 3. Results

The results are presented in four sections. Within each section, the indicators are presented within their final designated set – Accepted or Experimental, in alphabetical order. Non-obstetric indicators are followed by obstetric indicators, also in alphabetical order. The results for each of the rejected indicators are contained in Appendix F. The first section presents the results of the literature review. The second section presents the overall results of the clinician review; the third section also reports the results for the clinician review, but for specific indicators. The final section contains the comparative empirical results.

Obstetric indicators are grouped together in the results presentations to convey a number of differences from the other PSIs more clearly. First, the obstetric indicators, for the most part, were created after a review of the ICD-9-CM codes. There is little or no precedent for using most of these indicators, and little literature based evidence discussing these complications as measures of quality of care. In addition, little evidence of the coding validity of obstetric codes exists. Second, at the end of the clinician review it appeared that the obstetric panels treated similar complications differently from the other panels. For example, the diagnosis code for wound dehiscence was rejected by the multi-specialty panel, due to the ambiguity of the code. The obstetric panel, however, accepted the ambiguity of the parallel code for cesarean wound dehiscence. Third, an entirely different set of physicians and nurses, as well as only a subset of hospitals provide obstetric care. Fourth, empirical analyses found that obstetric PSIs on average tend to have considerably higher rates than non-obstetric PSIs. In addition, DRG and comorbidity risk adjustment is likely inadequate for these indicators (DRGs are split only by delivery type and the presence or absence of any complication or comorbidity, and the comorbidities examined in the risk adjustment are rare in this population and potentially not the most important comorbidities for which to risk adjust). A factor analysis found that these indicators tend to load onto one factor, while non-obstetric indicators appear to load on a separate factor, for the most part. Because of these considerations, the obstetric indicators are presented separately in this report, following the non-obstetric indicators in each subsection.

Section 3A. Literature Review Results

Background

In the context of widespread current interest in measuring and improving patient safety, potential quality indicators related to potentially preventable complications of medical care merit special attention. In this section, we review the literature on the application of administrative data to screening for such complications

The seminal studies that defined the epidemiology of medical errors[6, 25, 26] were based on a methodology that was pioneered by the California Medical Association (CMA) in 1976.[27] Specially trained nurses and medical records administrators screened inpatient records for any of 18 possible indicators of an adverse event.[28] Records that met one or more of these criteria were then reviewed independently by two board-certified physicians to identify “injuries due to medical management”; all differences were

reconciled by a third independent reviewer. Injuries "caused by the failure to meet standards reasonably expected of the average physician..." were labeled as "negligent" adverse events. Another seminal study employed "ethnographers trained in qualitative observational research" who prospectively identified "situations in which an inappropriate decision was made..." by attending all rounds, nursing sign-outs, case conferences, and other "organized settings in which health care providers discussed adverse events."[29] Neither of these methodologies use ICD-9-CM codes to identify adverse events. Another set of studies defined postoperative adverse events based on unusual occurrences and key clinical findings that are included in a proprietary clinical data system.[30-33] Some investigators have defined adverse events *de novo*, based on clinical experience and prior literature.[34-37] Others have estimated the incidence of adverse drug events using various pharmacy-based surveillance systems.[38, 39]

By contrast, relatively few studies have evaluated ICD-9-CM diagnosis or procedure codes as a method for finding adverse events or medical errors. Numerous investigators have proposed various ICD-9-CM definitions of adverse events or medical errors; some are limited to specific conditions or procedures[40-43] while others are applicable to broad groups of hospitalized patients.[10, 11, 44-48] However, most of these investigators initially validated their measures principally by assessing content validity[7] or by demonstrating that they were associated with substantially higher mortality, longer lengths of stay, and higher charges at the patient level,[40, 47, 48] even after adjusting for demographic characteristics and comorbidities.[10, 12] Brailer et al.[47] also found a strong association at the patient level (at 6 hospitals) between their proprietary (CareScience, Inc.), comorbidity-adjusted complication measure and a composite measure of 15 different adverse events (based on Maryland Hospital Association indicators). Among these 15 categories, inpatient mortality and unscheduled return to the operating room or special care unit (among others) were strongly associated with comorbidity-adjusted complications. Several other proprietary systems (e.g., Risk adjusted Major Complications, HealthGrades, Inc.; CareEnhance Resource Management Systems, McKesson Health Solutions; Disease Staging, MEDSTAT, Santa Barbara CA; Performance Measurement, QuadraMed, Larkspur CA; Intelligent Disease Analysis, MedAI Inc., Orlando FL) that estimate crude or risk adjusted complication rates based on administrative data have never been publicly validated.

Although these early studies generally supported the validity of using administrative data to ascertain adverse events, they also identified several sources of concern:

1. The ratio of observed to predicted complications, based on ICD-9-CM codes (predominantly 997.xx through 999.9x) from 776 acute care hospitals, increased substantially between 1983 and 1984, reflecting the impact of prospective payment on the reporting of complications.[45] Conversely, recent evidence suggests a significant decrease between 1997 and 1998 in the coding of acute posthemorrhagic anemia and selected other complications among Medicare inpatients undergoing hip and femur procedures (perhaps in response to the Office of the Inspector General's aggressive compliance program).[49] Proprietary data from Solucient, LLC also suggest a sudden 35% decrease in risk adjusted complications across nearly 3,000 hospitals between 1998 and 1999.[50]

2. Unlike analogous ratios for mortality and readmissions, hospitals' ratios of observed to predicted complications varied significantly by region and hospital case-mix index; such associations would not be expected for a valid measure.[45] In other studies, ICD-9-CM coded complications were more frequent at large hospitals than at smaller hospitals,[10] and complication rates were higher at large hospitals and academic medical centers.[11, 41] These findings contradict numerous studies suggesting better outcomes and processes of care, for at least some conditions, at high-volume and teaching hospitals.[51-53] The most plausible explanations for this finding (i.e., greater unmeasured severity of illness, more frequent use of invasive therapies, and more aggressive coding of complications at teaching hospitals) suggest the possibility of substantial bias in comparing performance across hospitals of different types.
3. There was minimal association between measures of risk adjusted complications and other outcome measures (e.g., rates of death, readmission, and major morbidity) at the hospital level (Spearman r=-0.01 to -0.05, [46]; partial r=0.09-0.11[47]; Spearman r=-0.01 for surgical patients, r=-0.12 for medical patients).[11] Although this finding has been interpreted as "desirable because (complications measures are) intended to provide information not captured by other outcome measures",[47] it is concerning that complication measures correlate so poorly with somewhat better validated measures of quality. [54-65] Two studies of adverse events after coronary artery bypass surgery represent notable exceptions to these findings. Specifically, risk adjusted death rates were significantly correlated with risk adjusted complication rates, according to Ghali et al. (r=0.73-0.74 [p<0.01][43]), and risk adjusted "major nonfatal" complication rates, according to Hartz et al. (r=0.31 and r=0.79 [p=0.035], before and after eliminating a single outlier.)[66]
4. Logistic regression models to predict complications, using information available from administrative data, are generally weaker than models to predict death or readmission, with receiver operating curve areas or c-statistics (measuring the model's ability to discriminate between patients with and without adverse outcomes) of 0.6-0.7[10, 41-43] and R-squared statistics (correlating observed and expected complication rates at the hospital level) of 0.42-0.48[45] or 0.16 (for medical cases) to 0.42 (for major surgery).[11] The difficulty of predicting complications suggests that underlying patient characteristics or other unmeasured factors may introduce even more bias than in comparative evaluations of other outcomes.

It should be noted that problems 2-4 above may not be unique to administrative data, but may apply to clinically derived measures of complications as well. For example, two studies by the same researchers, using different data sources, found no correlations between risk adjusted complication measures and hospital/operator volume for PTCA and CABG.[35, 67] Studies based on MedisGroups[32 68] data have confirmed that complications, adjusting for patient risk, are more frequent at large hospitals, hospitals with approved residency training programs, hospitals with high nurse-to-bed ratios and high proportions of board-certified anesthesiologists, and hospitals that offer subspecialty services (e.g., magnetic resonance imaging, bone marrow transplantation) - precisely the hospitals that

would be expected to provide better care. There was essentially no association at the hospital level between measures of risk adjusted complications and risk adjusted mortality for CABG (r=0.07, p=0.58),[32] and a weak association (r=0.21, 95% CI 0.04-0.38)[69] for elective adult general surgery after full risk adjustment (i.e., r=0.55, 95% CI 0.38-0.72 without risk adjustment). Similarly, the Department of Veterans' Affairs (VA) National VA Surgical Risk Study found significantly higher risk adjusted, 30-day postoperative morbidity at teaching hospitals than at non-teaching hospitals for general, orthopedic, urologic, and vascular (but not thoracic, neurologic, or otolaryngologic) surgery, [70] and essentially no association with risk adjusted mortality at the hospital level (r=-0.01 overall, range r=-0.03 for neurosurgery to r=0.28 for otolaryngologic surgery).[60] Finally, discrimination in predicting complications has also been relatively weak (c<0.79) in these detailed clinical data systems.[31, 33, 60, 69]

General Issues in Using Complications To Screen for Quality Problems

The companion technical report on the development of the AHRQ Quality Indicators describes three[3] areas important to the evaluation of a measure (i.e., precision, minimum bias and construct validity) that are pertinent to potential PSIs.

Precision

As with mortality rates, variations in complication rates may reflect random variation. However, the higher incidence of most complications compared to mortality reduces random variation, and provides an important incentive for using complication rates as quality measures. In addition, precision may be less important for PSIs than for other types of QIs. To the extent that these indicators capture preventable iatrogenesis, the precision with which prevalence is estimated at the provider level may be unimportant. The primary intended use of these indicators is not to compare performance across providers, but instead to assess the overall performance of the health care system at the regional, state, or national level, and to provide a screening tool that providers can use to identify cases that merit internal review.

It should be noted that the ICD-9-CM codes that are most likely to represent preventable adverse events are also relatively rare (see detailed reviews below). The ICD-9-CM codes for general complications are more common, but are subject to considerable coding error and may include a mix of preventable and non-preventable events. Efforts to focus on ICD-9-CM coded complications that are likely to reflect medical errors will inevitably increase random variation across providers.

Minimum Bias

All quality indicators, including the proposed PSIs, are susceptible to bias of three general types: selection effects, confounding, and misclassification. Selection bias arises when the sample available for quality measurement is not representative of the target population. In the current context, this problem arises principally for conditions that may be treated, or procedures that may be performed, in either inpatient or outpatient (short-stay) settings. For these conditions and procedures, HCUP data may not adequately

represent the population of interest. For example, in areas where freestanding birthing centers have a substantial market share, PSI rates based on HCUP data are likely to be biased.

Confounding arises in comparing PSI rates across hospitals, health systems, or regions because of differences in patients' underlying risk of these events. Patients who undergo certain procedures, or have certain diagnoses, are inherently at higher risk of experiencing adverse events, including adverse events due to medical error. Age is also a known risk factor for medical error, although its effect may be explained by the greater clinical complexity of care for elderly patients and their greater exposure to potential hazards.[6, 26] Well-established clinical prediction rules allow risk adjustment for patients experiencing perioperative cardiac and pulmonary complications[71-77], but risk adjustment systems remain relatively unstudied for most other complications [78]. Specific clinical prediction rules have been developed for morbidity after coronary artery bypass surgery,[79] carotid endarterectomy,[80-83], and percutaneous coronary interventions,[84] but not for many other high-risk procedures. In general, clinical factors such as the serum albumin level and functional status[37] are clearly associated with the risk of adverse events among both medical and surgical inpatients. These factors potentially confound the observed associations between hospital categories and adverse event rates,[25, 52] as well as the performance ranking of individual hospitals. For example, Hartz et al.[35] reported that the Wisconsin hospital with the highest unadjusted rate of major complications after Coronary Artery Bypass Graft (CABG) had an adjusted relative odds of 0.98, placing it right in the middle after risk adjustment.

Multiple studies have explored the relative performance of risk adjustment models for mortality, using administrative versus clinical data (or proprietary systems based on such data).[85-90] Although there is less evidence regarding the relative performance of risk adjustment models for adverse events, the same findings are likely to apply. For example, Hartz et al. reported c statistics of 0.71 using ICD-9-CM codes, and 0.80 using clinical variables, to predict adverse outcomes after stroke among Medicare patients.[91] Substantial opportunity for confounding bias therefore exists when provider-specific adverse event rates are compared.

Misclassification bias is likely to result from variation in coding practices across hospitals. As detailed below, we carefully reviewed the available literature to select PSIs for which the positive predictive value of coding appears to be at least 75%. However, there is less evidence on sensitivity (i.e., undercoding) than on predictive value (i.e., overcoding), so several of the accepted and experimental indicators may suffer from significant undercoding. Based on current guidelines that only require coding of "conditions that affect patient care in terms of requiring clinical evaluation... therapeutic treatment...diagnostic procedures...extended length of hospital stay...increased nursing care and/or monitoring,"[92] we avoided including potentially inconsequential diagnoses in the PSI definitions. However, we could not always do so, due to the ambiguity of ICD-9-CM. One recent study suggests that the sensitivity of coding postoperative complications after elective back surgery varies markedly across hospitals, such that about half of the difference in risk-adjusted complication rates between low and high outlier hospitals is attributable to reporting variation.[93]

Construct Validity

The literature identifies only a small number of explicit processes of care that have proven beneficial in randomized, placebo-controlled trials for preventing certain complications: (1) thromboembolism prophylaxis for most major surgeries[94-102]; (2) perioperative antibiotics for a smaller but still substantial number of surgical procedures[103-110]; (3) perioperative nutritional support for severely malnourished patients requiring laparotomy, thoracotomy[111, 112] and hip fracture repair[113]; (4) perioperative beta blockers to prevent cardiac complications among high-risk patients undergoing cardiac,[114] noncardiac[115] or vascular[116] surgery; and (5) antiplatelet agents to prevent early restenosis after percutaneous coronary interventions.[117, 118] Other potential interventions to improve patient safety have been thoroughly reviewed in a recent report.[2] To our knowledge, no additional studies to date have linked these specific processes of care with differences in risk adjusted rates of adverse outcomes across hospitals or physicians.

Given the small number of evidence-based processes-of-care related to the prevention of adverse events, one could argue for broad explicit review criteria that incorporate standards of care based on expert recommendations, rather than insisting on processes strongly supported by evidence. Condition-specific provider adherence measures of this type have been associated with the risk of in-hospital complications among adults admitted for diabetes and chronic obstructive pulmonary disease (COPD), but not congestive heart failure (CHF).[36] Iezzoni and colleagues developed a similar set of review instruments to compare Medicare cases flagged by the Complications Screening Program (CSP) in California and Connecticut in 1994 with unflagged cases.[16] Even with this broader look at processes of care, flagged cases did not differ significantly from unflagged cases in terms of the prevalence of generic quality problems. Specifically, 53% of 351 flagged surgical cases demonstrated one or more of 17 process-of-care problems, versus 46% of 140 unflagged surgical cases. Among medical cases, 5% of both flagged and unflagged cases demonstrated one or more process-of-care problems. None of the specific flags proved useful in identifying patients with a higher risk of these generic process deficiencies, except deep vein thrombosis/pulmonary embolism (DVT/PE) (11% flagged versus 4% unflagged, p=0.09) and miscellaneous complications (62% flagged versus 46% unflagged, p=0.06).

Implicit review is based upon global assessment of quality of care by physician peers.[119] In another recent evaluation of the Complications Screening Program, Weingart and colleagues[15] compared flagged and unflagged cases on the prevalence of quality problems identified by implicit review. Physician reviewers identified potential quality problems in 29.5% of flagged surgical cases and 15.7% of flagged medical cases, compared with 2.1% of unflagged medical and surgical controls. However, substantial variation across specific screens was noted. Potential quality problems were identified in 50% of surgical cases flagged for DVT/PE, but only 5% of surgical cases flagged for postoperative pneumonia. Potential quality problems were identified in less than 20% of medical cases flagged by each screen, except for post-procedural hemorrhage or hematoma (31%). Of two other studies involving structured implicit review by physicians as a "gold standard" for quality assessment, one confirmed the potential value of various morbidity-based screening tools based on nurse/staff review,[120] but another found that quality of care was equal between patients with and without complications,

and between hospitals with low and high risk adjusted complication rates.[121] In neither of these studies did the authors report the predictive validity of specific adverse outcome measures.

Part of the difficulty with linking adverse events and processes of care relates to the inherent lack of reproducibility in implicit assessments of quality. For instance, a well-known study in the 1980s examining deaths due to pneumonia, myocardial infarction and stroke reported inter-rater reliability for physicians' judgment of "preventable death" as 0.11, 0.51 and 0.55, respectively[122]. (The first value falls in the range conventionally regarded as "poor," while the other two values indicate "moderate" agreement.) In the Harvard Medical Practice Study, physician reviewers exhibited substantial agreement in identifying the presence of adverse events (kappa=0.61), but only "fair" agreement in identifying negligent care (kappa=0.24).[6] Two later studies reported moderate agreement among physician reviewers for the presence of an adverse event (kappa = 0.41-0.57), but only fair agreement for the judgment of preventability (kappa = 0.30)[123] or negligence (kappa = 0.19-0.24).[124] Weingart et al. reported borderline poor agreement among physician reviewers about both the presence of a CSP complication (kappa=0.22) and a potential quality problem (kappa = 0.22).[15] Agreement was somewhat better in the National VA Surgical Risk Study, in which physicians used a 5-point scale to rate overall quality of care (ICC=0.40-0.56).[121] A more recent study examined the impact of discussion between reviewers on agreement in assessing preventability of adverse events.[125] The authors created 7 different pairs among 13 reviewers participating in the study. They showed that discussion between the two physicians in a pair substantially improved their assessment of an adverse event as iatrogenic from (kappa = 0.46 to 0.71). However, the agreement across pairs remained relatively unchanged by discussion (kappa = 0.36 before to 0.40 after discussion).

In the absence of identifiable differences in processes-of-care in most cases studied, residual variation in complication rates after risk adjustment presumably reflects either unmeasured processes of care or differences in patients' baseline risk of complications that are not captured through risk adjustment. By definition, these concepts are difficult to measure, making it difficult to establish the construct validity of many potential PSIs.

Finally, correlations between adverse events and structural characteristics of hospitals have been cited as evidence of construct validity. However, these findings are often difficult to interpret because of uncertainty about which structural characteristics are truly associated with better care. Structural characteristics are also often difficult to modify; hence, identifying them has limited value for quality improvement. In evaluating the Complications Screening Program, Iezzoni and colleagues found that large hospitals, hospitals performing open heart surgery, and members of the Council of Teaching Hospitals (COTH) had 10-33% more complications than expected across most risk pools, whereas small hospitals, hospitals without open heart surgery facilities, and nonmembers of COTH, had 4-26% fewer complications than expected.[11] Similarly, patients at hospitals with fewer than 100 beds consistently had a 22-49% lower risk of complications than patients at hospitals with 500 or more beds.[10] A study of factors associated with adverse events after surgery, based on AHRQ's original HCUP Quality Indicators, revealed associations between four of these nine indicators and registered nurse staffing (as detailed below), including three of the five indicators that were judged *a priori* to be

"nurse-sensitive."[126] Differences in risk-adjusted QI rates across regions and hospital ownership categories were also noted. In evaluating a Risk-Adjusted Complications Index (RACI) based on administrative data, DesHarnais and colleagues found that hospitals' risk-adjusted complication rates were positively associated with their range of services, but not with their ownership, size, or teaching status.[46] Conversely, Myers found significantly higher complication rates after hysterectomy at teaching hospitals than at nonteaching hospitals.[41] These findings are probably attributable to bias from unmeasured case mix or differential reporting of complications. Studies based on chart review have suggested that major teaching hospitals experience more complications than nonteaching hospitals, but they are better at "rescuing" patients after complications, and relatively few of their complications (especially adverse drug events) are due to negligence.[25, 32, 52] Patient volume should be inversely associated with valid outcome rates, at least for procedures requiring technical skill, but the literature on this topic has generally focused on mortality and resource use, with complications of percutaneous coronary interventions[127-135] and stroke after endarterectomy the notable exceptions.[136] With the exception of a few recent studies on nurse staffing and hospital outcomes,[126, 137, 138] analyses of structural aspects of care have not been particularly helpful in establishing the construct validity of morbidity indicators based on administrative data, or suggesting interventions to improve patient outcomes.

Specific Review of the Evidence for Indicators

The potential patient safety indicators identified through literature and coding reviews are listed in Appendix A. These indicators were assigned to one of three categories: Accepted PSIs, Experimental PSIs and Rejected PSIs. Those in the last category were removed from further analyses based on evidence of poor coding or construct validity, poor ratings by panelists, or inability to implement the desired specification after receiving expert coding input. Indicators in the Accepted indicator set were rated favorably by clinical panels as being useful screens for potentially preventable complications. Finally, those in the Experimental indicator set fell between the other two categories, and underwent less extensive empirical analyses. This set is not recommended without considerable further testing, as described in Section 3B, Indicator Selection.

This section reviews the literature on the derivation and validity of each indicator, or the ICD-9-CM codes upon which it is based. We briefly compare the definitions reported in the literature with the final PSI definition. More detailed descriptions of the definitions, and explanations of differences, are presented in section 3D, Detailed Clinician Panel Results by Indicator. Literature reviews were performed on all indicators including those that were rejected based on poor panel ratings, and some that were rejected for other reasons. Literature reviews for those indicators are not presented in this section, but are presented in Appendix F. For each indicator, we report separately on whether it is coded accurately ("coding validity") and whether it is empirically associated with substandard quality or errors in processes of care ("construct validity").

The literature review results are provided to help researchers and providers assess the usefulness of each indicator in their own epidemiologic or quality improvement work. It was beyond the scope of this project to review clinical studies linking specific processes of care to specific, prospectively ascertained complications. Much of this

literature has been summarized in a recent AHRQ report on evidence-based practices to prevent medical errors.[2] For example, numerous randomized controlled trials have proven that thromboembolism prophylaxis reduces the risk of postoperative DVT/PE, and therefore that higher DVT/PE rates are likely to be associated with poorer quality of care. This literature review focuses instead on the validity of complication indicators based on ICD-9-CM diagnosis and/or procedure codes. Tables 9 and 10 summarize the strength of evidence for each Accepted and Experimental indicator respectively.

Table 9. Summary of Strength of Evidence in Literature for Accepted Indicators

Indicator	Coding[a,b]	Construct Explicit Process[a,b]	Construct Implicit Process[a,b]	Construct Staffing[a,b]
Complications of anesthesia	**0**	**0**	**0**	**0**
Death in low mortality DRGs	**+**	**0**	**+**	**0**
Decubitus ulcer	**-**	**0**	**0**	**±**
Failure to rescue	**+**	**0**	**0**	**++**
Foreign body left in during procedure	**0**	**0**	**0**	**0**
Iatrogenic penumothorax	**0**	**0**	**0**	**0**
Infection due to medical care	**0**	**0**	**0**	**0**
Postoperative hip fracture	**+**	**+**	**+**	**0**
Postoperative hemorrhage or hematoma	**±**	**±**	**+**	**0**
Postoperative physiologic and metabolic derangements	**-**	**0**	**0**	**-**
Postoperative respiratory failure	**+**	**±**	**+**	**±**
Postoperative PE or DVT	**+**	**+**	**+**	**±**
Postoperative sepsis	**±**	**0**	**0**	**-**
Technical difficulty with procedure	**±**	**0**	**0**	**0**
Transfusion reaction	**0**	**0**	**0**	**0**
Postoperative wound dehiscence	**0**	**0**	**0**	**0**
Birth trauma	**-**	**0**	**0**	**0**
Obstetric trauma – vaginal delivery with instrumentation	**+**	**0**	**0**	**0**
Obstetric trauma – vaginal delivery without instrumentation	**+**	**0**	**0**	**0**
Obstetric trauma – cesarean delivery	**+**	**0**	**0**	**0**

a Level of evidence

(-) Published evidence suggests that the indicator lacks validity in this domain (i.e., less than 50% sensitivity or predictive value; explicit or implicit process failure rates no more frequent than among control patients).

(0) No published evidence regarding this domain of validity.

(±) Published evidence suggests that the indicator may be valid in this domain, but different studies offer conflicting results (although study quality may account for these conflicts).

(+) Published evidence suggests that the indicator IS valid, or is likely to be valid, in this domain (i.e., one favorable study).

(++) There is strong evidence supporting the validity of this indicator in this domain (i.e., multiple studies with consistent results, or studies showing both high sensitivity and high predictive value).

[b] *Coding:* Sensitivity is the proportion of patients who suffered an adverse event, based on detailed chart review or prospective data collection, for whom that event was coded on a discharge abstract or Medicare claim. Predictive value is the proportion of patients with a coded adverse event who were confirmed as having suffered that event, based on detailed chart review or prospective data collection.

Construct, explicit process: Adherence to specific, evidence-based or expert-endorsed processes of care, such as appropriate use of diagnostic modalities and effective therapies. Our construct is that hospitals that provide better processes of care should experience fewer adverse events.

Construct, implicit process: Adherence to the "standard of care" for similar patients, based on global assessment of quality by physician chart reviewers. Our construct is that hospitals that provide better overall care should experience fewer adverse events.

Construct, staffing: Our construct is that hospitals that offer more nursing hours per patient day, better nursing skill mix, better physician skill mix, or more experienced physicians, should have fewer adverse events.

[c] Note that when content validity is exceptionally high, as for transfusion reaction or iatrogenic pneumothorax, construct validity becomes less important.

Table 10. Summary of Strength of Evidence in Literature for Experimental Indicators[a]

Indicator	Coding	Construct Explicit Process	Construct Implicit Process	Construct Staffing
Postoperative aspiration pneumonia	+	±	+	+
CABG following PTCA	+	0	0	++
Decubitus ulcer in high-risk patients	-	0	0	0
Postoperative fractures potentially related to falls	+	0	0	0
Intraoperative nerve compression injuries	0	0	0	0
Malignant hyperthermia	0	0	0	0
Postoperative acute myocardial infarction	++	-	+	-
Postoperative iatrogenic complications – cardiac	±	0	+	0
Postoperative iatrogenic complications – nervous system	0	0	0	0
Postoperative reopening of surgical site	+	-	+	0
Postoperative suture of laceration	+	0	+	+
Obstetric wound complications – cesarean	±	0	0	0
Obstetric wound complications – vaginal	±	0	0	0
Other obstetric complications of delivery	±	0	0	0
Third or fourth degree obstetric lacerations	+	0	0	0
Uterine rupture	+	0	0	0
Postpartum urinary tract infection	-	0	0	0

[a] See footnotes to Table 9.

Accepted Indicators

Complications of Anesthesia

Source. A subset of this indicator was originally proposed by Iezzoni et al.[10] as part of the CSP (CSP 21, "Complications relating to anesthetic agents and other CNS depressants"). Their definition also includes poisoning due to centrally acting muscle relaxants (968.0) and accidental poisoning by nitrogen oxides (E869.0), which were omitted from this PSI. Their definition excludes other codes included in this PSI, namely, poisoning by other and unspecified general anesthetics and external cause of injury codes for "endotracheal tube wrongly placed during anesthetic procedure" (E876.3) and adverse effects of anesthetics in therapeutic use (E938.1-E938.9).

Evidence

We were unable to find evidence on validity from prior studies.

Death in Low Mortality DRGs

Source. This indicator was originally proposed by Hannan et al. as a criterion for targeting "cases that would have a higher percentage of quality of care problems than cases without the criterion, as judged by medical record review."[139] An alternative form of this indicator focused on "primary surgical procedures," rather than DRGs, with less than 0.5% inpatient mortality.

Evidence

Construct validity. Based on two-stage implicit review of 8,109 randomly selected deaths from 104 New York hospitals in 1985-86, Hannan et al. found that patients in low-mortality DRGs (<0.5%) were 5.2 times more likely than all other patients who died (9.8% versus 1.7%) to have received "care that departed from professionally recognized standards," after adjusting for patient demographic, geographic, and hospital characteristics. In 15 of these 26 cases (58%) of substandard care, the patient's death was attributed at least partially to that care. The association with substandard care was stronger for the DRG-based definition of this indicator than for the procedure-based definition (5.7% versus 1.7%, OR=3.2). We were unable to find other evidence on the validity of this indicator.

Decubitus Ulcer

Source. This indicator was originally proposed by Iezzoni et al.[10] as part of the CSP (CSP 6, "cellulitis or decubitus ulcer"). Their definition also includes cellulitis of the upper extremity (682.3-682.4), which was omitted from this PSI. Needleman and Buerhaus[137] identified decubitus ulcer as an "Outcome Potentially Sensitive to Nursing," but unlike this PSI their definition includes cellulitis of any site (682). The American Nurses Association, its state associations, and the California Nursing Outcomes Coalition have identified the total prevalence of inpatients with Stage I, II, III, or IV pressure ulcers (based on clinical data collection) as a "nursing-sensitive quality indicator for acute care settings."[140]

Evidence

Coding validity. No evidence on validity is available from CSP studies. Geraci et al.[141] confirmed only 2 of 9 episodes of pressure ulcers (707.0) reported on discharge abstracts of Veterans Affairs (VA) patients hospitalized in 1987-89 for congestive heart failure (CHF), chronic obstructive pulmonary disease (COPD), or diabetes; the sensitivity for a nosocomial ulcer was 40% (2/5). Among Medicare hip fracture patients from 297 hospitals in 1985-86, Keeler et al.[51] confirmed 6 of 9 (67%) reported pressure ulcers, but failed to ascertain 89 additional cases (6% sensitivity) using ICD-9-CM codes. In the largest study to date, Berlowitz et al.[142] found that the sensitivity of a discharge diagnosis of pressure ulcer among all patients transferred from VA hospitals to VA nursing homes in 1996 was 31% overall, or 54% for stage IV (deep) ulcers. The overall sensitivity increased modestly since 1992 (26.0%), and was slightly but statistically significantly better among medical patients than among surgical patients (33% versus 26%).

Construct validity. Needleman and Buerhaus[137] found that nurse staffing was inconsistently associated with the occurrence of pressure ulcers among medical patients from 799 hospitals in 11 states in 1997, and was independent of pressure ulcers among major surgery patients. Nursing skill mix (RN hours/licensed nurse hours) was significantly associated (in the expected direction) with the pressure ulcer rate among 352 and 295 California hospitals in 1992 and 1994, respectively, and also among 126 and 131 New York hospitals in the same years.[138] Total licensed nurse hours per acuity-adjusted patient day were inconsistently associated with the rate of pressure ulcers.

Failure To Rescue

Source. This indicator was originally proposed by Silber et al.[31] as a more powerful tool than the risk adjusted mortality rate to detect true differences in patient outcomes across hospitals. The underlying premise was that better hospitals are distinguished not by having fewer adverse occurrences but by more successfully averting death among (i.e., rescuing) patients who experience such complications. Silber et al's original definition was based on key clinical findings abstracted from the medical records of 2,831 cholecystectomy patients and 3,141 transurethral prostatectomy patients admitted to 531 hospitals in 1985. The key postoperative diagnoses that defined the denominator at risk of " failure to rescue" included cardiac arrhythmias, congestive heart failure, cardiac arrest, pneumonia, pulmonary embolus, pneumothorax, renal dysfunction, stroke, wound infection, and unplanned return to surgery.

More recently, Needleman and Buerhaus[137] adapted failure to rescue to administrative data sets, hypothesizing that this outcome might be sensitive to nurse staffing. Their denominator definition included the ICD-9-CM codes for sepsis, pneumonia (including aspiration), acute upper gastrointestinal bleeding, shock, cardiac/respiratory arrest, deep vein thrombosis (DVT), and pulmonary embolus (PE).

Evidence

Construct validity. Silber and colleagues have published a series of studies establishing the construct validity of failure to rescue rates through their associations with hospital characteristics and other measures of hospital performance. Among patients admitted for cholecystectomy and transurethral prostatectomy, failure to rescue was independent of severity of illness at admission, but was significantly associated with the presence of surgical housestaff and a lower percentage of board-certified anesthesiologists.[31] The adverse occurrence rate was independent of this hospital characteristic. In a larger sample of 74,647 patients who underwent general surgical procedures in 1991-92, lower failure to rescue rates were found at hospitals with high ratios of registered nurses to beds.[68] Failure rates were strongly associated with risk adjusted mortality rates, as expected, but not with complication rates.[143] Finally, among 16,673 patients admitted for coronary artery bypass surgery, failure rates were lower (whereas complication rates were higher) at hospitals with magnetic resonance imaging facilities, bone marrow transplantation units, or approved residency training programs.[32]

More recently, Needleman and Buerhaus[137] confirmed that higher registered nurse staffing (RN hours/adjusted patient day) and better nursing skill mix (RN hours/licensed nurse hours) were consistently associated with lower failure to rescue rates among major surgery patients from 799 hospitals in 11 states in 1997, even using administrative data to define complications. An increase from the 25th to the 75th percentile on these two measures of staffing was associated with 5.9% (95% CI, 1.5% to 10.2%) and 3.9% (95% CI, -1.1% to 8.8%) decreases, respectively, in the rate of failure-to-rescue among major surgery patients.[138] These associations were inconsistent among medical patients, in that nursing skill mix was associated with the failure-to-rescue rate (rate ratio 0.81, 95% CI 0.66-1.00) but aggregate registered nurse staffing was not (rate ratio 1.00, 95% CI 0.99-1.01). An increase from the 25th to the 75th percentile on nursing skill mix was associated with a 2.5% (95% CI, 0.0% to 5.0%) decrease in the failure-to-rescue rate among medical patients.

Foreign Body Left in During Procedure

Source. This indicator was originally proposed by Iezzoni et al.[10] as part of the Complications Screening Program (CSP "sentinel events"), along with gas gangrene, CNS abscess, anoxic brain injury, accidental puncture or laceration, wound dehiscence, and ABO/Rh transfusion reactions (all of which were omitted from this PSI). It was also included as one component of a broader indicator ("adverse events and iatrogenic complications") in AHRQ's original HCUP Quality Indicators.[144] It was proposed by Miller et al. [17] in the "Patient Safety Indicator Algorithms and Groupings." Based on expert consensus panels, McKesson Health Solutions included this indicator in its CareEnhance Resource Management Systems, Quality Profiler Complications Measures Module.

Evidence

We were unable to find evidence on validity from prior studies, which is likely due to the rarity of this diagnosis.

Iatrogenic Pneumothorax

Source. This diagnosis code was proposed by Miller et al.[17] as one component of a broader indicator ("iatrogenic conditions") in the "Patient Safety Indicator Algorithms and Groupings." It was also included as one component of a broader indicator ("adverse events and iatrogenic complications") in AHRQ's Version 1.3 HCUP Quality Indicators.

Evidence

We were unable to find evidence on validity from prior studies, which is probably because this diagnosis code was introduced in 1994.

Infection Due to Medical Care

Source. This indicator was originally proposed by Iezzoni et al. as part of the Complications Screening Program (CSP 11, "miscellaneous complications"). Their definition also includes other specified and unspecified complications of procedures or medical care, air embolism, persistent postoperative fistula, minor transfusion reactions, and an array of external cause of injury codes representing various "misadventures" and "abnormal reaction of patient" during medical care, including aspiration (which were omitted from this PSI).[10] The University HealthSystem Consortium adopted the CSP indicator for major (#2933) and minor (#2961) surgery patients. A much narrower definition, including only 999.3 ("other infection after infusion, injection, transfusion, vaccination") was proposed by Miller et al.[17] in the "Patient Safety Indicator Algorithms and Groupings." The American Nurses Association and its state associations have identified the number of laboratory-confirmed bacteremic episodes associated with central lines per critical care patient day as a "nursing-sensitive quality indicator for acute care settings."[140]

Evidence

No evidence on validity is available from CSP studies, because this code was grouped with "miscellaneous complications." Geraci et al.[141] grouped this code with sepsis (see below). Keeler et al.[51] grouped this code with pneumonia and hip joint infection. We were unable to find other evidence on the validity of this indicator.

Postoperative Hemorrhage or Hematoma

Source. This indicator was originally proposed by Iezzoni et al.[10] as part of the Complications Screening Program (CSP 24, "post-procedural hemorrhage or hematoma"), although their definition allowed either procedure (i.e., control of hemorrhage) or diagnosis (i.e., hemorrhage, hematoma, or seroma) codes. By contrast, the current definition requires either a hemorrhage diagnosis with an associated procedure to control that hemorrhage, or a hematoma diagnosis with an associated procedure to drain that hematoma. The University HealthSystem Consortium adopted the CSP indicator for medical (#2804), cardiac procedure (#2912), and major surgery (#2947) patients. It was also included as one component of a broader indicator ("adverse events and iatrogenic complications") in AHRQ's original HCUP Quality Indicators.[144]

Evidence

Coding validity. The original CSP definition had a relatively high confirmation rate among major surgical cases in the FY1994 Medicare inpatient claims files from California and Connecticut (83% by coders' review, 57% by physicians' review, 52% by nurse-abstracted clinical documentation, and 76% if nurses also accepted physicians' notes as adequate documentation). [13-15] Its confirmation rate was moderate among medical cases (49% by coders' review, 55% by physicians' review, 29% by nurse-abstracted clinical documentation, and 65% if nurses also accepted physicians' notes), partially because some cases were present at admission. An earlier study of elderly Medicare beneficiaries from Massachusetts, Alabama, Iowa, and New York in FY1993 revealed poorer confirmation rates of 34% (35/104) among major surgical cases (of whom 17 or 49% lacked laboratory or clinical evidence of significant blood loss) and 28% (24/85) among medical cases (of whom 10 or 42% lacked laboratory or clinical evidence of significant blood loss).[145]

Among 185 total knee replacement patients from 5 Ontario hospitals in 1984-90, Hawker et al.[146] found that the sensitivity and predictive value of hemorrhage codes (definition not given) were 57% (8/14) and 80% (8/10), respectively. Faciszewski et al.[147] aggregated postoperative hemorrhage or hematoma (998.1) with wound dehiscence (998.3), and reported a pooled confirmation rate of 17% (1/6) with 3% (1/34) sensitivity of coding among 310 patients who underwent spinal fusion at the Marshfield Clinic in 1991-92 (given an unusually broad clinical definition of these wound complications). Romano et al.[93] identified 6 of 16 episodes of hemorrhage or hematoma (998.1) using discharge abstracts of diskectomy patients at 30 California hospitals in 1990-91; there were no false positives.

At least two studies have estimated the validity of hemorrhage codes using a gold standard based on transfusion "requirement." Hartz and Kuhn identified only 146 of 568 (26%) episodes of bleeding (defined as requiring return to surgery or transfusion of at

least 6 units of blood products) by applying this indicator (998.1) to Medicare patients who underwent coronary artery bypass surgery in Wisconsin in 1990-91; the predictive value was 75% (146/195).[66] In comparison with the VA's National Surgical Quality Improvement Program database from 123 hospitals in 1994-95, in which hemorrhage is defined by transfusion of at least four units of blood products within 30 days after surgery, the ICD-9-CM diagnosis (998.1) had a sensitivity of 13% and a predictive value of 10%.[148]

Construct validity. Explicit process of care failures in the CSP validation study were relatively frequent among major surgical cases with CSP 24, but not among medical cases (66% and 13%, respectively), after excluding patients who had hemorrhage or hematoma at admission.[16] Cases flagged on this indicator and unflagged controls did not differ significantly on a composite of 17 generic process criteria. Similarly, cases flagged on this indicator and unflagged controls did not differ significantly on a composite of 4 specific process criteria for major surgical cases and 2 specific process criteria for medical cases in the earlier study of elderly Medicare beneficiaries from Massachusetts, Alabama, Iowa, and New York.[145] Physician reviewers identified potential quality problems in 37% of major surgery patients and 31% of medical patients with CSP 24 (versus 2% of unflagged controls for each risk group).[15]

Postoperative Hip Fracture

Source. This indicator was originally proposed by Iezzoni et al.[10] as part of the CSP (CSP 25, "in-hospital hip fracture or fall"). Their definition also includes any documented fall, based on external cause of injury codes, which was omitted from this PSI. Needleman and Buerhaus [137] considered in-hospital hip fracture as an "Outcome Potentially Sensitive to Nursing," based on input from their Technical Expert Panel, but discarded it because the "event rate was too low to be useful." The American Nurses Association, its state associations, and the California Nursing Outcomes Coalition have identified the number of patient falls leading to injury per 1,000 patient days (based on clinical data collection) as a "nursing-sensitive quality indicator for acute care settings."[140]

Evidence

Coding validity. The original CSP definition had an adequate confirmation rate among major surgical cases in the FY1994 Medicare inpatient claims files from California and Connecticut (57% by coders' review, 71% by physicians' review), but a very poor confirmation rate among medical cases (11% by both coders' and physicians' review).[13, 15] This problem was attributable to the fact that most hip fractures among medical inpatients were actually comorbid diagnoses present at admission rather than complications of hospital care. Nurse reviews were not performed.

Construct validity. Explicit process of care failures in the CSP validation study were relatively frequent among cases with CSP 25 (76% of major surgery patients, 54% of medical patients), after excluding patients who had hip fractures at admission, but unflagged controls were not evaluated on the same criteria.[16] Physician reviewers identified potential quality problems in 24% of major surgery patients and 5% of medical patients with CSP 25 (versus 2% of unflagged controls for each risk group).[15]

Postoperative Physiologic and Metabolic Derangements

Source. This indicator was originally proposed by Iezzoni et al.[10] as part of the CSP (CSP 20, "postoperative physiologic and metabolic derangements"). Their definition also includes (non-diabetic) hypoglycemic coma (251.0), postoperative shock (998.0), and oliguria/anuria (788.5), which were omitted from this PSI, but it excludes several codes that were included in this PSI, namely, diabetes with hyperosmolarity, diabetes with other (hypoglycemic) coma, and acute renal failure. The University HealthSystem Consortium adopted the CSP indicator for major surgery patients (#2945). Needleman and Buerhaus[137] identified postoperative physiologic/metabolic derangement as an "Outcome Potentially Sensitive to Nursing," but they added fluid and electrolyte disorders (276) to the original CSP 20. Hannan et al. had earlier focused an analogous indicator exclusively on those fluid and electrolyte disorders.[139]

Evidence

Coding validity. No evidence on validity is available from CSP studies. Geraci et al.[141] confirmed (by serum chemistry) only 5 of 15 (33%) episodes of acute renal failure (584, 586) and 12 of 34 (35%) episodes of hypoglycemia (E932.3, 251.0, 251.2, 962.3) reported on discharge abstracts of VA patients hospitalized in 1987-89 for CHF, COPD, or diabetes. The sensitivity for a 2.0 mg/dL or greater increase in serum creatinine was 28% (5/18), while the sensitivity for symptomatic diabetic hypoglycemia less than 70 mg/dL was 16% (12/76). Romano et al.[93] identified 2 of 2 episodes of acute renal failure or hypoglycemia (251.0, 251.2, E932.3, 584.x) using discharge abstracts of diskectomy patients at 30 California hospitals in 1990-91; there were no false positives. In comparison with the VA's National Surgical Quality Improvement Program database from 123 hospitals in 1994-95, in which acute renal failure is defined as requiring dialysis within 30 days after surgery, ICD-9-CM diagnoses (585 or 788.5) had a sensitivity of 8% and a predictive value of 4%.[148]

Construct validity. Based on two-stage review of 8,109 randomly selected deaths from 104 New York hospitals in 1985-86, Hannan et al.[139] reported that cases with a secondary diagnosis of fluid and electrolyte disorders were no more likely to have received care that departed from professionally recognized standards than cases without that code (2.2% versus 1.7%, OR=1.13), after adjusting for patient demographic, geographic, and hospital characteristics. However, these ICD-9-CM codes were omitted from the accepted AHRQ PSI. Needleman and Buerhaus[137] found that nurse staffing was independent of the occurrence of metabolic derangement among major surgery patients from 799 hospitals in 11 states in 1997.

Postoperative Pulmonary Embolism or Deep Vein Thrombosis

Source. This indicator was originally proposed by Iezzoni et al.[10] as part of the CSP (CSP 22, "venous thrombosis and pulmonary embolism"), although their definition was slightly narrower. It was one of AHRQ's original HCUP Quality Indicators[144] for major surgery and invasive vascular procedure patients. Needleman and Buerhaus[137] identified DVT/PE as an "Outcome Potentially Sensitive to Nursing," using the same CSP definition. The Health Care Financing Administration (now CMS) selected "venous thrombosis or pulmonary embolism following selected inpatient surgical procedures" as

one of its surveillance measures of Medicare quality of care.[149] A code introduced in 1995 (415.11) that maps to this indicator in the final AHRQ PSI was proposed by Miller et al.[17] as one component of a broader indicator ("iatrogenic conditions") in the "Patient Safety Indicator Algorithms and Groupings."

Evidence

Coding validity. CSP 22 had a moderately high confirmation rate among major surgical cases in the FY1994 Medicare inpatient claims files from California and Connecticut (59% by coders' review, 70% by physicians' review, 60% by nurse-abstracted clinical documentation, and 68% if nurses also accepted physicians' notes as adequate documentation). Its confirmation rate among medical cases was poor (32% by coders' review, 28% by physicians' review, 32% by nurse-abstracted clinical documentation, and 39% if nurses also accepted physicians' notes as adequate documentation) because many cases were present at admission.[13-15]

Geraci et al.[34] confirmed only 1 of 6 episodes of DVT (451.1x) or PE (415.1) reported on discharge abstracts of Veterans Affairs (VA) patients hospitalized in 1987-89 for CHF, COPD, or diabetes; the sensitivity was 100% (1/1). Among Medicare hip fracture patients from 297 hospitals in 1985-86, by contrast, Keeler et al.[51] confirmed 11 of 20 (88%) reported PE cases, and failed to ascertain just 6 cases (65% sensitivity) using ICD-9-CM codes. For DVT (451.x, 453.x, 997.2), they found just 1 of 6 cases using ICD-9-CM codes (but no false positive codes). Among 185 total knee replacement patients from 5 Ontario hospitals in 1984-90, Hawker et al.[146] found that the sensitivity and predictive value of DVT codes (definition not given) were 50% (4/8) and 100%, respectively. Romano et al.[93] identified 5 of 6 episodes of thromboembolic disease (415.1x, 451.1x, 451.2, 451.8x, 451.9, 453.2, 453.8, 453.9) using discharge abstracts of diskectomy patients at 30 California hospitals; there was one false positive. In comparison with the VA's National Surgical Quality Improvement Program database from 123 hospitals in 1994-95, the ICD-9-CM diagnosis of PE (415.1) had a sensitivity of 49% and a predictive value of 48% for PE within 30 days after surgery.[148] Although Best et al. also reported on the ability to use administrative data to find cases of DVT, their results cannot be interpreted due to misapplication of ICD-9-CM.

Other studies using the California patient discharge data set have demonstrated that ICD-9-CM codes for DVT and PE have high predictive value when listed as the principal diagnosis for readmissions after major orthopedic surgery (i.e., 17/17 or 100%) or after inferior vena cava filter placement (i.e., 64/65 or 98%).[150] However, these findings do not directly address the validity of DVT/PE as a secondary diagnosis among patients treated by anticoagulation.

Construct validity. Explicit process of care failures in the CSP validation study were relatively frequent among both major surgical and medical cases with CSP 22 (72% and 69%, respectively), after disqualifying cases in which DVT/PE was actually present at admission.[16] Major surgical cases flagged on this indicator and unflagged controls differed marginally (11% versus 4%, p=0.09) on a composite of 17 generic process criteria; medical cases and controls were not evaluated on the same criteria. Physician reviewers identified potential quality problems in 50% of major surgery patients and 20% of medical patients with CSP 22 (versus 2% of unflagged controls for each risk group).[15]

Needleman and Buerhaus[137] found that nurse staffing was independent of the occurrence of DVT/PE among both major surgical or medical patients from 799 hospitals in 11 states in 1997. However, Kovner and Gergen reported that among 506 community hospitals in the 1993 NIS, having more registered nurse hours and non-RN hours per adjusted patient day were both associated with a lower rate of DVT/PE after major surgery.[126] Nurse staffing was not associated with the rate of DVT/PE after invasive vascular procedures.

Postoperative Respiratory Failure

Source. This indicator was originally proposed by Iezzoni et al.[10] as part of the CSP (CSP 3, "postoperative pulmonary compromise"). Their broader definition also includes not just respiratory failure, but also pulmonary congestion, other (or postoperative) pulmonary insufficiency, and acute pulmonary edema, which were omitted from this PSI. The University HealthSystem Consortium (#2927) and AHRQ's original HCUP Quality Indicators[144] adopted the CSP indicator for major surgery patients. Needleman and Buerhaus[137] identified postoperative pulmonary failure as an "Outcome Potentially Sensitive to Nursing," using the original CSP definition.

Evidence

Coding validity. CSP 3 had a relatively high confirmation rate among major surgical cases in the FY1994 Medicare inpatient claims files from California and Connecticut (72% by coders' review, 75% by physicians' review).[13, 15] Nurse reviews were not performed. An earlier study of elderly Medicare beneficiaries from Massachusetts, Alabama, Iowa, and New York in FY1993 revealed a similarly high confirmation rate of 72% (66/92) among major surgical cases, although 27% of those patients (18/66) had inadequate clinical documentation of the diagnosis.[145]

Geraci et al.[34] confirmed 1 of 2 episodes of respiratory failure (518.81, 518.82) reported on discharge abstracts of VA patients hospitalized in 1987-89 for CHF or diabetes; the sensitivity for respiratory decompensation requiring mechanical ventilation was 25% (1/4). Best et al.[148] reported on the ability to use administrative data to find cases of "unplanned intubation," but their results cannot be interpreted due to misapplication of ICD-9-CM.

Construct validity. Explicit process of care failures in the CSP validation study were slightly but not significantly more frequent among major surgical cases with CSP 3 than among unflagged controls (52% versus 46%).[16] Indeed, cases flagged on this indicator were significantly **less** likely than unflagged controls (24% versus 64%) to have at least one of four specific process-of-care problems in the earlier study of elderly Medicare beneficiaries from Massachusetts, Alabama, Iowa, and New York.[145] Physician reviewers identified potential quality problems in 20% of major surgery patients with CSP 3 (versus 2% of unflagged controls).[15]

Needleman and Buerhaus[137] found that nurse staffing was independent of the occurrence of pulmonary failure among major surgery patients from 799 hospitals in 11 states in 1997. However, Kovner and Gergen reported that among 506 community hospitals in the 1993 NIS, having more registered nurse hours per adjusted patient day was associated with a lower rate of "pulmonary compromise" after major surgery.[126]

Postoperative Sepsis

Source. This indicator was originally proposed by Iezzoni et al.[10] as part of the Complications Screening Program (CSP 7, "septicemia"), although their definition also includes unspecified bacteremia, which was omitted from this PSI. Needleman and Buerhaus [137] identified sepsis as an "Outcome Potentially Sensitive to Nursing," using the same CSP definition.

Evidence

Coding validity. No evidence on validity is available from CSP studies. Barbour[151] reported that only 38% (53/141) of discharge abstracts from 5 VA medical centers in 1990 with a diagnosis of sepsis (038.x) actually had hospital-acquired sepsis. However, this review was not limited to cases with a *secondary* diagnosis of sepsis, and sensitivity could not be evaluated. Massanari et al.[152] identified 79% of cases of "nosocomial bacteremia" using 1984 hospital discharge data from the University of Iowa, but no definitions were provided. Geraci et al.[34] confirmed (by blood culture) only 2 of 15 episodes of sepsis or "other infection" (038.x, 999.3) reported on discharge abstracts of VA patients hospitalized in 1987-89 for CHF, COPD, or diabetes; the sensitivity for a positive blood culture was 50% (2/4). Romano et al.[93] identified 2 of 3 episodes of sepsis or bacteremia (038.x, 707.0) using discharge abstracts of diskectomy patients at 30 California hospitals in 1990-91; there were no false positives. Belio-Blasco et al.[153] reported that "discharge forms" had a sensitivity of 18% (7/39) and a specificity of 100% for identifying nosocomial bacteremia among surgical patients in a Spanish teaching hospital. In comparison with the VA's National Surgical Quality Improvement Program database from 123 hospitals in 1994-95, in which "systemic sepsis" is defined by a positive blood culture and systemic manifestations of sepsis within 30 days after surgery, the ICD-9-CM diagnosis (038.x) had a sensitivity of 37% and a predictive value of 30%.[148]

Construct validity. Needleman and Buerhaus [137] found that nurse staffing was independent of the occurrence of sepsis among both major surgical or medical patients from 799 hospitals in 11 states in 1997.

Postoperative Wound Dehiscence

Source. An indicator on this topic (998.3) was originally proposed by Hannan et al. to target "cases that would have a higher percentage of quality of care problems than cases without the criterion, as judged by medical record review."[139] The same code was also included as one component of a broader indicator ("adverse events and iatrogenic complications") in AHRQ's original HCUP Quality Indicators.[144] Iezzoni et al.[10] identified an associated procedure code for reclosure of an abdominal wall dehiscence (54.61), and included both codes in the CSP (CSP "sentinel events" and CSP 9, "reopening of surgical site," respectively). Miller et al.[17] suggested the use of both codes (as "wound disruption") in the original "AHRQ PSI Algorithms and Groupings."

Evidence

Coding validity. No evidence on validity is available from CSP studies. Among 185 total knee replacement patients from 5 Ontario hospitals in 1984-90, Hawker et al.[146]

found that the sensitivity and predictive value of 998.3 were both 100% (4/4). Faciszewski et al.[147] aggregated wound dehiscence (998.3) with postoperative hemorrhage or hematoma (998.1), and reported a pooled confirmation rate of 17% (1/6) with 3% (1/34) sensitivity of coding among 310 patients who underwent spinal fusion at the Marshfield Clinic in 1991-92 (given an unusually broad clinical definition of these wound complications). In comparison with the VA's National Surgical Quality Improvement Program database from 123 hospitals in 1994-95, in which dehiscence is defined as fascial disruption within 30 days after surgery, the ICD-9-CM diagnosis of wound dehiscence (998.3) had a sensitivity of 25% and a predictive value of 23%.[148] This code (998.3) was ultimately removed from the accepted PSI because our clinical panel was concerned that the ICD-9-CM definition was too broad and failed to distinguish skin from fascial separation.

Construct validity. Based on two-stage review of 8,109 randomly selected deaths from 104 New York hospitals in 1985-86, Hannan et al.[139] reported that cases with a secondary diagnosis of 998.3 (wound disruption) were 3.0 times more likely to have received care that departed from professionally recognized standards than cases without that code (4.3% versus 1.7%), after adjusting for patient demographic, geographic, and hospital characteristics. In 3 of these 7 cases (44%) of substandard care, the patient's death was attributed at least partially to that care. However, this code was removed from the accepted PSI after discussions with our clinical panel.

Technical Difficulty With Procedure

Source. This indicator was originally proposed by Iezzoni et al.[10] as part of the CSP, although unlike the final PSI, its codes were split between two CSP indicators (CSP 27, "technical difficulty with medical care," and "sentinel events"). The latter indicator also includes gas gangrene, CNS abscess, anoxic brain injury, foreign body left in, wound dehiscence, and ABO/Rh transfusion reactions, all of which were omitted from this PSI. The former indicator also includes failure of sterile precautions, mechanical failure of instrument or apparatus, and "contaminated or infected blood, other fluid, drug," etc, although these codes were not included in the final definition of this PSI. It was also included as one component of a broader indicator ("adverse events and iatrogenic complications") in AHRQ's original HCUP Quality Indicators.[144] The University HealthSystem Consortium adopted CSP 27 as an indicator for medical (#2806) and major surgery (#2956) patients. Miller et al. [17] also split this set of ICD-9-CM codes into two broader indicators ("miscellaneous misadventures" and "E codes") in the original "AHRQ PSI Algorithms and Groupings." Based on expert consensus panels, McKesson Health Solutions included one component of this PSI (998.2, "Accidental Puncture or Laceration") in its CareEnhance Resource Management Systems, Quality Profiler Complications Measures Module.

Evidence

Coding validity. No evidence on validity is available from CSP studies. A study of laparoscopic cholecystectomy in 18 Ontario hospitals in 1991-95[154] found that 95% (99/104) of patients with an ICD-9 code of 998.2 or E870.0 had a confirmed injury to the bile duct or gallbladder. However, only 27% had a clinically significant injury that required any intervention; sensitivity of reporting was not evaluated. A similar study of

all cholecystectomies performed in Western Australia between 1988 and 1994 reported that these two ICD-9 codes had a sensitivity of 40% (19/48) and a predictive value of 23% (19/84) in identifying bile duct injuries.[155] Among 185 total knee replacement patients from 5 Ontario hospitals in 1984-90, Hawker et al.[146] found that the sensitivity and predictive value of codes describing "miscellaneous mishaps during or as a direct result of surgery" (definition not given) were 86% (6/7) and 55% (6/11), respectively. Romano et al.[93] identified 19 of 45 episodes of accidental puncture or laceration (998.2, E870.0, or related procedure) using discharge abstracts of diskectomy patients at 30 California hospitals in 1990-91; there was one false positive.

Transfusion Reaction

Source. This indicator was originally proposed by Iezzoni et al.[10] as part of the Complications Screening Program (CSP "sentinel events"), along with gas gangrene, CNS abscess, anoxic brain injury, accidental puncture or laceration, wound dehiscence, and foreign body left in (all of which were omitted from this PSI). It was also included as one component of a broader indicator ("adverse events and iatrogenic complications") in AHRQ's original HCUP Quality Indicators.[144] It was proposed by Miller et al. [17] in the original "AHRQ PSI Algorithms and Groupings," although their definition also includes minor transfusion reactions (999.8), which was omitted from this PSI.

Evidence

We were unable to find evidence on validity from prior studies, most likely because this complication is quite rare.

Accepted Obstetric Indicators

Birth Trauma – Injury to Neonate

Source. This indicator has been widely used in the obstetric community, although it is most commonly based on chart review rather than administrative data. It was proposed by Miller et al.[17] in the original "AHRQ PSI Algorithms and Groupings," although their definition also includes injury to the brachial plexus (767.6), which was excluded from this PSI. Based on expert consensus panels, McKesson Health Solutions included a broader version of this indicator (767.xx) in its CareEnhance Resource Management Systems, Quality Profiler Complications Measures Module.

Evidence

Coding validity. A study of 669 newborns at Georgetown University Hospital who had a discharge diagnosis of birth trauma (codes not specified) found that only 25% (164/669) had sustained a significant injury to the head, neck, or shoulder.[156] The remaining patients either had superficial injuries or injuries inferior to the neck. We were unable to find other evidence on the validity of this indicator. Towner et al. linked California maternal and infant discharge abstracts from 1992 through 1994, but they used only infant discharge abstracts to describe the incidence of neonatal intracranial injury, and they did not report the extent of agreement between the two data sets.[157]

Obstetric Trauma (All Delivery Types)

Source. An overlapping subset of this indicator (third or fourth-degree perineal laceration [664.2x-664.3x]) has been adopted by the Joint Commission for the Accreditation of Healthcare Organizations (JCAHO) as a core performance measure for "pregnancy and related conditions" (PR-25). (The JCAHO indicator was less preferred by the clinical panelists than a definition restricted to fourth degree lacerations, so the JCAHO definition was retained for exploration as an Experimental indicator.) Based on expert consensus panels, McKesson Health Solutions included the JCAHO indicator in its CareEnhance Resource Management Systems, Quality Profiler Complications Measures Module. Fourth degree laceration (664.3x), one of the codes mapped to this PSI, was included as one component of a broader indicator ("obstetrical complications") in AHRQ's original HCUP Quality Indicators.[144]

Evidence

Coding validity. In a stratified probability sample of 1,611 vaginal and cesarean deliveries from 51 California hospitals in 1992-93, the weighted sensitivity and predictive value of coding for third and fourth degree lacerations and vulvar/perineal hematomas (based on either diagnosis or procedure codes) were 89% (311/340) and 90% (311/337), respectively.[158] The authors did not report coding validity for third and fourth degree lacerations separately. We were unable to find other evidence on validity from prior studies.

Experimental Indicators

Aspiration Pneumonia

Source. This indicator was originally proposed by Iezzoni et al.[10] as part of the CSP (CSP 2, "aspiration pneumonia"). Needleman and Buerhaus[137] identified postoperative pneumonia as an "Outcome Potentially Sensitive to Nursing," but their definition aggregated bacterial, aspiration (507.0), and "hypostatic" (514) pneumonia. The University HealthSystem Consortium adopted the CSP indicator for major surgery patients (#2924).

Evidence

Coding validity. CSP 2 had a moderate confirmation rate among major surgical cases in the FY1994 Medicare inpatient claims files from California and Connecticut (77% by coders' review, 59% by physicians' review, 50% by nurse-abstracted clinical documentation, and 85% if nurses also accepted physicians' notes as adequate documentation).[13-15] Geraci et al.[34] confirmed (by chest radiography) 0 of 7 episodes of aspiration pneumonia (482.9, 507.0) reported on discharge abstracts of VA patients hospitalized in 1987-89 for CHF, COPD, or diabetes; the sensitivity for a new alveolar infiltrate was 0% (0/5).

Construct validity. Explicit process of care failures in the CSP validation study were relatively frequent among major surgical cases with CSP 2 (69%), after excluding two patients who had aspiration pneumonia at admission.[16] Cases flagged on this indicator and unflagged controls did not differ significantly on a composite of 17 generic

process criteria. Physician reviewers identified potential quality problems in 21% of major surgery patients with CSP 2 (versus 2% of unflagged controls).[15]

Needleman and Buerhaus[137] found that higher registered nurse staffing (RN hours/adjusted patient day) and better nursing skill mix (RN hours/licensed nurse hours) were consistently associated with the occurrence of pneumonia (including aspiration and "hypostatic" pneumonia) among medical patients from 799 hospitals in 11 states in 1997. An increase from the 25th to the 75th percentile on these two measures of staffing was associated with 2.7% (95% CI, -0.4% to 5.8%) and 6.4% (95% CI, 2.8% to 10.0%) decreases, respectively, in the rate of pneumonia.[159] Skill mix was "weakly" associated with the rate of pneumonia among major surgical patients. Nursing skill mix was significantly associated (in the expected direction) with the pneumonia rate among 352 and 295 California hospitals in 1992 and 1994, respectively, but not among 126 and 131 New York hospitals in the same years.[138] Total licensed nurse hours per acuity-adjusted patient day were not associated with the pneumonia rate, except in California in 1994, where the association was actually positive.

CABG Following PTCA

Source. This indicator was developed by the University HealthSystem Consortium (#2906) to identify patients who experienced a complication of PTCA that required urgent surgical repair. This indicator has been used in several studies of PTCA outcomes and the relationship between volume and outcome.[127-135]

Evidence

We were unable to find evidence on validity from prior studies, except insofar as higher hospital angioplasty volume has consistently been associated with lower risk of CABG following PTCA.[127-135] Physician volume generally has an independent effect on the risk of CABG following PTCA, confirming that this measure is sensitive to operator experience and skill,[132-135] although some recent data suggest that this effect may disappear at high-volume hospitals.[160] One study involving Medicare inpatient claims from 1987 through 1990 also showed that CABG following PTCA was slightly less frequent at hospitals with "major" medical school affiliations than at other hospitals.[131]

Decubitus Ulcer in High-Risk Patients

Source. This variation of Accepted PSI "Decubitus ulcer" was designed in response to concerns that the accepted indicator excludes the subset of patients at highest risk of developing pressure ulcers if they receive inadequate care in the hospital. It differs from Accepted PSI "Decubitus Ulcer" in that the denominator population is limited to patients with hemiplegia, paraplegia, or quadriplegia, and patients admitted from long term care facilities. The American Nurses Association, its state associations, and the California Nursing Outcomes Coalition have identified the total prevalence of inpatients with Stage I, II, III, or IV pressure ulcers (based on clinical data collection) as a "nursing-sensitive quality indicator for acute care settings."[140]

Evidence

We were unable to find evidence on validity from prior studies, but this is simply a modified version of an indicator on the accepted list. Validity may be lower in this setting, if a substantial proportion of pressure sores are pre-existing, but may be higher if these patients are especially sensitive to the effects of suboptimal nursing care.

In-Hospital Fractures Possibly Related to Falls

Source. This indicator was developed by our clinical panels, based on Accepted indicator "Postoperative hip fracture." Needleman and Buerhaus [137] considered in-hospital fall or fracture as an "Outcome Potentially Sensitive to Nursing," based on input from their Technical Expert Panel, but discarded it because the "event rate was too low to be useful." The American Nurses Association, its state associations, and the California Nursing Outcomes Coalition have identified the number of patient falls leading to injury per 1,000 patient days (based on clinical data collection) as a "nursing-sensitive quality indicator for acute care settings."[140]

Evidence

Coding validity. Among 185 total knee replacement patients from 5 Ontario hospitals in 1984-90, Hawker et al.[146] found that the sensitivity and predictive value of "fall and fracture" codes (definition not given) were 80% (4/5) and 100%, respectively. We were unable to find other evidence for this indicator.

Intraoperative Nerve Compression Injuries

Source. A subset of this indicator (brachial plexus lesions [353.0]) was originally proposed by Iezzoni et al.[10] as part of the CSP (CSP 13, "postoperative complications relating to central or peripheral nervous system"). The University HealthSystem Consortium adopted this CSP indicator for major surgery patients (#2934). However, this indicator was extensively revised after discussions with our clinical panels.

Evidence

We were unable to find evidence on validity from prior studies, because this complication is quite rare. Best et al.[148] reported on the ability to use administrative data to find cases of "other neurologic" (including peripheral nerve) deficits, but their results cannot be interpreted due to misapplication of ICD-9-CM.

Malignant Hyperthermia

Source. This indicator was created after review of ICD-9-CM codes, and discussions with our clinical panel.

Evidence

We were unable to find evidence on validity from prior studies, because this diagnosis code was introduced in 1998.

Postoperative Acute Myocardial Infarction

Source. This indicator was originally proposed by Iezzoni et al.[10] as part of the CSP (CSP 14, "postoperative acute myocardial infarction"). The University HealthSystem Consortium (#2935) and AHRQ's original HCUP Quality Indicators[144] adopted this CSP indicator for major surgery patients.

Evidence

Coding validity. CSP 14 had a high confirmation rate among major surgical cases in the FY1994 Medicare inpatient claims files from California and Connecticut (84% by coders' review, 95% by physicians' review, 81% by nurse-abstracted clinical documentation, and 89% if nurses also accepted physicians' notes as adequate documentation).[13-15] An earlier study of elderly Medicare beneficiaries from Massachusetts, Alabama, Iowa, and New York in FY1993 revealed a similarly high confirmation rate of 84% (69/82) among major surgical cases, although 39% of those patients (27/69) had neither electrocardiographic nor enzyme evidence supporting the diagnosis.[145]

Geraci et al.[141] identified 0 of 3 AMI episodes (410.x1) using the discharge abstracts of VA patients hospitalized in 1987-89 for CHF, COPD, or diabetes. In comparison with the VA's National Surgical Quality Improvement Program database from 123 hospitals in 1994-95, the ICD-9-CM diagnosis of AMI (410.xx) had a sensitivity of 58% and a predictive value of 47% for Q-wave infarctions within 30 days after surgery.[148?] By contrast, the 1985 National DRG Validation Study suggested that the sensitivity of ICD-9-CM 410.xx exceeds 75%, even when it is coded as a secondary diagnosis (n=67) rather than as the reason for admission.[161]

Construct validity. Explicit process of care failures in the CSP validation study were only moderately frequent among major surgical cases with CSP 14 (46%).[16] Cases flagged by this indicator and unflagged controls differed significantly ($p<0.02$) on a composite of 17 generic process criteria, but the latter group actually demonstrated worse performance. Similarly, cases flagged on this indicator were significantly less likely than unflagged controls (29% versus 57%) to have at least one of seven specific process-of-care problems in the earlier study of elderly Medicare beneficiaries from Massachusetts, Alabama, Iowa, and New York.[145] Physician reviewers identified potential quality problems in 22% of major surgery patients with CSP 14 (versus 2% of unflagged controls).[15] Kovner and Gergen reported that among 506 community hospitals in the 1993 NIS, having more registered nurses per adjusted patient day was not associated with lower rates of AMI after major surgery.[126]

Postoperative Iatrogenic Complications – Cardiac System

Source. This indicator was originally proposed by Hannan et al. as a criterion for targeting "cases that would have a higher percentage of quality of care problems than cases without the criterion, as judged by medical record review."[139] It was endorsed by Iezzoni et al.[10] as one component of a much broader indicator (CSP 26, "iatrogenic complications") in the CSP. The definition of that indicator includes central nervous system, cardiac, peripheral vascular, respiratory, gastrointestinal, urinary, and unspecified

amputation stump complications, as well as complications affecting other body systems. It was also included as one component of a broader indicator ("adverse events and iatrogenic complications") in AHRQ's original HCUP Quality Indicators.[144] The University HealthSystem Consortium adopted this CSP indicator for cardiac procedure patients (#2913).

Evidence

Coding validity. CSP 26 had a very high confirmation rate among major surgical cases in the FY1994 Medicare inpatient claims files from California and Connecticut (92% by coders' review) and a borderline confirmation rate among medical cases (59% by coders' review).[13] Physician reviews were not performed. Faciszewski et al. [147] confirmed only 20% (2/10) of reported cases of cardiac complications (997.1) among 310 patients who underwent spinal fusion at the Marshfield Clinic in 1991-92. The sensitivity of coding for this complication was 40% (2/5). Among 185 total knee replacement patients from 5 Ontario hospitals in 1984-90, Hawker et al.[146] found that the sensitivity and predictive value of cardiac complication codes (definition not given) were 67% (6/9) and 86% (6/7), respectively. Romano et al. [93] identified 2 of 5 episodes of cardiac complications (with 2 false positives) using discharge abstracts of diskectomy patients at 30 California hospitals in 1990-91.

Construct validity. Explicit process of care failures in the CSP validation study were slightly but not significantly more frequent among cases with CSP 26 (58% surgical, 9% medical) than among unflagged controls (46% surgical, 5% medical). Based on two-stage review of 8,109 randomly selected deaths from 104 New York hospitals in 1985-86, Hannan et al.[139] reported that cases with a secondary diagnosis of 997.1 (cardiac) were 3.4 times more likely to have received care that departed from professionally recognized standards than cases without that code (7.1% versus 1.7%), after adjusting for patient demographic, geographic, and hospital characteristics. In 25 of these 33 cases (76%) of substandard care, the patient's death was attributed at least partially to that care.

Postoperative Iatrogenic Complications – Nervous System

Source. This diagnosis code was originally proposed by Iezzoni et al.[10] as one component of a much broader indicator (CSP 26, "iatrogenic complications"), which was part of the CSP. Their definition includes central nervous system, cardiac, peripheral vascular, respiratory, gastrointestinal, urinary, and unspecified amputation stump complications, as well as complications affecting other body systems. It was also included as one component of a broader indicator ("adverse events and iatrogenic complications") in AHRQ's original HCUP Quality Indicators.[144] The University HealthSystem Consortium adopted this CSP indicator for cardiac procedure patients (#2913).

Evidence

Coding validity. CSP 26 had a very high confirmation rate among major surgical cases in the FY1994 Medicare inpatient claims files from California and Connecticut (92% by coders' review) and a borderline confirmation rate among medical cases (59%

by coders' review).[13] Physician reviews were not performed. Romano et al.[93] identified 1 of 2 episodes of CNS complications (with 4 false positives) using discharge abstracts of diskectomy patients at 30 California hospitals in 1990-91.

Construct validity. Explicit process of care failures in the CSP validation study were slightly but not significantly more frequent among cases with CSP 26 (58% surgical, 9% medical) than among unflagged controls (46% surgical, 5% medical).

Reopening of Surgical Site

Source. This indicator was originally proposed by Iezzoni et al.[10] as part of the CSP (CSP 9, "reopening of surgical site"), although their definition was slightly broader than the proposed PSI (i.e., it includes revision of corrective procedure on heart (35.95) and reclosure of postoperative disruption of the abdominal wall (54.61)). The University HealthSystem Consortium adopted this CSP indicator for major surgery patients (#2930).

Evidence

Coding validity. CSP 9 had a relatively high confirmation rate among major surgical cases in the FY1994 Medicare inpatient claims files from California and Connecticut (97% by coders' review, 61% by physicians' review, 84% by nurse-abstracted clinical documentation).[13-15]

Construct validity. Explicit process of care failures in the CSP validation study were only moderately frequent among major surgical cases with CSP 9 (43%), after excluding one patient who had this complication at admission,[16] but unflagged controls were not evaluated on the same criteria. Physician reviewers identified potential quality problems in 48% of major surgery patients with CSP 9 (versus 2% of unflagged controls).[15]

Suture of Laceration

Source. This indicator was originally proposed by Iezzoni et al.[10] as part of the CSP (CSP 17, "procedure-related perforation or laceration"). Their definition includes diagnosis codes (not included in this PSI) for spontaneous perforation of the esophagus (530.4), intestine (569.83), gallbladder (575.4), or bile duct (576.3), as well as procedure codes for repair of various organ lacerations. It was utilized by Miller et al.[17] in the original "AHRQ PSI Algorithms and Groupings," although their definition added suture of laceration of diaphragm (34.82), small intestine (46.73), and anus (49.71). These additional codes were included in this PSI, along with a few more codes (e.g. laceration of nerve). The University HealthSystem Consortium adopted this CSP indicator for major surgery patients (#2941).

Evidence

Coding validity. This cluster is very similar to CSP 17, which had a relatively high confirmation rate among major surgical cases in the FY1994 Medicare inpatient claims files from California and Connecticut (71% by coders' review, 58% by physicians' review, 69% by nurse-abstracted clinical documentation, and 75% if nurses also accepted physicians' notes as adequate documentation).[13-15] The CSP criteria were not fully successful in excluding pre-admission trauma, but it is not clear which code(s)

accounted for this problem. An earlier study of elderly Medicare beneficiaries from Massachusetts, Alabama, Iowa, and New York in FY1993 revealed a similar confirmation rate of 70% (65/93) among major surgical cases, although 18% of those patients (12/65) lacked clear physical examination evidence of the diagnosis.[145]

Construct validity. Physician reviewers identified potential quality problems in 36% of major surgery patients with CSP 17 (versus 2% of unflagged controls).[15] In the New York SID from 1997, nursing expertise (full-time and part-time RNs as a proportion of all licensed nurses) below the statewide median level was associated with a higher unadjusted rate of this indicator (24 versus 15 events per 10,000 discharges).[17]

Experimental Obstetric Indicators

Obstetric Wound Complications – Cesarean Delivery

Source. Disruption of a cesarean wound (674.1x) was proposed by Miller et al.[17] as part of a broader indicator ("obstetrical misadventures") in the original "AHRQ PSI Algorithms and Groupings." It was also included as one component of a broader indicator ("obstetrical complications") in AHRQ's original HCUP Quality Indicators.[144]

Evidence

Coding validity. Weiss et al.[162] reviewed 636 deliveries in Massachusetts hospitals in 1990-97 reported to have had cesarean wound disruption (674.1x), and found that 29% (179/636) were actually uterine ruptures before or during labor. Therefore, the maximum possible predictive value of this diagnosis was 71%. In a stratified probability sample of 1,611 vaginal and cesarean deliveries from 51 California hospitals in 1992-93, the sensitivity and predictive value of wound disruption, hematoma, or infection (based on either diagnosis or procedure codes) were 27% and 91%, respectively.[163] We were unable to find other evidence on validity from prior studies.

Obstetric Wound Complications – Vaginal Delivery

Source. This variation of the above PSI was designed as a "sister" measure for vaginal deliveries, based on review of ICD-9-CM codes and discussions with the clinical panel. Perineal wound disruption (674.2x), one of the codes mapped to this PSI, was also included as one component of a broader indicator ("obstetrical complications") in AHRQ's original HCUP Quality Indicators.

Evidence

Coding validity. In a stratified probability sample of 1,611 vaginal and cesarean deliveries from 51 California hospitals in 1992-93, the weighted sensitivity and predictive value of wound disruption, hematoma, or infection (based on either diagnosis or procedure codes) were 27% (18/37) and 91% (18/21), respectively.[163] We were unable to find other evidence on validity from prior studies.

Other Obstetric Complications

Source. These diagnosis codes were proposed by Miller et al. [17] as part of a broader indicator ("obstetrical misadventures") in the original "AHRQ PSI Algorithms and Groupings." They include codes 668.x and 669.x (pulmonary, cardiac, and central nervous system complications, other specified and unspecified complications of anesthesia or sedation, shock and other major complications of obstetric procedures, acute postpartum renal failure). All of the codes mapped to this PSI were included as part of a broader indicator ("obstetrical complications") in AHRQ's original HCUP Quality Indicators.[144]

Evidence

Coding validity. In a stratified probability sample of 1,611 vaginal and cesarean deliveries from 51 California hospitals in 1992-93, the weighted sensitivity and predictive value of coding for cardiac (668.1x, 995.4) and pulmonary (668.2x) complications of obstetric anesthesia or analgesia were 24% (8/16) and 97% (8/9), respectively.[163] The authors did not report coding validity for the other components of this PSI. We were unable to find other evidence on validity from prior studies.

Postpartum Urinary Tract Infection

Source. This indicator was created after review of ICD-9-CM codes and discussions with the clinical panel. The definition is specific to "infections of the genitourinary tract" that are labeled as postpartum complications, although some of these infections may have originated in the antepartum period.

Evidence

Coding validity. In a stratified probability sample of 1,611 vaginal and cesarean deliveries from 51 California hospitals in 1992-93, the weighted sensitivity and predictive value of postpartum urinary tract infection were 20% (5/13) and 41% (5/8), respectively.[163] We were unable to find other evidence on validity from prior studies, because this indicator has not previously been used as a measure of quality.

Third or Fourth Degree Obstetric Lacerations

Source. This indicator has been adopted by the JCAHO as a core performance measure for "pregnancy and related conditions" (PR-25). A revised version of this indicator, based on input from our clinical panel, qualified as Accepted indicators, "Obstetric trauma."

Evidence

Coding validity. In a stratified probability sample of 1,611 deliveries from 51 California hospitals in 1992-93, the weighted sensitivity and predictive value of coding for third and fourth degree lacerations and vulvar/perineal hematomas (based on either diagnosis or procedure codes) were 89% (311/340) and 90% (311/337), respectively.[158]

The authors did not report coding validity for third and fourth degree lacerations separately. We were unable to find other evidence on validity from prior studies.

Uterine Rupture

Source. This indicator has been widely used for monitoring the impact of vaginal birth after cesarean delivery, which is associated with an increased incidence of uterine rupture.[164, 165]

Evidence

Coding validity. Weiss et al.[162] reviewed 615 deliveries in Massachusetts hospitals in 1990-97 reported to have had uterine rupture before or during labor (665.0x, 665.10, 665.11), and confirmed 51% (306/615). The maximum possible sensitivity was 64% (306/480), because some uterine ruptures were miscoded as cesarean wound disruption (674.1x). We describe this estimate as the "maximum possible sensitivity" because false negatives were only captured if they were miscoded with 674.1.

Construct validity. Although we found no data on how often quality-of-care problems are associated with uterine rupture, Gregory et al. showed that women in California who delivered at hospitals with high attempted VBAC (vaginal birth after cesarean) rates in 1995 were more likely to have successful VBAC, but also more likely to experience uterine rupture, than women who delivered at hospitals with lower VBAC rates. This finding is consistent with the construct that high uterine rupture rates reflect an overly aggressive approach to VBAC. Induction of labor with prostaglandins has been associated with a major increase in the risk of uterine rupture (RR=15.6).[164, 165]

Section 3B. Indicator Selection

Indicator selection consisted of a multi-stage process, shown in Flow Diagram 1. Promising indicators identified from the literature or other sources were assessed for face validity by clinicians through a structured process. The first round specifications of indicators were usually modified to varying extents based on clinical and coding input. Then for each indicator, the revised specification was rated by panelists on a number of dimensions, but most importantly the likely usefulness of the indicator as a screen for potentially preventable complications of care. The usefulness rating provided the primary filter by which indicators were grouped into three categories representing the more promising to less useful indicators — a.) Accepted, b.) Experimental, or c.) Rejected. Table 11 provides a summary of Accepted PSIs and the panel ratings show that these indicators were rated as fairly useful by either practically all of the panelists (Acceptable) or most with minimal dissent from those rating it lower (Acceptable (-)). Table 12 lists the Experimental PSIs, those measures which panelists were less sanguine about than those in the Accepted indicator set or that were more problematic to specify according to the intent of the panel discussion. Each indicator in the Experimental indicator set has some positive characteristics, along with some relatively important potential limitations. Table 13 lists Rejected indicators, indicators that received low ratings by the panelists, and did not merit further exploration. The footnotes to these tables summarize idiosyncratic reasons for the categorization rationale.

Table 11. Accepted Indicators (provider and area level)

Indicator Name	Multi-specialty Panel Evaluation[a]		Surgical Panel Evaluation[a]		Definition Used
Complications of anesthesia			3	Acceptable (-)	Surgical
Death in low mortality DRGs	M2	Acceptable			
Decubitus ulcer	M1	Acceptable			
Failure to rescue	M2	Acceptable			
Foreign body left in during procedure[b]	S2	Acceptable	2	Acceptable (-)	Same
Iatrogenic pneumothorax[b]	P1	Acceptable			
Infection due to medical care[b]	M1	Acceptable (-)			
Postoperative hemorrhage or hematoma[d]	S1	Acceptable (-)	3	Acceptable	Surgical
Postoperative hip fracture[c]	M1	Acceptable			
Postoperative physiologic and metabolic derangements	S3	Acceptable (-)	3	Unclear	Surgical
Postoperative respiratory failure	S2	Unclear	2	Acceptable (-)	Surgical
Postoperative pulmonary embolism or deep venous thrombosis	S1	Acceptable (-)	1	Acceptable	Same
Postoperative sepsis	M1	Acceptable (-)			
Postoperative wound dehiscence[b]	S2	Acceptable (-)	2	Acceptable (-)	Surgical
Technical difficulty with procedure[b]	P1	Acceptable			
Transfusion reaction[b]	S3	Acceptable	3	Acceptable	Same
Birth trauma-injury to neonate	O1	Acceptable			
Obstetric trauma - cesarean section[e]	O1	Acceptable (-)			
Obstetric trauma - vaginal with instrument[e]	O1	Acceptable (-)			
Obstetric trauma - vaginal without instrument[e]	O1	Acceptable (-)			

[a] M, P, O, S refer to Medical, Procedure, Obstetric or Surgery Multi-specialty Panels and their identifying number (see Appendix B for further detail). 1,2,3 refers to the Surgical Panel, if reviewed by Surgical Panel (see Appendix B). "Acceptable" indicates that the indicator was rated as useful by almost all panelists. "Acceptable (-)" indicates that the indicator was rated as useful by most panelists, although a few rated it as less useful (but not as poor). "Unclear" indicates that panelists rated the usefulness of the indicator as moderate. Panel overall ratings are described in detail Clinician Panel Review Methods (Section 2D) under Tabulation of Results subsection.

[b] Provider and area level indicators specified for this indicator.

[c] Panel requested other fractures in addition to hip fracture, but empirical analyses indicated concerns about ability to operationalize well enough for accepted list.

[d] Codes for post-op hemorrhage or hematoma were expanded to include 5th digits in October 1996, and therefore this indicator is invalid before that date.

[e] Obstetric trauma indicators were not rated separately, though panelists were informed that the indicator would be split into three types of delivery.

Table 12. Experimental Indicators

Indicator Name	Multi-specialty Panel Evaluation[a]		Surgical Panel Evaluation[a]		Definition Used
Aspiration pneumonia	S2	Unclear	2	Unclear	Same
CABG after PTCA[b]	P1	Acceptable			
Decubitus ulcer in high risk patients[c]					
In-hospital fractures possibly related to falls[d]	M1	Acceptable			
Intraoperative nerve compression injuries[e]	S3	Acceptable	3	Acceptable	Surgical
Malignant hyperthermia[f]	S3	Acceptable	1	Acceptable (-)	Same
Postoperative acute myocardial infarction[g]	S1	Unclear (-)	3	Acceptable (-)	Surgical
Postoperative iatrogenic complications – cardiac system[h]	P1	Not rated separately			
Postoperative iatrogenic complications – nervous system[h,i]	P1	Not rated separately			
Reopening of surgical site[j]	S2	Unclear	3	Acceptable (-)	Surgical
Suture of laceration[k]	S2	Acceptable	2	Unclear (-)	Surgical
Obstetric wound complications-cesarean section	O2	Acceptable			
Obstetric wound complications-vaginal delivery	O2	Unclear			
Other obstetric complications	O2	Unclear			
Post-partum urinary tract infection	O2	Acceptable (-)			
Third or fourth degree obstetric laceration (JCAHO)[l]					
Uterine rupture[m]					

[a] M, P, O, S refer to Medical, Procedure, Obstetric or Surgery Multi-specialty Panels and their identifying number (see Appendix B for further detail). 1,2,3 refers to the Surgical Panel, if reviewed by Surgical Panel (see Appendix B). "Acceptable" indicates that the indicator was rated as useful by almost all panelists. "Acceptable (-)" indicates that the indicator was rated as useful by most panelists, although a few rated it as less useful (but not as poor). "Unclear" indicates that almost all panelists rated the usefulness of the indicator as moderate.
"Unclear (-)" indicates that most of the panelists rated the usefulness as moderate, although a few rated it as less useful. Panel overall ratings are described in detail Clinician Panel Review Methods (Section 2D) under Tabulation of Results subsection.

[b] Accepted by panel, but lack of review by physicians performing PTCA led to demoting indicator.

[c] Indicator suggested by panel, with concerns, and by AHRQ.

[d] This indicator was defined as closely to the panel suggestion as possible, but empirical analysis showed higher fracture rates in non-elderly men. Further analysis led to exclusions and a more limited list of fractures to reduce the likelihood of capturing fractures unrelated to falls. However, the problem still persists to some degree. We therefore demoted the indicator to the experimental list and retained a CSP based version of the hip fracture indicator on the accepted list.

[e] This indicator is extremely rare, leading to questions regarding coding and operationalization. This indicator requires the code 997.09 which was not added until October 1995. This indicator is invalid before that date.

[f] This code (995.86) was added in October 1998 and thus this indicator is invalid before this date. Although accepted by panels, with one dissent, we cannot evaluate because data sources date only to 1997.

[g] This indicator was rejected by the multi-specialty panel (median=4), but accepted by the surgical panel.

[h] These indicators, although accepted by panel were demoted due to concern that panel discussions were not comprehensive enough to justify acceptance for each of the split indicators.

[i] Codes for iatrogenic nervous system complications were expanded to include 5th digits in October 1995, and therefore this indicator is invalid before that date.

[j] Accepted by surgical panel only, but concerns about operationalization remain and cannot be easily resolved.

[k] This indicator was rejected by surgical panel (median = 5), accepted by multi-specialty.

[l] This indicator is a core JCAHO indicator, not reviewed by panel, although 4th degree lacerations are part of the Obstetric Trauma indicator on the Accepted Listing.

[m] This indicator was split off from other Obstetric complications, due to questions on operationalization of panel requests and strong arguments for splitting.

Table 13. Rejected Indicators

Indicator Name	Multi-specialty Panel Evaluation[a]		Surgical Panel Evaluation[a]		Definition Used
Dosage complications	M2	Unclear (-)			
Iatrogenic hypotension	P1	Unclear (-)			
Intestinal infection due to C. difficile	M1	Unclear (-)			
PO Iatrogenic complications – digestive complications[b]	P1	Not rated separately			
PO Iatrogenic complications – respiratory complications[b]	P1	Not rated separately			
PO Iatrogenic complications – urinary complications[b]	P1	Not rated separately			
PO Iatrogenic complications – vascular complications[c]	P1	Not rated separately			
Postoperative pneumonia	S1	Unclear (-)	3	Unclear	Same
Unexpected LOS/Conditional LOS	M2	Unclear			Unable to specify panel suggestions
Obstetric thrombosis or embolism	O2	Unclear (-)			
Puerperal infection	O2	Unclear (-)			

[a] M, P, O, S refer to Medical, Procedure, Obstetric or Surgery Multi-specialty Panels and their identifying number (see Appendix B for further detail). "Unclear" indicates that almost all panelists rated the usefulness of the indicator as moderate. "Unclear (-)" indicates that most of the panelists rated the usefulness as moderate, although a few rated it as less useful. Panel overall ratings are described in detail Clinician Panel Review Methods (Section 2D) under Tabulation of Results subsection.

[b] Panel accepted the concept of capturing a set of iatrogenic complications, but empirical analyses suggests that most complications in this category are clinically insignificant.

[c] Panel accepted, but covers same complications as vascular complications indicator, which is more complete measure.

The degree to which panelists perceived indicators as preventable (e.g., "Foreign body left in during procedure," "Decubitus ulcer," "Obstetric trauma-cesarean section") tended to relate to the usefulness rating. In other words, the higher the rating for usefulness, the higher the rating for preventability. All indicators in the Accepted indicator set received a median rating of at least 6 by one or more panels (on a scale from 1 to 9 where higher scores represent the opinion that a complication is preventable). However, some rejected indicators that panelists thought would surely be preventable (e.g., dosage complications received a median score of 8) were rated poorly overall because of problems with the indicator (e.g., that it would be inconsistently documented). The adapted UCLA/RAND method may be applied to the preventability ratings to identify complications felt by panelists to be more or less preventable, although this rating does not take into account other potential pitfalls of indicators, such as bias or charting practices. Table 14 shows the results of this categorization for the preventability ratings for the Accepted indicators.

For most indicators, panelists rated the medical error scale lower than the preventability scale. However, several indicators had relatively high scores (median, 7 – 8) equivalent for both of these scales – "Foreign body left in during procedure," "Decubitus ulcer," "Iatrogenic pneumothorax," "Dosage complications," "In-hospital fracture," and "Transfusion reaction." Again, the UCLA/RAND method may be applied to the medical error ratings. Table 15 demonstrates the wider dispersion in Accepted indicators when medical error ratings are used.

Table 14. Groupings Based on Preventability

Acceptable	Acceptable (-)	Unclear	Unclear (-)
Decubitus ulcer	Comp. of anesthesia	Death in low mortality DRG	Failure to rescue
Foreign body	Infection due to med. care	PO hemmorhage/ hematoma	PO physio. or metab. derangement
Iatrogenic pneumothorax[a]	PO PE or DVT[b]	PO pulmonary compromise	
In-hosp. fracture[a]	Transfusion reaction	PO wound dehiscence	
Tech. diff. with procedure	Birth trauma	Postoperative sepsis	
OB trauma (all delivery types)	Post-partum UTI	OB wound comp. – c-sect	

[a]Panel ratings based on definitions different than final definitions. For "Iatrogenic pneumothorax," the rated denominator was restricted to patients receiving thorocentesis or central lines; the final definition expands the denominator to all patients (with same exclusions). For "In-hospital fracture" panelists rated the broader Experimental indicator, which was replaced in the Accepted set by "Postoperative hip fracture" due to operationalization concerns.
[b]Vascular complications rated as Unclear (-) by surgical panel.

Table 15. Grouping Based on Medical Error

Acceptable	Acceptable (-)	Unclear	Unclear (-)
Decubitus ulcer[g]	Comp. of anesthesia[g]	Death in low mort. DRG	Failure to rescue
Foreign body[c, g]	In-hosp. fracture[a, g]	Infection due to med. care	PO hemmorhage/ hematoma
Iatrogenic pneumothorax[a, g]	Transfusion reaction[d, g]	PO PE or DVT[b]	PO pulmonary compromise
		PO wound dehiscence[e]	Birth trauma
		Postoperative sepsis	OB trauma
		Tech. diff. with procedure	
		PO physio. or meta. Derangement[f]	

[a]Panel ratings based on definitions different than final definitions. (See Table 14 footnote)
[b]Vascular complications rated as Unacceptable by surgical panel.
[c]Foreign body rated as Acceptable (-) by surgical panel.
[d]Transfusion reaction rated as Unclear (-) by surgical panel.
[e]PO wound dehiscence rated as Unclear (-) by surgical panel.
[f]PO physiologic and metabolic derangement rated as Unclear (-) by surgical panel.
[g]Rated highly on both preventability and medical error questions.

Although the Accepted indicators did have relatively high ratings regarding the overall usefulness of the indicator, the panel review only addressed the face validity of the indicators. Additional research will be required to establish the validity of all indicators. In general, Accepted indicators have more compelling validity based on the current findings than do Experimental indicators. Each of the Experimental indicators is subject to one or more major concerns that tend to group into three categories. First, panelists rated some of the Experimental indicators lower than the Accepted indicators because they had concerns regarding the construct validity of the indicator (the ability of

the indicator to measure potentially preventable complications). Additional research utilizing other sources of data, such as medical charts, will help to determine the construct validity of these indicators. Although all indicators have no or little current evidence regarding their construct validity, panelists felt particularly concerned about those indicators designated as Experimental. Second, a few indicators either did not have adequate panel review, or were not evaluated by panels (since they were added after the panel review). These indicators should be reviewed by clinical panels with appropriate composition (e.g., inclusion of cardiac surgeons and interventional cardiologists for "CABG after PTCA"). Finally, a few indicators were of interest to the panels, but could not be operationalized adequately within the project timeframe and resources, and will therefore require investigation into whether available codes capture the complication of interest and risk pool adequately. Table 16 identifies the suggested research for each of the Experimental indicators.

Table 16. Suggested Initial Further Research for Experimental Indicators

Indicator	Construct Validity	Clinician Panel Review	Operationalization Review
Aspiration pneumonia	X		
CABG after PTCA		X	
Decubitus ulcer in high risk patients	X	X	
In-hospital Fractures possibly related to falls			X
Intraoperative nerve compression injuries	X		X
Malignant hyperthermia	X		X
Postoperative acute myocardial infarction	X	X[a]	
Postoperative iatrogenic complications – cardiac system		X	
Postoperative iatrogenic complications – nervous system		X	
Reopening of surgical site			X
Suture of laceration	X	X[a]	
Obstetric wound complications – cesarean section	X		
Obstetric wound complications - vaginal delivery	X		
Other obstetric complications	X		
Post-partum urinary tract infection	X		
Third or fourth degree obstetric laceration (JCAHO)	X		
Uterine rupture	X	X	

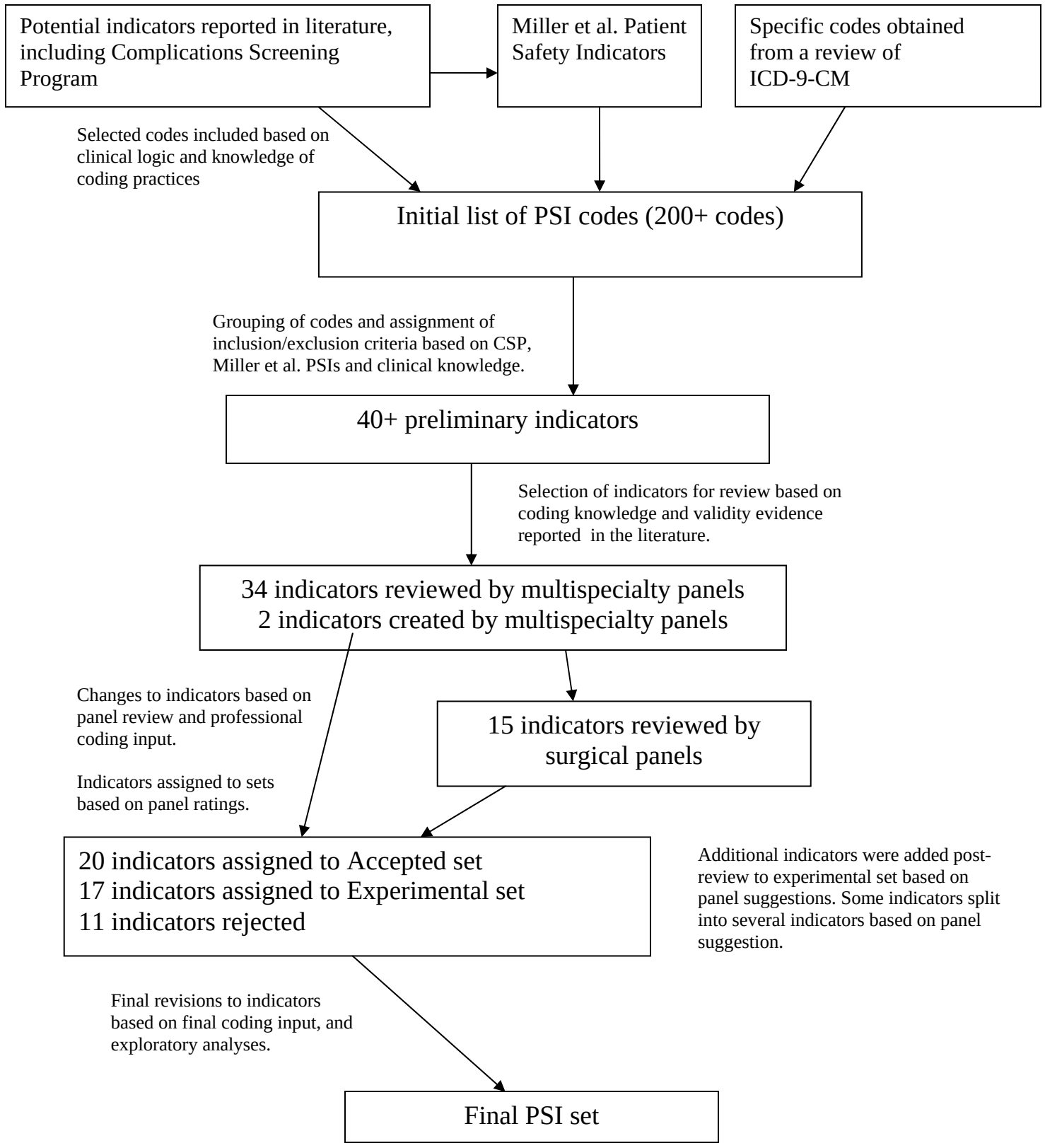
[a]Indicators were accepted by one panel, but rejected by another. Additional review may aid in interpreting these differences of opinion.

Most of the indicators were specified to include pediatric patients. To assess the applicability of the indicators to the pediatric population, rates were also calculated for the following age strata: less than one year, 1 – 14 years, 15 – 24 years and 25 years and older (see Appendix G, Supplemental Tables 3 and 4). Many indicators appear to have similar rates across all pediatric patients as adults. However, the mechanisms of complication development may differ in the pediatric population. For instance, DVTs in a pediatric population may be more reflective of catheter care and use than perioperative

prevention strategies. Where mechanisms or risk factors may differ from the adult population, they are noted in Section 3D.

The remaining portions of the report focus on reporting more details about these indicators. Section 3C. Overall Clinician Review Results provides general themes related to these indicators and highlighted by the panel discussions. Section 3D. Detailed Panel Results by Indicator, provides details on the definition choices made for each indicator, and the concerns raised specific to each indicator. Section 3E. Comparative Empirical Results, relates the findings of the empirical analyses for indicators in the Accepted and Experimental indicator sets. Appendix E provides the detailed specification for the final definitions used for each indicator, and Section 3D. Detailed Panel Results by Indicator also includes the basic definition and rationale for each indicator. As previously noted, all of the results for and brief descriptions of the Rejected indicators are presented in Appendix F.

Flow Diagram 1. Process for the Selection of Indicators



Section 3C. Overall Clinician Panel Review Results

During the course of the clinician review, panelists discussed and offered both specific suggestions regarding a specific indicator, as well as general themes about quality indicator use. These "themes" provided important insights into how quality improvement and indicators are viewed by clinicians, how such indicators are likely to be used and interpreted, and the validity of such indicators from a clinical perspective. While our sample of clinicians was diverse, it is not a nationally representative sample, as these individuals were nominated and volunteered to participate. Nevertheless, the themes that consistently arose in the process are important to address in the development and use of quality indicators. While many of these themes reflect areas covered in previous studies, the novel, though not surprising, finding is that clinician panelists considered these areas vital to discuss as they provided input about the development of patient safety and complications indicators.

Application of Quality Indicators

Panelists repeatedly discussed that the validity of quality indicators is dependent on the intended use (e.g., public reporting of provider rates versus internal quality improvement). For example, an indicator designed to be more specific increases the surety that the indicator will most certainly flag only cases where a medical error or process failure has occurred. The tradeoff, as with any diagnostic test, is that the indicator will then be less sensitive, missing true instances of error. For internal quality improvement, it may be more useful to identify changes in rates of complications that may signal a potential process flaw. While this approach is less precise in terms of yielding only cases of high concern, it would likely identify a broader range of potential quality concerns. For public reporting of provider rates, however, a choice to emphasize sensitivity over specificity in designing indicators may lead to misinterpretation about a particular providers' performance, as some that may use such data may be unfamiliar with the extensive list of caveats that must be considered when interpreting results for each quality indicator. The primary goal of the AHRQ quality indicators is to implement screening tools, meaning that further investigation is expected to certify that an abnormal rate is indeed due to a quality problem. Nonetheless, panelists remained concerned that if these indicators were used to report rates publicly, such limitations would be obscured.

Purpose of Quality Indicators

Indicators may be designed for a variety of uses. There is a distinction between the use of QIs as "case finding tools" and as "quality improvement" tools. Case finding tools are primarily used to identify a specific case or patient in which a quality problem may have led to the outcome in question. In some cases, this may be used for case investigation, mortality and morbidity discussions, or negligence attributions. Another way to use the indicators is as quality improvement tools, in which the rate of a complication provides the most useful information. Unlike case finding tools, this approach focusing on complication rates admits that not each case will reflect negligence or medical error. However, hospitals with extremely high rates compared to similar

institutions may have cause for concern. Interventions may be able to reduce the rate of a complication, but not always prevent a complication from occurring in a particular patient. Panelists were told that this indicator set is designed as a quality improvement tool. Like indicators used for public reporting of provider rates, indicators used for case finding must be much more specific than quality improvement tools, since imprecision from a more sensitive measure may cause problems. Panelists expressed concern that some of the indicators under development may be construed as case finding tools, despite being designed and validated as quality improvement tools. In this event, physicians or other clinicians may be unfairly accused of negligence in a particular case, when, in fact, the clinician could not have prevented the outcome for that particular patient.

Importance of Risk Adjustment or Stratification

Panelists noted that for many indicators, case mix, screening and charting practices, and other factors vary systematically between providers. Panelists discussed alternatives to address such bias, as outlined below.

For many indicators, the exclusion of certain high risk populations, such as trauma patients, may increase the homogeneity of the population at risk. Such restrictions would decrease bias that could result from inconsistent distribution among hospitals of high risk populations. In some cases, panelists favored such exclusions when the population was at such a high risk, that most of the complications would not be preventable. Panelists noted that this approach has the undesired effect of obscuring outstanding quality care, where some providers may be better at preventing complications in high risk patients. This difference would be very important to illuminate, leading some panelists to suggest stratification rather than exclusions.

Stratification has the advantage of allowing providers to view rates of complications in patients with varying risks of developing that complication. Such stratification would remove bias caused by high risk patients. For instance, deep vein thromboses (DVT) and pulmonary embolism (PE) are more common after some orthopedic surgeries. Providers specializing in orthopedic surgery may appear to have an abnormally high rate of DVT/PE, although the rate is due primarily to case mix. Stratified rates would allow the provider to view the orthopedic surgical complications rates separately from other lower risk procedures, allowing exploration of whether the high rate was indeed due to the provider's orthopedic surgery case-mix. Panelists suggested stratifying some indicators by primary procedure type, trauma, elective and urgent admission, and specified comorbidities. In addition to singling out potentially high risk strata, stratification may aid in illuminating the source of a particularly high rate, beyond case mix differences. For demonstration, panelists noted that DVT and PE are identified differently by different providers. Some providers specifically screen for DVT after surgery, while others do not. Thus, providers that screen will appear to have a higher rate, simply because they detect more DVTs. Stratification by DVT rate versus PE rate would allow providers to identify whether a high rate is driven by a higher rate of DVTs, which may be due to screening, or whether the more serious and less ambiguous PE rate is also high. The review of each specific indicator notes suggestions that panelists made regarding stratification.

In some cases, stratification may not be the best or only approach. Panelists noted that case mix adjustment is desirable for many indicators, especially when a variety of factors, such as age, sex, principal procedure or diagnosis, and comorbidities, may influence the likelihood of complications occurring, and when many of these factors vary systematically by providers. Under these circumstances, case-mix adjustment may be easier to interpret than stratification or other approaches. However, case-mix adjustment has many caveats, especially when limited to administrative data. Panelists noted that for many of these indicators, risk adjustment using administrative data is a blunt tool. Additional clinical data would provide much better risk adjustment information. Such data are likely to differ by indicator, and often would require chart review. However, even some risk adjustment may indicate whether or not there is a possibility that a high rate could be due to differences in case mix. While many panelists expressed concern that without risk adjustment indicator results would be misconstrued as due to poor quality of care, some panelists also expressed that blaming high rates on case mix differences may not be appropriate. Their point of view was that adequate risk adjustment could reveal under what circumstances high complication rates appear attributable to case mix differences.

Understanding of Data

Throughout the structured review process, it was clear that some panelists had sophisticated knowledge of administrative data and ICD-9-CM coding, while many panelists were unclear about the limitations of administrative data. To remedy this problem, we provided panelists with information on coding and administrative data. Throughout the conference call we clarified any misconceptions regarding the available data. Through these interventions, panelists' understanding appeared sufficient regarding the limited nature of administrative data. However, we did note that before this education, panelists often assumed that administrative data were clinically rich, containing information on physiological data or very specified diagnoses or procedures. Most panelists were unaware of how ICD-9-CM codes were assigned; unaware that such codes are based on the physician notes and are therefore subject to differences in physicians' diagnosis and charting practices. Panelists were also often unaware that the precise timing of a diagnosis or procedure was impossible to ascertain with most administrative data. The variety of baseline knowledge regarding administrative data from which indicators are constructed suggests potential future problems in interpretation. Physicians and other clinicians, as well as the public and other end users may assume that the data from which indicators are created are detailed, and therefore that indicators or risk adjustment procedures are more clinically valid than is true. A lack of understanding of administrative data may promote inappropriate use of indicators. Without understanding data elements captured in an indicator specification, users of indicators may have difficulties determining what additional data collection efforts might help explain varying rates observed by providers. It should be noted that while some panelists appeared to believe that administrative data were more detailed, others had great skepticism about its use (see below).

Charting, Coding and Reporting

Panelists expressed skepticism about the quality of coding for some of the indicators, stemming from a variety of problems ranging from incentives to chart events to possible inexperience of coders assigning ICD-9-CM codes. Panelists noted that there are many reasons why a physician may not chart a diagnosis or procedure. First, some of the reviewed complications, such as "failure of sterile procedures" or "suture of laceration" when the laceration is minor, may not be coded by some physicians because they may not seem to be clinically significant. In these cases the "rate" of a complication is related mostly to the detail of the physician notes, and thus may be biased. In some cases, there may be disincentive to specifically chart a complication of questionable clinical importance. The culture of a hospital may discourage reporting of errors, if a physician feels that they will be punished for reporting the error. Thus, hospitals with good reporting programs for medical error may appear to have poorer quality of care than hospitals that do not encourage error reporting.

In some cases, the clinical significance of a complication may be very clear, and will usually be charted. However, panelists noted that there still may be variation in charting these complications. Since ICD-9-CM codes are assigned based on physicians' written notes, the exact term a physician uses to describe a condition effects the code assigned. For instance, pneumonia and atelectasis may be used by different physicians to describe the same clinical findings, resulting in different ICD-9-CM codes. In addition, physicians may have differing clinical thresholds and diagnostic practices when identifying a condition. In the pneumonia example, some physicians may diagnose pneumonia using chest x-ray findings, while others may require positive results from a broncoscopy before documenting the diagnosis. Again, these variations result in varying "rates" without true variation in the rate of the actual complication. Even when the complication is clearly defined, some indicators require that the complication be labeled as the direct result of a procedure or medical care, or "iatrogenic". Panelists reported that such a link is often not included in the chart. If another code is available, such as is the case for hypotension, for instance, that code is likely to be assigned. Coders, by direction, and because they are not physicians, do not make inferences during coding to correct some of these variations. In fact, panelists repeatedly expressed skepticism about the accuracy of coding from physician notes, although specific observations of inaccuracy were not reported.

Summary

Throughout our clinical panel review process, we identified recurring themes relating to the usefulness of indicators in a clinical setting. Panelists noted that many problems associated with indicators might not be accurately noted when interpreting indicators in a clinical setting, and generally expressed concern regarding the use of these indicators as definitive quality measures or for public reporting. However, panelists did express interest and indicated a need for such quality indicators, especially for non-punitive internal quality monitoring and improvement.

Section 3D. Detailed Panel Results by Indicator

This section reports the results of the clinician panel's ratings and discussion of each indicator. Medical, procedure and obstetric related indicators were reviewed by multi-specialty panels. A subset of indicators was then reviewed by surgical panels. The table (Table 17) below summarizes the genealogy or history of panel reviews for each indicator; letters in parentheses after an indicator show the final disposition of the indicator based on panel and other findings. Rejected means that the indicator was not retained for further evaluations, usually due to low ratings by the panelists. These rejected indicators are in addition to ones that were not even evaluated by clinical panels. Experimental indicates that the indicator was of some potential use as a patient safety indicator, but had generated some reasonable concerns that would need to be explored through chart reviews or other methods that were outside of the scope of this project. These indicators were evaluated as an Experimental indicator set in the empirical analysis. The final disposition, Accepted means that an indicator as specified after panel input was thought to be useful as a screen for potentially preventable complications of care. These Accepted indicators were evaluated empirically in detail. In this section, Accepted indicators are presented first, in alphabetical order; non-obstetric indicators are followed by obstetric indicators. Next Experimental indicators are presented, also in alphabetical order; again, non-obstetric indicators are followed by obstetric indicators. For explanation of the isolation of obstetric indicators see the introduction to this chapter. The results for each Rejected indicator are found in Appendix F.

Each indicator review follows the same pattern. First, a brief description of the indicator rationale is given followed by the *final* definition of the indicator. The definition shown reflects the suggested changes made by the panel. The original definitions presented to the panel may be found in Appendix I. The final definition is followed by the *final post-conference call* ratings for each indicator. These ratings are usually based on the definition provided. In cases where changes were made after the panel's final rating, an explanation is included in the narrative. Finally, two sections describe the input of the panel. The first section, "Changes to the indicator" documents suggested and implemented changes to the definition and the rationale for each. Definitional changes included changes to both the complication of interest and the population at risk. The second section, "Concerns not addressable by changes" documents any concerns raised during the conference call and subsequent ratings about the indicator.

Table 17. Indicators Reviewed by Panel Type

Indicator[a]	Multi-specialty Panel[b]		Surgical Panel[b]		Final Designation[c]
	Pre Conf. Call	Post Conf. Call	Pre Conf. Call	Post Conf. Call	
Aspiration pneumonia	XXX	XXX	XXX	XXX	Experimental
Birth trauma - injury to neonate	XXX	XXX			Accepted
CABG following PTCA	XXX	XXX			Experimental
Complications of anesthesia[d]	XXX	XXX	XXX	XXX	Accepted
Death in low mortality DRGs	XXX	XXX			Accepted
Decubitus ulcer	XXX	XXX			Accepted
Decubitus ulcer in high-risk patient[e]					Experimental
Dosage complications	XXX	XXX			Rejected
Failure to rescue[f]	XXX	XXX			Accepted
Foreign body left in during procedure	XXX	XXX	XXX	XXX	Accepted
Iatrogenic hypotension	XXX	XXX			Rejected
Iatrogenic pneumothorax	XXX	XXX			Accepted
Infection due to medical care	XXX	XXX			Accepted
In-hospital fractures possibly related to falls[g]		XXX			Experimental
Intestinal infection due to *Clostridium difficile*	XXX	XXX			Rejected
Intraoperative nerve compression injuries[i]		XXX	XXX	XXX	Experimental
Malignant hyperthermia[j]		XXX	XXX	XXX	Experimental
Obstetric thrombosis or embolism	XXX	XXX			Rejected
Obstetric trauma-cesarean section	Obstetric trauma[k]	Obstetric trauma[k]			Accepted
Obstetric trauma-vaginal with instrument					Accepted
Obstetric trauma- vaginal without instrument					Accepted
Obstetric wound complications-cesarean section delivery	Obstetric Wound Complications[l]	XXX			Experimental
Obstetric wound complications-vaginal delivery		XXX			Experimental
Other obstetric complications	XXX	XXX			Experimental
Postoperative acute myocardial infarction	XXX	XXX	XXX	XXX	Experimental
Postoperative hemorrhage or hematoma	XXX	XXX	XXX	XXX	Accepted
Postoperative iatrogenic complications-cardiac system	Postoperative iatrogenic complications[m]	Postoperative iatrogenic complications			Experimental
Postoperative iatrogenic complications-digestive					Rejected
Postoperative iatrogenic complications-nervous					Experimental

Indicator[a]	Multi-specialty Panel[b]		Surgical Panel[b]		Final Designation[c]
	Pre Conf. Call	Post Conf. Call	Pre Conf. Call	Post Conf. Call	
Postoperative iatrogenic complications-respiratory					Rejected
Postoperative iatrogenic complications-urinary					Rejected
Postoperative iatrogenic complications-vascular					Rejected
Postoperative hip fracture[h]	XXX				Accepted
Postoperative physiologic and metabolic derangements	XXX	XXX	XXX	XXX	Accepted
Postoperative pneumonia	XXX	XXX	XXX	XXX	Rejected
Postoperative respiratory failure	XXX	XXX	XXX	XXX	Accepted
Postoperative pulmonary embolism or deep venous thrombosis	XXX	XXX	XXX	XXX	Accepted
Postoperative sepsis	XXX	XXX			Accepted
Postoperative wound dehiscence	XXX	XXX	XXX	XXX	Accepted
Post-partum UTI		XXX			Experimental
Puerperal infection	XXX	XXX			Rejected
Reopening of surgical site	XXX	XXX	XXX	XXX	Experimental
Suture of laceration	XXX	XXX	XXX	XXX	Experimental
Technical difficulty with procedure	XXX	XXX			Accepted
Transfusion reaction	XXX	XXX	XXX	XXX	Accepted
Unexpected LOS/ Conditional LOS[n]	XXX	XXX			Rejected
Uterine Rupture[o]					Experimental

[a]Obstetric and non-obstetric indicators are included in this table for ease of finding indicators on table.
[b]XXX denotes indicator was reviewed.
[c]Accepted and experimental indicators were empirically evaluated; rejected indicators were not.
[d]Multi-specialty panel suggested that this indicator be dropped and suggested two indicators (minor peri-operative physical injuries and malignant hyperthermia) in lieu of indicator. Surgical panel reviewed and revised original indicator.
[e]Indicator was created after clinical panel reviews based on panel suggestion, underwent empirical evaluation only.
[f]Clinicians on multi-specialty panel evaluated 2 failure to rescue indicators with different definitions. Both definitions were combined into the single "Failure to rescue" indicator following the conference call.
[g]Original indicator was titled "Postoperative hip fracture and fall" prior to conference call; the new indicator reflects suggested change of panel.
[h]Indicator was accepted in lieu of the suggested indicator due to difficulty operationalizing the suggested indicator “in-hospital fractures, possibly due to falls”
[i]Original indicator was titled "Minor-perioperative physical injury." Indicator name changed to "Intraoperative nerve compression injury" when corneal abrasion and lip laceration were eliminated from the definition.
[j]Indicator was created based on panel suggestion following discussion of “Complications of Anesthesia” indicator.
[k]Indicator was stratified according to delivery type following final rating due to panelist suggestions.
[l] Indicator was stratified according to delivery type following initial rating due to panelist suggestions.
[m]Indicator was split into 5 indicators, reflecting the individual complication codes included in the indicator. For the final rating, panelists were informed of the intention to split the indicator, but panelists provided only one rating.
[n]Multi-specialty panel reviewed 2 definitions, selecting “Unexpected LOS” for further consideration.
[o]Indicator was created after clinical panels reviewed the “Other obstetric complications” Indicator

The review of each indicator includes the indicator name, description with rationale, definition, panel ratings and a summary of panel comments. More detailed specifications of indicators are documented in Appendix E. The six questions about aspects of the indicator (e.g., how preventable the complication is) were rated by panelists on a scale from 1 to 9, with the higher numbers relating to better patient safety measures, with one exception. In the case of the question related to how subject an indicator might be to bias (e.g., effects of case mix), a lower rating corresponds to a better patient safety indicator. Each rating table shows the panel median score, as well as the level of agreement, where "agreement" corresponds to little dispersion of opinion, "indeterminate" means that the opinion ranged but did not reach the point of clear "disagreement", the final category where there were panelists with diametrically different opinions. Section 2D. Clinician Panel Review Methods provides details on agreement categorization. The indicators are organized according to final designation as accepted or experimental, with non-obstetric indicators preceding obstetric indicators. Indicators that were reviewed, but ultimately rejected can be found in Appendix F.

Accepted Indicators

Complications of Anesthesia

This indicator is intended to flag cases of specific complications due to anesthesia that can be clearly identified using administrative data. Specifically, the final definition captures cases flagged by External Cause-of-Injury Codes (E-Codes) and complications codes for adverse effects from the administration of therapeutic drugs, and the overdose of anesthetic agents used primarily in therapeutic settings.

Final Definition

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM diagnosis codes for **[anesthesia complications]** in any secondary diagnosis field per 100 discharges.
Denominator	All **[surgical]** discharges. Exclude patients with codes for poisoning due to anesthetics *[E855.1, 968.1-4, 968.7]* AND any diagnosis code for **[active drug dependence], [active nondependent abuse of drugs],** or **[self- inflicted injury]**.

Post-Conference Call Panel Ratings[a]

Question	***Median (MS)***	***Agreement status (MS)***	***Median (S)***	***Agreement status (S)***
Overall rating	Not Rated		7	Indeterminate
Not present on admission	Not Rated		5.3	Indeterminate
Preventability	Not Rated		7.5	Indeterminate
Due to medical error	Not Rated		7.3	Indeterminate
Charting by physicians	Not Rated		5.3	Indeterminate
Bias (lower rating favorable)	Not Rated		6.8	Disagreement

[a]Multi-specialty Panel – Surgical Complications 3
Surgical Panel – Surgical Complications 3

Multi-specialty Panel Results

This panel agreed that this indicator should be dropped as originally defined. They suggested the creation of two alternate indicators related to complications of anesthesia: "Malignant hyperthermia" and "Minor perioperative injuries". Thus, this indicator was not rated after discussion by this panel.

Concerns not addressable by changes. This panel felt strongly that shock due to anesthesia was too nebulous of a diagnosis. This diagnosis varies widely depending on the charting and judgment, and this diagnosis may represent many varied physiological states. In addition, there was concern that shock was expected in certain situations, such as major abscesses. Finally, in many instances shock may not be clearly attributable to anesthesia, as it may have arisen from a variety of causes. The panel suggested this code be omitted.

The panel also expressed concern regarding the code for incorrect placement of endotrachial tube. Panelists were unsure what events would be assigned this code. They noted that in surgery, misplacement would be corrected immediately, and likely would not be charted. If the tube could not be placed correctly, the patient would be awakened. They noted that these few cases do not represent medical error. Indeed, they noted that true misplacement that resulted in harm to the patient does represent medical error, but they expressed skepticism over whether or not this code would be limited to those situations.

Panelists suggested several additional situations that could be monitored. A few situations, such as anoxic brain damage, did not have specific ICD-9-CM codes. Air embolism was included in another indicator. Suggestions for monitoring malignant hyperthermia and lip lacerations were included in new indicators.

Surgical Panel Results

Changes to the indicator. The surgical panel also expressed concern about the code for shock due to anesthesia. In addition to the concerns expressed by the multi-specialty panel, this panel specifically noted that shock may be labeled as hypotension instead of shock. They also noted that shock due to anesthesia is not always preventable. For these reasons, they suggested removing the code.

The panel suggested instead adding a variety of additional codes that may be used for reactions to and overdose of anesthetics. These codes include so-called "E-codes" for adverse effects of the administration of therapeutic drugs. Panelists did express concern that E-codes are not consistently coded, but agreed that they should be tracked nonetheless. Other codes included a series of codes representing accidental poisoning by anesthetics, limited to anesthetics that are not commonly used as recreational drugs, with specific exclusions to reduce the chance that poisoning was present on admission.

Concerns not addressable by changes. No other concerns were added.

Summary Across Panels

The two panels suggested different, almost entirely new, indicators, rejecting the original definition for this indicator. As a result all ratings were considered separately. The multi-specialty panel created two indicators that were rated separately. The surgical panels revised the definition of this indicator, and rated its overall usefulness as relatively favorable. As such, this indicator was retained in the Accepted provider level indicator set.

Panelists had concerns about the frequency of coding of these complications, especially since the use of E-codes is considered voluntary and appears to vary widely between providers. Plausibly a "reaction" may be described without attributing it to anesthetic. Another concern is that some of these cases would be present on admission (e.g., due to recreational drug use). Ideally, this indicator would be used with a coding designation that distinguishes conditions present on admission from those that develop in-hospital. However, this is not available in the administrative data used to define this indicator, and so this concern was addressed by eliminating codes for drugs that are commonly used as recreational drugs. While this does not eliminate the chance that these codes represent intentional or accidental overdose on the part of the patient, it should eliminate many of these cases.

Death in Low Mortality Drgs

This indicator is intended to identify in-hospital deaths in patients unlikely to die during hospitalization. The underlying assumption is that when patients admitted for an extremely low-mortality condition or procedure die, a health care error is more likely to be responsible. Patients experiencing trauma, or having an immunocompromised state or cancer are excluded, as these patients have higher non-preventable mortality.

Final Definition

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	All discharges with disposition of "deceased" per 100 population at risk.
Denominator	Patients in DRGs with less than 0.5% mortality rate, based on NIS 1997 [low mortality DRG]. If a DRG is divided into "without/with complications" both DRGs must have mortality rates below 0.5% to qualify for inclusion. Exclude patients with any code for [trauma], [immunocompromised] state, or [cancer].

Post-Conference Call Panel Ratings[a]

Question	*Median*	*Agreement status*
Overall rating	7.5	Agreement
Not present on admission	Not applicable	Not applicable
Preventability	6	Indeterminate agreement
Due to medical error	6	Indeterminate agreement
Charting by physicians	9	Agreement
Bias (lower rating is favorable)	4.5	Indeterminate agreement

[a] Medical Complications 2 Multi-specialty Panel

Changes to the indicator. Panelists suggested no changes to this indicator.

Concerns not addressable through changes. Panelists expressed some concern regarding bias inherent in this indicator. Specifically, panelists noted that hospital case-mix may affect the rate of death in low mortality DRGs. Patients referred from skilled nursing facilities, those with certain comorbidities and older patients may be at higher risk of dying. Risk adjustment for comorbidities and age was highly advocated. Panelists also suggested that social factors play a role, with socio-economic status being correlated with many other risk factors that

may affect the health and healing of the patient. Some panelists advocated for stratification by insurance status. Finally, panelists noted that some hospitals accept transfers from other hospitals. At times, these transfers are very appropriate, but sometimes the transfer occurs too late for the receiving hospital to prevent death. If these scenarios occur systematically, this indicator could be biased against referral centers. Panelists also expressed that hospital size may be a factor. Since deaths in these DRGs are rare, hospitals that have very few patients may be more affected by random variation.

Despite the concerns expressed regarding bias in the low mortality DRG indicator, panelists noted that this indicator was of great interest. Panelists noted that although many deaths in these DRGs are likely to be non-preventable and not due to medical error, that all deaths in low mortality DRGs should be subject to internal review, and that high rates may indicate a quality problem. However, panelists were quick to emphasize use of this indicator as a screening tool for internal quality improvement efforts. Given potential bias and questions about the extent of preventability, panelists advocated that this indicator not be subject to public reporting.

Summary

The overall usefulness of this indicator was rated as favorable by panelists, and as such it was retained in the Accepted provider level indicator set. To standardize the indicator, since the denominator of this indicator includes many heterogeneous patients cared for by different services, this indicator should be stratified by DRG type (i.e., medical, surgical, psychiatric, obstetric, pediatric) when used as an indicator of quality.

Decubitus Ulcer

This indicator is intended to flag cases of in-hospital decubitus ulcers. It is related to a complications indicator developed as part of the Complications Screening Program,[7] although it omits several of the original codes for cellulitis. In order to better screen out cases of decubitus ulcer that are present on admission, this indicator limits its definition of decubitus ulcer to secondary diagnoses (meaning decubitus ulcer was not labeled as the principal diagnosis). In addition, this indicator excludes patients that have a length of stay less than 4 days, as it is unlikely that a decubitus ulcer would develop within this period of time. Finally, this indicator excludes patients who are particularly susceptible to decubitus ulcer, namely patients with major skin disorders (MDC 9) and paralysis.

Final Definition

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM code of 707.0 in any secondary diagnosis field per 100 discharges.
Denominator	All **[medical]** and **[surgical]** discharges. Include only patients with a length of stay of more than 4 days. Exclude patients in MDC 9 or patients with any diagnosis of **[hemiplegia, paraplegia, or quadriplegia].** Exclude patients admitted from a **[long term care facility].**

Post-Conference Call Panel Ratings[a]

Question	*Median*	*Agreement status*
Overall rating	8	Agreement
Not present on admission	8	Agreement
Preventability	8	Agreement
Due to medical error	8	Agreement
Charting by physicians	7	Indeterminate agreement
Bias (lower rating is favorable)	3	Indeterminate agreement

[a] Medical Complications 1 Multi-specialty Panel

Changes to the indicator. The original definition of this indicator was based on the Complications Screening Program.[7] This included an exclusion for patients older than 80 years of age, since these patients may be more likely to have pre-existing decubiti. Panelists felt that this exclusion was undesirable, as it eliminates patients who should be monitored. Panelists instead suggested that patients admitted from a long-term care facility be excluded, as these patients may have an increased risk of having decubiti present on admission.

The original definition included only patients with a length of stay of 10 days or more, to better ensure that the decubiti developed within the admission in question. Panelists agreed that this length of stay was too long, limiting the indicator to only the most ill patients. Instead, panelists agreed to limit the indicator to patients with length of stay to 4 days or more, a limitation utilized for this indicator in a study by Needleman et al.[137]

Concerns not addressable through changes. Most panelists had few concerns regarding this indicator. In general panelists felt that this complication was preventable, and in many cases reflects medical error, although a small number of cases may not be preventable. One panelist suggested that little published evidence exists regarding practices that providers may adopt to reduce decubitus ulcer rates.

Some panelists had minimal concern that reporting of decubiti may vary by providers. Specifically, staging of decubitus ulcers affects the charting of the complication, with earlier stage ulcers reported more variably than later stage ulcers. Nurses were noted to be more vigilant than physicians in reporting ulcers; however, nursing notes are not considered when assigning ICD-9-CM diagnosis codes. In addition, some facilities routinely screen for decubitus ulcers as part of quality improvement programs, while other facilities do not. Hospitals that screen would have an artificially high rate of ulcers as compared to other hospitals. If this concern is demonstrated in reality, than this indicator may be somewhat biased.

A final source of potential bias is case mix. Panelists noted that very ill patients may be at higher risk for developing decubiti, and therefore hospitals that care for sicker patients may have higher rates of this complication. In addition, one panelist noted that since patients admitted from long-term care facilities are excluded, that hospitals admitting more patients from these facilities may appear better than other facilities.

Although panelists chose to retain the exclusion of high risk patients, many panelists expressed interest in tracking decubiti in a higher risk population. It was felt that bias may result from adding these patients to the population at risk. On the other hand, the high risk population is one for which vigilance of the treatment team should be high and may have a substantial effect. They suggested, that if possible in the future, that high risk patients also be tracked separately.

An indicator for this purpose was added to the experimental set because of its face validity, but need for further testing.

Summary

The overall usefulness indicator was rated as very favorable by panelists. Although panelists felt that this complication most often reflected medical error, concerns regarding the systematic screening for ulcers and reliability of coding, especially for early stage ulcers brought into question that assertion. Thus, this indicator appears to be best used as a rate based indicator, despite its high rating on the medical error question. This indicator was retained in the Accepted provider level indicator set.

This indicator includes pediatric patients. Pressure sores are very unusual in children, except among the most critically ill children (who may be paralyzed to improve ventilator management) and children with chronic neurologic problems.

Failure To Rescue

This indicator is intended to identify patients that die following the development of a complication. The underlying assumption is that good hospitals may not be able to prevent complications, but they identify these complications quickly and treat them aggressively to prevent adverse sequelae, such as death. The original definition of this indicator was developed by Silber et al.[31] and was based on clinical data, focusing on complications of cardiac surgery that were serious and often non-preventable. Jack Needleman and colleagues, in a recent study, operationalized failure to rescue using administrative data only, across a wide range of surgical and medical patients.[137] Needleman's list of complications was closely related to the complications defined in the Complications Screening Program.[7] These complications include exclusions designed to avoid counting patients with the complication present on admission. In this definition, Needleman used patients identified under his modified definition as having a serious iatrogenic complication as the population at risk. Patients that transferred to or from another hospital are excluded. Patients admitted from a long-term facility are also excluded.

Final Definition

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	All discharges with disposition of "deceased" per 100 population at risk.
Denominator	Discharges with potential complications of care listed in **[failure to rescue]** definition (i.e., pneumonia, DVT/PE, sepsis, acute renal failure, shock/cardiac arrest, or GI hemorrhage/acute ulcer). Exclusion criteria specific to each diagnosis. Exclude patients **[transferred to acute care facility].** Exclude patients **[transferred from acute care facility]** Exclude patients admitted from a **[long-term care facility]**.

Post-Conference Call Panel Ratings[a]

Question	*Median*	*Agreement status*
Overall rating	7	Agreement
Not present on admission	7	Indeterminate agreement
Preventability	5	Agreement
Due to medical error	5	Indeterminate agreement
Charting by physicians	8	Agreement
Bias (lower rating is favorable)	4	Disagreement

[a]Medical Complications 2 Multi-specialty Panel

Changes to the indicator. Panelists were asked for additional suggestions of complications to be included in the denominator of this indicator. Panelists unanimously suggested that acute renal failure be added.

Panelists expressed concern regarding patients with "do not resuscitate" (DNR) status. In cases where this DNR status is not a direct result of poor quality of care, it would be contrary to patient desire and poor quality of care to rescue a patient. In addition, very old patients, or patients with advanced cancer or human immunodeficiency virus (HIV) may not desire or may be particularly difficult to rescue from these complications. As a result, several changes were suggested for this indicator. These changes include the stratification of this indicator by age, such that patients over 75 years may be examined separately from younger patients. In addition, panelists suggested the exclusion of patients admitted from long term care facilities. Although these changes do not directly nor completely address panelist concerns, they may improve ability to interpret results.

Panelists also noted that transfer practices may play a role in this indicator. As patients that develop some complications may be transferred to more specialized hospitals, referral centers may not always be able to rescue that patient, particularly if the transfer occurs too late. In this case the referral care center would appear to have poorer quality than the hospital in which the complication arose in the first place. Thus, patients who have been transferred to or from another acute care facility are also excluded from this indicator.

Concerns not addressable through changes. Panelists expressed some concern over the validity of this indicator, although it was eventually accepted by panelists for inclusion. Some panelists wanted to see additional validity work on the concept that failure to rescue is a valid marker of quality of care. Others were concerned that although the concept may be valid, that it would be very difficult to operationalize this indicator well, with varied definitions of complications, difficulty ascertaining whether the complication occurred in-hospital, and the lack of adjustment for the many factors that influence the ability and appropriateness of the hospital to rescue a patient from these complications.

Panelists noted that several adverse incentives may be introduced by implementing this indicator. In particular, since some type of adjustment may be desirable, this indicator may encourage the upcoding of complications and comorbidities to inflate the denominator or manipulate risk adjustment. Others noted that this indicator could encourage irresponsible resource use and allocation, although this is likely to be a controversial idea. Finally, panelists emphasized that this indicator should be used internally by hospitals, as it is not validated for public reporting.

Summary

The overall usefulness of this indicator was rated favorably and as such it is included in the Accepted provider level indicator set. However, this indicator may be fundamentally different than other indicators reviewed in this report, as it may reflect different aspects of quality of care (effectiveness in rescuing a patient from a complication versus preventing a complication). For this reason, this indicator has been considered separately from other indicators in this report.

This indicator includes children. It is important to note that children beyond the neonatal period inherently recover better from physiological stress and thus may have a higher rescue rate.

Foreign Body Left in During Procedure

This indicator is intended to flag cases of a foreign body accidentally left in body during a procedure. It is based on an indicator developed as part of the Complications Screening Program,[7] although all codes are considered sentinel events in that system. The indicator is defined both on the area level by including all cases, and on the hospital level by restricting cases to those flagged by a secondary diagnosis or procedure code.

Final Definition

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM codes for **[foreign body left in during procedure]** in any secondary diagnosis field per 100 surgical discharges.
Denominator	All **[medical]** and **[surgical]** discharges.

Post-Conference Call Panel Ratings[a]

Question	***Median (MS)***	***Agreement status (MS)***	***Median (S)***	***Agreement status (S)***
Overall rating	8	Agreement	7	Indeterminate
Not present on admission	8	Agreement	7	Agreement
Preventability	8	Agreement	7.5	Agreement
Due to medical error	8	Agreement	7	Indeterminate
Charting by physicians	7	Agreement	8	Indeterminate
Bias (lower rating favorable)	3.5	Indeterminate	4	Indeterminate

[a]Multi-specialty Panel – Surgical Complications 2
Surgical Panel – Surgical Complications 2

Multi-specialty Panel Results

Changes to the indicator. Panelists were queried regarding the addition of the code for the removal of foreign body from the peritoneal cavity. This code may include some foreign bodies accidentally left in during abdominal surgery when the physician has not specified that the foreign body was not accidentally left in, or the coder chooses to use this code instead of the 998 code. This procedure code was included in Iezonni's CSP.[7] Panelists agreed that this code

would also pick up some important events, although this code does not specify that the foreign body must be left in accidentally.

Concerns not addressable by changes. Panelists noted that each case of foreign body left in during procedure needed examination. Some automated systems do report this complication when a foreign body is actually left in intentionally. In addition, other cases may require a foreign body to remain. As some codes do not specify that the foreign body must accidentally be left in the body during procedure, some of these foreign bodies may be left in the patient intentionally. This code can be used when a granuloma occurs from a suture accidentally left in the body. Panelists agreed that such granulomas are substantially different in terms of morbidity from other foreign bodies accidentally left in during a procedure. They recommended that the percentage of suture granulomas be ascertained when using this indicator.

Some patients seem to be more likely to have foreign bodies left in during a procedure. Although panelists agreed that these patients (e.g., trauma) should not be excluded, except in the case of removal of foreign body from the abdominal cavity (e.g., possible gun shots). Panelists suggested that users of this indicator examine these cases closely. Panelists suggested that this indicator be adjusted for emergency surgery or type of procedure.

Surgical Panel Results

Changes to the indicator. Panelists suggested no changes to this indicator.

Concerns not addressable by changes. Panelists, especially orthopedic surgeons, noted that some foreign bodies are left in on purpose. This occurs frequently, such as when a k-wire or a drill bit breaks off during a procedure. To remove the foreign body may cause more damage than to leave it in. In this case, surgeons felt that the foreign body did not reflect a medical error. The panelists felt that this indicator should be stratified or risk adjusted for the type of procedure. Panelists were concerned about the coding of this indicator. Specifically, this coding requires the physician to note that the foreign body was accidentally left in. There was concern that this additional information would not always be reported. Because of this situation, some physicians have a higher rate than others. Therefore, physicians who do not specify that a foreign body was left in accidentally would not be flagged by this indicator. Panelists also noted that some foreign bodies left in do not cause substantial morbidity, although the foreign body may be removed, resulting in a diagnosis code or an E-code. Some foreign bodies do not represent a clinically significant complication.

Panelists noted that the population at risk included both medical and surgical patients, but not all of these patients are at risk. The panelists felt that limiting to surgical patients would decrease the sensitivity of this indicator substantially. However, it should be made clear that not all patients in the denominator are actually at risk. Therefore, some hospitals may appear to have a lower rate if they have less medical patients who have undergone invasive procedures.

The surgical panel was also queried about removing the code related to removal of foreign body from peritoneal cavity. However, this panel felt that the category was too broad, and could easily include a number of cases where no foreign body was left in. For this reason, they suggested that this code not be included.

Summary Across Panels

Both panels believed that this indicator was useful in identifying cases of a foreign body left in during a procedure. They suggested that since this indicator was likely to yield few cases,

that each case identified be examined carefully by the hospital. Since both panels did not agree to add the code for removal of foreign bodies in the peritoneal cavity, this code was not included. Given the favorable rating of the overall usefulness of this indicator, it is included in the Accepted provider level indicator set. An area level analog of this indicator was included in the Accepted area level indicator set.

Iatrogenic Pneumothorax

This indicator is intended to flag cases of pneumothorax caused by medical care. The area level indicator is intended to capture all cases of iatrogenic pneumothorax, not only those occurring in-hospital. The provider level indicator is restricted to secondary diagnosis of iatrogenic pneumothorax, and is intended to flag cases occurring during the hospitalization. To exclude patients that may be more susceptible to non-preventable iatrogenic pneumothorax, or patients with miscoded traumatic pneumothorax, this indicator excludes all trauma patients.

Final Definition

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM code of 512.1 in any diagnosis field per 100 discharges.
Denominator	All discharges. Exclude patients with any diagnosis of **[trauma].** Exclude patients with any code indicating **[thoracic surgery]** or **[lung or pleural biopsy]** or assigned to **[cardiac surgery].**

Post-Conference Call Panel Ratings[a]

Question	*Median*	*Agreement status*
Overall rating	7.5	Agreement
Not present on admission	8	Agreement
Preventability	8	Agreement
Due to medical error	8	Agreement
Charting by physicians	7	Indeterminate agreement
Bias (lower rating is favorable)	3	Indeterminate agreement

[a]Procedural Complications 1 Multi-specialty Panel

Changes to the indicator. The original definition of this indicator included all patients, surgical and medical. Panelists noted that pneumothorax can arise from different causes, primarily as a result of a procedure, or from barotrauma in ventilated patients. They noted that although ventilator management matters, pneumothorax arising from barotrauma is much less straightforward than that arising from procedures such as central line placement. Thus, panelists suggested that the indicator would better reflect quality of care, if it were restricted to patients receiving a central line, Swan-Ganz catheter, or thorocentesis (see summary paragraph below, as this change was ultimately removed).

Pneumothorax is an expected complication of some procedures, namely thoracic surgery and pleural or lung biopsy. Panelists felt that these patients should be excluded, since pneumothorax may not be preventable in those patients.

Concerns not addressable through changes. Panelists noted that pneumothorax is a good marker of operator skill. In particular, panelists postulated a clear "July effect" of increased rates when new residents begin performing such procedures.

A few panelists noted that it would be helpful to know the exact procedure associated with the pneumothorax, specifically the approach of the central line placement (e.g., subclavian, jugular). Panelists did express concern that some patients with a recorded central line placement may also be ventilated. In this case it would be impossible to tell from administrative data whether the complication arose from the central line placement procedure or from barotrauma.

Finally, it should be noted that this indicator includes Peripherally Inserted Central Catheter (PICC) line placement as well as central line placement, due to coding constraints. Panelists felt that this was not of concern. They noted that an appropriate replacement of use of central line access with PICC lines might occur to some degree as a result of implementing this indicator.

Summary

Panelists rated the overall usefulness of this indicator favorably, although the definition rated included the suggested denominator, limited to patients receiving a central line, Swan-Ganz catheter or thorocentesis. However, exploratory empirical analyses found that this denominator was not reliably defined using administrative data, as these procedures appeared to be under-reported. Thus, the ratings reported reflect a definition that could not be operationalized, and must be considered in that context. Although the panelists noted that this complication, given the definition rated, reflected medical error, the actual final definition of this indicator includes cases which may be less reflective of medical error. Specifically, this indicator includes patients in whom a pneumothorax resulted from barotrauma, including patients with acute respiratory distress syndrome. Thus, this indicator may not as clearly detect medical error as suggested by the panel ratings.

Panelists expressed concern that some approaches of placing a central line (e.g., subclavian) may be more likely to result in pneumothorax than other approaches (e.g., internal jugular). However, other complications, such as complications of the carotid artery would be more common with internal jugular approaches. Thus, if providers simply change approach they may have a decrease in pneumothorax, but an increase in other unmeasured complications.

This indicator includes children, which was not discussed by panelists. It should be noted that the smaller anatomy of children may increase the technical complexity of these procedures in this population (especially among neonates). However, these procedures are less likely to be performed in this population in unmonitored settings.

Given the high overall rating of the indicator, and the great interest in identifying this complication, this indicator was included in the Accepted provider level indicator set. An area level analog of this indicator was included in the Accepted area level indicator set.

Infection Due to Medical Care

This indicator is intended to flag cases of infection due to medical care, specifically those related to IV lines and catheters. As an area indicator, it is intended to capture all cases of such

infection, not only those that occur in-hospital. Defined as a hospital level indicator, it captures cases based on secondary diagnosis, and is therefore limited to those infections associated with the same hospitalization. This indicator excludes patients with potential immunocompromised states (e.g., AIDS, cancer, transplant), as they may be more susceptible to such infection.

Final Definition

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM code of 999.3 or 996.62 in any diagnosis field per 100 discharges.
Denominator	All **[medical]** and **[surgical]** discharges. Excludes patients with any diagnosis code for **[immunocompromised]** state or **[cancer]**.

Post-Conference Call Panel Ratings[a]

Question	*Median*	*Agreement status*
Overall rating	8	Indeterminate agreement
Not present on admission	7	Indeterminate agreement
Preventability	7	Indeterminate agreement
Due to medical error	6	Indeterminate agreement
Charting by physicians	7	Agreement
Bias (lower rating is favorable)	3.5	Indeterminate agreement

[a] Medical Complications 1 Multi-specialty Panel

Changes to the indicator. The original definition of this indicator included several ICD-9-CM codes representing infections that may arise as a result of medical care, including intravenous (IV) and catheter infections and infection due to contaminated or infected blood or other substance. Panelists felt that these two codes identified two very different complications and should not be combined. They felt that the former code, which focused on IV and catheter infections, was most useful for quality improvement, while the latter code is likely to be very rare and poorly reported. For this reason, panelists agreed that this indicator should only include the code for "other infection due to medical care," focusing on IV and catheter infections. A second code was added after consultation with a coding specialist, as this code also is used to denote catheter infections.

Panelists expressed that the existing exclusion criteria for this indicator needed revision. The original definition excluded trauma patients, as these patients may be at a higher risk for these types of infection. The panel agreed unanimously that these patients should be tracked and therefore included in the population at risk. Panelists did feel that immunocompromised patients were at a higher risk of developing these complications, and that these infections may be less preventable in this population. Therefore, the panel agreed to exclude immunocompromised patients from the population at risk.

Concerns not addressable through changes. Panelists noted that while many of these infections are preventable, even with the best of care, there is a normal underlying rate of these infections. Panelists also expressed concern over the charting of this indicator. Panelists noted that charting of these infections is likely to be varied, and reflect differences in documenting

clinically less significant infections, or the aggressiveness of treating such infections. Despite the potential of bias due to charting or under-reporting, panelists for the most part felt that these complications were important to track. Finally, as with other indicators tracking infections, concern regarding the potential overuse of prophylactic antibiotics remains.

Summary

Panelists rated the overall usefulness of this indicator favorably, and they expressed particular interest in tracking IV and catheter related infections. This indicator was retained as in the Accepted provider level indicator set. An area level analog of this indicator was included in the Accepted area level indicator set.

This indicator includes children and neonates, which was not specifically discussed by panelists. It should be noted that high-risk neonates are at particularly high risk for catheter-related infections.

Postoperative Hemorrhage and Hematoma

This indicator is intended to flag cases of hemorrhage or hematoma following a surgical procedure. It is based on an indicator developed as part of the Complications Screening Program.[7] This indicator limits hemorrhage and hematoma codes to secondary procedure and diagnosis codes in order to isolate those hemorrhages that can truly be linked to a surgical procedure. For the same reason, this indicator eliminates all procedures to control hemorrhages that take place before the principal procedure. To ensure that the reported hematoma or hemorrhage is a clinically significant complication, such diagnoses must be accompanied by a procedure code, indicating clinical intervention.

Final Definition

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM codes for **[postoperative hemorrhage]** or **postoperative hematoma]** in any secondary diagnosis field AND code for postoperative **[control of hemorrhage]** or [**drainage of hematoma]** (respectively) in any secondary procedure code field per 100 surgical discharges. Procedure code for postoperative control of hemorrhage or hematoma must occur on the same day or after the principal procedure.
Denominator	All **[surgical]** discharges. Exclude all obstetric admissions (MDC 14 and 15).

Post-Conference Call Panel Ratings[a]

Question	*Median (MS)*	*Agreement status (MS)*	*Median (S)*	*Agreement status (S)*
Overall rating	7	Indeterminate	7	Agreement
Not present on admission	8	Agreement	8	Agreement
Preventability	8	Agreement	6	Indeterminate
Due to medical error	4.5	Indeterminate	5	Agreement
Charting by physicians	7	Agreement	8	Agreement
Bias (lower rating favorable)	5	Disagreement	3	Disagreement

[a]Multi-specialty Panel – Surgical Complications 1
Surgical Panel – Surgical Complications 1

Multi-specialty Panel Results

Changes to the indicator. Panelists did not suggest any changes to this indicator to address concerns.

Concerns not addressable through changes. Panelists noted that risk of developing postoperative hemorrhage or hematoma differs in complicated and uncomplicated cases. They suggested that an exclusion be added for patients with coagulopathies or for those on anticoagulant medication. However, this exclusion cannot be adequately implemented using administrative data. They suggested that this indicator be risk adjusted, rather than using exclusions of complicated cases. This panel felt that examining the overall rate followed by further investigations would be more useful than creating a homogenous denominator of uncomplicated cases. This panel noted that postoperative hemorrhage and severe hematoma are captured frequently because they require a return to the operating room. However, some panelists expressed that during the re-operative procedure, it is often difficult to find the source of the hemorrhage. They questioned whether or not surgical technique influenced the rate of postoperative hemorrhage or hematoma. Overall, this panel deferred to the surgical specialists in reviewing this indicator.

Surgical Panel Results

Changes to the indicator. The panelists noted that seromas are often clinically insignificant complications. They expressed that this complication is not of interest and should be removed from the indicator. The panel also noted that some hematomas may be insignificant, but that those requiring a procedure are highly significant and should be tracked. The panelists expressed the desire to have any diagnosis code linked to a procedure for drainage of hematoma. The procedure for drainage of hematoma is not specific to hematoma but may also include draining of other fluids, including abscesses or seromas. Because of this non-specificity of procedure codes, all procedure codes must be paired with a diagnosis code for hemorrhage or hematoma in order to be included in this indicator. Panelists felt that this specification would limit the flagged complications to those reflecting higher morbidity of patients.

Concerns not addressable through changes. Surgical panelists noted that post-surgical hemorrhage or hematoma occurs in non-surgical patients undergoing invasive procedures such as those undergoing PTCA or cardiac catheterization. They noted that this is an important

population that is not covered by this indicator. They also noted that additional patients would be missed if they were admitted for hematoma after an outpatient surgery or if they were discharged before the hemorrhage or hematoma occurred and then readmitted to the hospital. Panelists felt that these patients were particularly import to track. However, the administrative data used in this project do not allow for tracking readmissions, or admissions after outpatient surgery. Panelists noted that some patients may be at higher risk for developing a postoperative hemorrhage or hematoma. Specifically, like the multi-specialty panel, the surgical panel was concerned about patients with coagulopathies, and those on anticoagulants. They suggested that where possible, this indicator be stratified for patients with underlying clotting differences. They also noted that patients admitted for trauma may be at a higher risk for developing postoperative hemorrhage or may have a hemorrhage diagnosed that occurred during the trauma. They also suggest that this indicator be stratified for trauma and non-trauma patients.

Summary Across Panels

Because the multi-specialty panelists suggested further surgical input for this indicator, the changes to definitions suggested by the surgical panel were implemented. The ratings of the surgical panelists were considered more valid, and resulted in the indicator being included in the Accepted provider level indicator set.

Postoperative Hip Fracture
In-Hospital Fractures Possibly Related To Falls

(Initially reviewed: "In-hospital hip fracture and fall"; see Summary below)

This indicator is intended to flag cases of in-hospital fracture, specifically hip fractures for one version of the indicator, and a broader group of fractures possibly related to falls for another version of the indicator. It is related to an indicator developed as part of the Complications Screening Program.[7] This indicator limits diagnosis codes to secondary diagnosis codes in order to eliminate fractures that were present on admission. It further excludes patients in MDC 8 (musculoskeletal disorders) and patients with indications for trauma or cancer, or principal diagnoses of seizure, syncope, stroke, coma, cardiac arrest, or poisoning, as these patients may have a fracture present on admission.

Final Definition

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM code for **[fracture]** in any secondary diagnosis field per 100 surgical discharges.
Denominator	All **[surgical]** discharges. Exclude all patients with diseases and disorders of the musculoskeletal system and connective tissue (MDC 8). Excludes patients with principal diagnosis codes for **[seizure], [syncope], [stroke], [coma], [cardiac arrest], [anoxic brain injury], [poisoning], [delirium or other psychoses], [trauma], [minor trauma and/or physical abuse],** indication of **[alcohol or drug abuse]**, or **[self-inflicted injury].** Exclude patients with any diagnosis of **[metastatic cancer], [lymphoid malignancy]** or **[bone malignancy]**. Exclude patients 17 years of age or younger.

Post-Conference Call Panel Ratings[a]

Question	*Median*	*Agreement status*
Overall rating	8	Agreement
Not present on admission	7	Indeterminate agreement
Preventability	8	Agreement
Due to medical error	7	Indeterminate agreement
Charting by physicians	8	Agreement
Bias (lower rating is favorable)	3	Indeterminate agreement

[a]Medical Complications 1 Multi-specialty Panel

Changes to the indicator. Panelists noted the following:

In-hospital falls. Panelists expressed concern that physicians would variably report in-hospital falls. Therefore, providers who record falls less would appear to have higher quality, without actually having lower rates of falls. In addition, panelists were concerned that the definitions of "fall" may vary. Although coding conventions require that any recorded fall result in a medical intervention or injury, that intervention could be screening x-rays or other procedures. Panelists were concerned that some clinically insignificant falls would be variably reported. Overall, panelists agreed unanimously that falls should not be tracked in this indicator, and these codes were removed.

Expansion of tracked fractures. Panelists agreed that in-hospital hip fractures were severe complications that increase patient morbidity and resource consumption. Panelists also reported that many preventable falls and injuries in hospitals do not result in hip fractures, but other types of fractures, including other extremity fractures. Panelists agreed that all fractures occurring in the hospital setting were important to track. This indicator specification was expanded to include all types of fractures. (However, empirical testing of this specification revealed a disproportionate number of fractures in younger men, raising the concern that the administrative data exclusions were not adequately limiting the population at risk, as these fractures seemed more likely to occur as a result of trauma rather than in-hospital falls. Thus, it was felt that this change could not be implemented. As a result, the panel ratings, which were clearly based on the indicator measuring in-hospital fractures, would be more applicable to the “In-hospital fracture possibly related to falls” Experimental indicator which shows increasing prevalence with increasing patient age, as expected.)

Addition of exclusions. In response to the final questionnaire, panelists suggested that patients with delirium may be at higher risk for having fractures present on admission. In response, patients with a principal diagnosis of delirium were excluded from the population at risk. In addition, panelists noted that patients with lymphoma or bone cancer are at a higher risk for non-preventable fractures in-hospital. These patients were also excluded from the population at risk for both of the empirically tested indicator definitions (i.e., in-hospital hip fracture on the accepted indicator set, and in-hospital fractures possibly related to falls on the experimental indicator set).

Concerns not addressable through changes. After implementing the changes listed above, a few relatively minor concerns remained. Panelists rated this indicator very well, despite these concerns. Several panelists expressed a desire to expand the population at risk to medical

patients in addition to surgical patients. This change was not implemented based on data reported by Iezzoni et al.[15] in relation to their "In-hospital hip fracture and fall" indicator. They reported that only 11% of "flagged" cases of in-hospital hip fracture in medical patients actually represented true cases of this complication, with most of the "false positives" representing fractures that were present on admission. On the other hand, 51%-71% of "flagged" cases in surgical patients represented true occurrences of in-hospital hip fractures and falls. To minimize the number of "false positive" cases, we chose to limit this indicator to surgical patients, who are less likely to have such a fracture present on admission (given our exclusions to the population at risk).

Panelists did express that given the occurrence of an in-hospital fracture, some of these fractures may not be preventable by good quality care. Fractures may be more likely in the aged and frail population, who have weaker bones, and are more vulnerable to falls. This may result in some slight bias for this indicator for hospitals that care for more of these patients. Finally, in the effort to prevent some falls, adverse effects may occur. One panelist expressed concern that deconditioning may be a particularly dangerous side effect of efforts to reduce fractures by decreasing the mobilization of elderly patients.

Summary

Although this indicator was initially presented as "In-hospital hip fracture and fall," panelists unanimously suggested that falls should be eliminated from this indicator and that all in-hospital fractures should be included. The resulting indicator implemented both of these changes, and was termed "In-hospital fracture possibly related to falls." The exclusion of children was added after empirical analysis revealed that children did not have a substantial number of cases in the numerator. Ratings are reported for this specification. However, the “In-hospital hip fracture” indicator was selected for inclusion in the Accepted provider level indicator set, as a subset of the preferred specification of a broader group of fractures related to in-hospital falls. The more inclusive fracture indicator was retained on the Experimental indicator set because of both its potential usefulness and its need for further validation to assure restriction to the intended group of patients who likely experience in-hospital fall.

Postoperative Physiologic and Metabolic Derangements

This indicator is intended to flag cases of selected postoperative metabolic or physiologic complications. It is based on an indicator developed as part of the Complications Screening Program.[7] The population at risk is limited to elective surgical patients, as patients undergoing non-elective surgery may develop less preventable derangements. In addition, each diagnosis has specific exclusions, designed to reduce the number of flagged cases in which the diagnosis was present on admission or was more likely to be non-preventable.

Final Definition

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM codes for **[physiologic and metabolic derangements]** in any secondary diagnosis field per 100 surgical discharges. Discharges with acute renal failure (subgroup of physiologic and metabolic derangements) must be accompanied by a procedure code for dialysis (39.95, 54.98).

Denominator	All **[elective] [surgical]** discharges. Exclude patients with both a diagnosis code of ketoacidosis, hyperosmolarity or other coma (subgroups of physiologic and metabolic derangements coding) AND a principal diagnosis of **[diabetes].** Exclude patients with both a secondary diagnosis code for acute renal failure (subgroup of physiologic and metabolic derangements coding) AND a principal diagnosis of **[acute myocardial infarction], [cardiac arrhythmia], [cardiac arrest], [shock], [hemorrhage]** or **[gastrointestinal hemorrhage].** Exclude all obstetric admissions (MDC 14 and 15).

Post-Conference Call Panel Ratings[a]

Question	*Median (MS)*	*Agreement status (MS)*	*Median (S)*	*Agreement status (S)*
Overall rating	8	Indeterminate	6.8	Indeterminate
Not present on admission	7.5	Indeterminate	7	Indeterminate
Preventability	7	Indeterminate	6	Disagreement
Due to medical error	6	Indeterminate	5.3	Disagreement
Charting by physicians	7	Indeterminate	7	Indeterminate
Bias (lower rating favorable)	6	Indeterminate	3.5	Indeterminate

[a]Multi-specialty panel – Surgical Complications 3
Surgical panel – Surgical Complications 3

Multi-specialty Panel Results

Changes to the indicator. The multi-specialty panel suggested several changes to this indicator. First, they agreed that diabetic comas be added in addition to diabetic ketoacidosis. They noted that hyperosmolar coma is less clearly medical error than hypoglycemic coma, but that both should be tracked. They also supported the addition of hyponatremia to the indicator, suggesting that appropriate fluid management should prevent this complication when it is clinically severe. They conceded that both minor and major hyponatremia would be caught by this indicator, and noted that further investigation would be needed to examine only the severe cases. Finally, this panel supported the removal of shock from this indicator, noting that this diagnosis is nebulous and subject to interpretation. Thus, it is impossible to know what physiological state exactly is represented by this code.

In addition to changes in the numerator, this panel supported the limitation of the population at risk to elective surgery patients. This panel felt that only these patients could be appropriately screened and managed preoperatively in an effort to prevent these complications. Patients admitted emergently or urgently may not have the same opportunity for assessment, and thus complications in these patients may be less preventable.

Concerns not addressable through changes. Panelists noted that the coding of some metabolic and physiologic complications may be lacking. Specifically they noted that if the episode is relatively transient, such as in some cases of diabetic ketoacidosis, then the physician may not code the episode. In other cases, some physicians may be quite vigilant in recording small physiologic disturbance, such as minor oliguria, resulting in the capture of non-clinically

significant events in this indicator. Similarly, they noted that acute renal failure is a vague diagnosis, and that use of specific creatinine levels would be a better indicator of renal failure.

Surgical Panel Results

Changes to the indicator. The surgical panel suggested most of the same changes supported by the multi-specialty panel, for similar reasons, and some additional changes. Panelists supported the removal of shock and addition of diabetic comas, as well as the limitation of the population at risk to elective surgical patients. However, the panel did not support the addition of hyponatremia. They noted that most hyponatremia is clinically insignificant, and does not constitute a serious adverse event. They further argued that a diagnosis of hyponatremia represents a variety of severities and that it was impossible to distinguish easily which events were clinically significant.

Panelists expressed similar concerns about oliguria and anuria as they did about hyponatremia. They expressed that oliguria is difficult to define and in many patients difficult to prevent. The varied preventability and definitions introduce extreme bias to this indicator. For this reason, they argued that these codes be dropped from the indicator. Acute renal failure also suffers from the problem of varied definitions. What one doctor calls acute renal failure, another may not. In addition, the inclusion of this code may help to shift patients to a higher paying DRG, increasing its use artificially. To ensure that the only renal failure cases that are picked up are those that are clinically severe, this panel suggested that acute renal failure be included only when it is paired with a procedure code for dialysis.

Finally, panelists questioned the exclusion of MDC 8. This exclusion was included to exclude patients with hemodialysis who are at increased risk of developing acute renal failure which is not due to medical error. However, panelists felt that this exclusion was too broad and did not really identify patients who were at increased risk for acute renal failure after surgery which is not due to medical error.

Concerns not addressable through changes. No additional concerns were discussed during the conference call.

Summary Across Panels

The two indicators proposed by each panel differed substantially in their definitions. For this reason it was necessary to select a definition. The inclusion of hyponatremia could not adequately be specified, as it was difficult to exclude patients that are at a high risk of developing this complication. The multi-specialty panel also expressed similar concerns over oliguria and acute renal failure as the surgical panel, although they did not feel as strongly about these concerns. Because these concerns were expressed by both panels, we chose the most conservative indicator, that proposed by the surgical panel. This indicator is included in the Accepted provider level indicator set, given the high overall rating of the indicator.

This indicator includes children, which was not specifically discussed by the panel. It should be noted that the incidence of these complications is a function of the underlying prevalence of diabetes and renal impairment which are less common among children than among adults.

Postoperative Respiratory Failure

(formerly Postoperative pulmonary compromise)

This indicator is intended to flag cases of Postoperative respiratory failure, specifically respiratory failure. It is based on an indicator developed as part of the Complications Screening Program.[7] This indicator limits the code for respiratory failure to secondary diagnosis codes in order to eliminate respiratory failure that was present on admission. It further excludes patients who have major respiratory or circulatory disorders, as these patients may have respiratory failure present on admission, or may be more likely to develop such compromise after surgical procedures. This indicator also limits the population at risk to elective surgery patients, as these patients were judged to be at a lower risk for non-preventable complications.

Final Definition

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM codes for acute respiratory failure (518.81) in any secondary diagnosis field per 100 surgical discharges.
Denominator	All **[elective] [surgical]** discharges. Exclude patients with respiratory or circulatory diseases (MDC 4 and MDC 5). Exclude all obstetric admissions (MDC 14 and 15)

Post-Conference Call Panel Ratings[a]

Question	*Median (MS)*	*Agreement status (MS)*	*Median (S)*	*Agreement status (S)*
Overall rating	6.5	Indeterminate	7	Indeterminate
Not present on admission	6.5	Indeterminate	8	Agreement
Preventability	6	Indeterminate	6	Indeterminate
Due to medical error	4.5	Agreement	4	Agreement
Charting by physicians	6	Indeterminate	8	Agreement
Bias (lower rating favorable)	6	Indeterminate	6	Indeterminate

[a]Multi-specialty panel – Surgical Complications 2
Surgical panel – Surgical Complications 2

Multi-specialty Panel Results

Changes to the indicator. The panel suggested that only acute respiratory failure and acute edema of lung, unspecified be used. These complications were felt to be the only complications from the original definitions that are more likely to be preventable, and for which variations in rates might be meaningful in reference to the quality of care.

Panelists felt that the population at risk should be limited to patients undergoing elective surgical procedures, as complications in these patients were felt to be more preventable compared with non-elective surgery cases. In addition, panelists suggested that trauma patients should be excluded, as some pulmonary complications are expected in the course of treatment for trauma.

Concerns not addressable by changes. Panelists noted that this indicator is "messy," in that even with the more conservative definition, preventability of these complications in some patients is dubious. Further, panelists expressed concern that the clinical definition of these complications may vary from provider to provider.

Surgical Panel Results

Changes to the indicator. Panelists felt that only acute respiratory failure should be retained in this indicator. They noted that this is a clinically significant event that is at least partially preventable. ICD-9-CM coding guidelines state "Respiratory failure is a life-threatening disorder that requires close patient monitoring and evaluation, with aggressive management usually requiring placement of the patient in a monitored bed, aggressive respiratory therapy, and/or mechanical ventilation."[166]

Panelists felt that mechanical ventilation is a hard clinical endpoint, and thus, there would be less variation in the severity of the conditions captured by this indicator. All other codes in the original indicator definition were considered to be either less preventable or nebulous as to their clinical significance, and thus were eliminated.

The surgical panel agreed that the population at risk should be limited to elective surgical patients for similar reasons as the multi-specialty panel.

Concerns not addressable by changes. Panelists expressed concern that acute respiratory failure is affected by case mix and type of surgery. For instance, patients undergoing hepatic resections or patients that are immunocompromised or malnourished may be more likely to develop these complications. As a result, this indicator may be subject to some bias.

Summary Across Panels

Both panels rated the overall usefulness of this indicator as relatively favorable. The surgical panel proposed a more conservative indicator than the multi-specialty panel. Since it was beyond the scope of our study to inquire of the multi-specialty panel regarding the more conservative definition, the more conservative definition was retained as an Accepted provider level indicator.

Postoperative Pulmonary Embolism or Deep Venous Thrombosis

This indicator is intended to flag cases of postoperative venous thromboses and embolism, specifically pulmonary embolism (PE) and deep venous thromobosis (DVT). It is closely related to an indicator developed as part of the Complications Screening Program.[7] This indicator limits vascular complications codes to secondary diagnosis codes in order to eliminate complications that were present on admission. It further excludes patients who have principal diagnosis of DVT, as these patients are likely to have had PE/DVT present on admission.

Final Definition

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM codes for **[deep vein thrombosis]** or **[pulmonary embolism]** in any secondary diagnosis field per 100 surgical discharges.
Denominator	All **[surgical]** discharges. Exclude patients with a principal diagnosis of **[deep vein thrombosis].** Exclude all obstetric admissions (MDC 14 and 15). Exclude patients with secondary procedure code 38.7 when this procedure occurs on the day of or previous to the day of the principal procedure.

Panelists suggested that this indicator be reported for PE and DVT separately. Thus, this indicator would be reported by the software as three rates - the overall thromboembolism rate, the PE rate, and the DVT rate (all other codes). Panelists felt that the reporting of PE and DVT separately would allow users to distinguish rates which may be higher than expected due to routine postoperative screening for DVT, or other differences in diagnostic methods.

Post-Conference Call Panel Ratings[a]

Question	***Median (MS)***	***Agreement status (MS)***	***Median (S)***	***Agreement status (S)***
Overall rating	7	Indeterminate	7	Agreement
Not present on admission	7	Indeterminate	7	Agreement
Preventability	7	Indeterminate	6	Disagreement
Due to medical error	6	Indeterminate	3	Indeterminate
Charting by physicians	7	Indeterminate	7	Indeterminate
Bias (lower rating favorable)	5	Indeterminate	6.5	Indeterminate

[a]Multi-specialty panel – Surgical Complications 1
Surgical Panel – Surgical Complications 1

Multi-specialty Panel Results

Changes to the indicator. Panelists expressed concern about the code for venous embolism, and thrombosis of the vena cava. Panelists felt that these complications were not preventable through the same mechanisms as the other diagnoses included in the definition (e.g., pulmonary embolism, phlebitis and thrombophlebitis, femoral vein or other deep vessels, etc.). Although some vena cava thromboses may result from intra vena cava (IVC) filters, the panel was concerned that the pathophysiology of thrombosis in this setting is quite different, and that the decision to place an IVC involves a difficult balancing of risks and benefits. For this reason the code for venous embolism of thrombosis of the vena cava was removed from the definition of this indicator.

Concerns not addressable through changes. There were no other additional concerns regarding this indicator expressed during the conference call.

Surgical Panel Results

Changes to the indicator. This panel expressed concerns regarding the code for phlebitis for venous embolism and thrombosis of the vena cava. They felt that the data on IVC filters were still inconclusive and that venous embolism and thrombosis of the vena cava represented a different type of complication than the other codes. They recommended that the code for venous embolism of thrombosis of the vena cava be deleted from the indicator definition.

Panelists were concerned that reporting pulmonary embolism and deep venous thrombosis together may be misleading. Panelists noted that, although in many cases pulmonary embolism and deep venous thrombosis are simply different manifestations of the same complication, deep vein thrombosis is reported more variably. Several panelists noted that some hospitals routinely screen patients for deep vein thrombosis, while others do not. In addition, deep vein thrombosis is diagnosed by various methods. While some providers require ultrasound verification, others require clinical symptoms in order to diagnose deep vein thrombosis. These differences in diagnosis may lead to bias for this indicator. For this reason, panelists suggested that this indicator include reporting of three rates: the overall thrombosis embolism and the pulmonary embolism rate together, the pulmonary embolism rate alone, and the deep vein thrombosis embolism rate alone. This suggestion will be incorporated into the final software for this indicator.

Concerns not addressable through changes. It is widely documented that the risk for DVT/PE varies greatly according to the type of procedure performed. As clotting is more common in peripheral orthopedic procedures, these surgeries have a higher postoperative vascular complication rate than other types of surgeries. Panelists noted, that because of this difference in underlying risk for deep vein thrombosis or pulmonary embolism, that this indicator should be adjusted or stratified according to surgical procedure types. Panelists also noted that despite varying causes for developing DVT/PE that preventative techniques currently exist and the proper use of these techniques should reduce the rate of venous thrombosis or pulmonary embolism. Panelists did note that the literature surrounding preventative techniques is limited to deep vein thrombosis and may or may not be generalized to pulmonary embolism.

Summary Across Panels

Both panels rated the overall usefulness of this indicator relatively highly as compared to other indicators. Panelists expressed interest in tracking for the DVT/PE in surgical patients. They noted that preventative techniques should decrease the rate of this indicator. Both recommended the same changes to the indicator. The surgical panel also suggested reporting of pulmonary embolism and deep vein thrombosis separately in the software. This indicator was retained in the Accepted provider level indicator set.

This indicator includes children, which was not specifically discussed by our panelists. It should be noted that in the absence of specific thrombophilic disorders, postoperative thromboembolic complications in children are most likely to be secondary to venous catheters rather than venous stasis in the lower extremities.

Postoperative Sepsis

This indicator is intended to flag cases of nosocomial Postoperative sepsis. It is closely related to a complications indicator developed as part of the Complications Screening Program.[7] In order to better screen out cases of sepsis that are present on admission this indicator limits its definition of sepsis to secondary diagnoses (meaning sepsis was not labeled as the principal diagnosis). In addition this indicator excludes patients that have principal diagnoses of infection, as it is likely that these patients may have developed sepsis due to these infections, and patients which had a length of stay less than 3 days, as it is unlikely that nosocomial sepsis may have developed in such a short time. This indicator limits the population at risk to patients only with certain medical conditions, as these patients are not at as high a risk for sepsis as other patients (e.g., patients that have undergone procedures of a contaminated structure). Finally, this indicator excludes patients who are particularly susceptible to non-preventable sepsis, namely patients with potential immunocompromised states (e.g., Acquired Immune Deficiency Syndrome (AIDS), cancer, transplant).

Final Definition

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM code for **[sepsis]** in any secondary diagnosis field per 100 discharges in the population at risk.
Denominator	All **[elective] [surgical]** discharges. Exclude patients with a principal diagnosis of **[infection],** or any code for **[immunocompromised]** state, or **[cancer].** Include only patients with a length of stay of more than three days. Exclude all obstetric admissions (MDC 14 and 15).

Post-Conference Call Panel Ratings[a]

Question	***Median***	***Agreement status***
Overall rating	8	Indeterminate agreement
Not present on admission	8	Agreement
Preventability	6.5	Agreement
Due to medical error	6	Indeterminate agreement
Charting by physicians	8	Agreement
Bias (lower rating is favorable)	3	Indeterminate agreement

[a] Medical Complications 1 Multi-specialty Panel

Changes to the indicator. The original definition of this indicator, based on Iezzoni et al.'s CSP,[7] limited the population at risk to patients in certain MDCs and DRGs for which it was judged that sepsis would be a potentially preventable complication. Panelists felt that this population at risk was too broad, and may include patients that either had sepsis present on admission, or patients with conditions predisposing patients to sepsis. In addition, this definition excluded some patients for which sepsis would be preventable. Panelists agreed that limiting this indicator to all surgery patients undergoing elective surgery was a better way to capture patients

for which sepsis is a potentially preventable complication, primarily through pre-surgical screening and appropriate prophylactic therapy.

Concerns not addressable through changes. Panelists expressed few additional concerns regarding this indicator during the conference call and the subsequent evaluation. Some concern was expressed over the varying clinical definitions of "sepsis." Providers may have different thresholds and methods of diagnosing a patient as septic, leading to some bias for this indicator. Some panelists also expressed that this complication was less of a concern than other complications rated, and that it would be very rare in the population at risk. Finally, two panelists expressed concern about increased inappropriate antibiotic use resulting from the implementation of this indicator.

Summary

Panelists rated the overall usefulness of this indicator favorably, although they were less sure that this complication was reflective of medical error. Given the overall rating, this indicator was retained in the Accepted provider level indicator set.

This indicator includes children, which was not specifically discussed by the panel. It should be noted that high-risk neonates are at particularly high risk for catheter-related infections.

Postoperative Wound Dehiscence in Abdominopelvic Surgical Patients

This indicator is intended to flag cases of wound dehiscence in patients who have undergone abdominal and pelvic surgery. The area level indicator is intended to capture all cases of wound dehiscence, not only those occurring in-hospital. The hospital level indicator is restricted to secondary diagnoses, and is intended to capture cases occurring during the same hospitalization.

Final Definition

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM codes for reclosure of postoperative disruption of abdominal wall (54.61) in any secondary procedure field per 100 discharges.
Denominator	All **[abdominopelvic]** surgical discharges. Exclude all obstetric admissions (MDC 14 and 15).

Post-Conference Call Panel Ratings[a]

Question	***Median (MS)***	***Agreement status (MS)***	***Median (S)***	***Agreement status (S)***
Overall rating	7.5	Indeterminate	7	Indeterminate
Not present on admission	7.5	Indeterminate	8	Agreement
Preventability	6	Agreement	7	Indeterminate
Due to medical error	6	Agreement	5	Indeterminate
Charting by physicians	7	Agreement	8	Indeterminate
Bias (lower rating favorable)	4	Indeterminate	7	Indeterminate

[a]Multi-specialty panel – Surgical Complications 2
Surgical panel – Surgical Complications 2

Multi-specialty Panel Results

Changes to the indicator. Panelists felt that the diagnosis code for postoperative wound disruption would include both minor and severe wound dehiscence, without a means of distinguishing between the two. Panelists felt that a majority would be clinically insignificant minor dehiscences, and preferred to limit the indicator to cases in which a procedure was performed.

Panelists felt that cancer patients should not be excluded, as most of these patients are not at a significant increased risk for the development of non-preventable wound dehiscence.

Concerns not addressable by changes. Panelists reported that the risk of developing wound dehiscence varies with patient factors such as age and comorbidities. If these factors varied systematically by institution, this indicator could be subject to some bias.

Surgical Panel Results

Changes to the indicator. Panelists suggested the removal of the diagnosis code for postoperative wound disruption for similar reasons as the multi-specialty panel. As a result, the only code left was limited to abdominal and pelvic surgical patients, and the population at risk was modified to reflect this.

The surgical panel suggested that trauma, cancer, and immunocompromised patients be included as they were interested in tracking these patients, and felt that these patients would not add a sufficient amount of false positives to raise concern. These groups could be examined more closely on further evaluation of this indicator.

Concerns not addressable by changes. Like the multi-specialty panel, the surgical panel noted that patient health is an important factor underlying the risk of developing postoperative wound dehiscence. Patients with comorbidities and older patients may be at higher risk.

Summary Across Panels

Both panels suggested similar indicators, although the surgical panel suggested that the indicator include trauma, cancer, and immunocompromised patients. The surgical panel definition was retained in the Accepted provider level indicator set. An area level analog of this indicator was included in the Accepted area level indicator set.

Technical Difficulty With Procedure

This indicator is intended to flag cases of complications that arise due to technical difficulties in medical care, specifically those involving an accidental puncture or laceration. It is based on an indicator developed as part of the Complications Screening Program.[7]

Final Definition

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM code denoting **[technical difficulty]** (e.g., accidental cut, puncture, perforation or laceration during a procedure) in any secondary diagnosis field per 100 discharges.
Denominator	All **[medical]** and **[surgical]** discharges. Exclude all obstetric admissions (MDC 14 and 15).

Post-Conference Call Panel Ratings[a]

Question	*Median*	*Agreement status*
Overall rating	7	Agreement
Not present on admission	8	Agreement
Preventability	7	Agreement
Due to medical error	6	Indeterminate agreement
Charting by physicians	6	Indeterminate agreement
Bias (lower rating is favorable)	5	Indeterminate agreement

[a] Procedural Complications 1 Multi-specialty Panel

Changes to the indicator. The original definition of this indicator included several complications that could arise from difficulty in performing a procedure, including failure of sterile precautions, performance of an inappropriate operation, emphysema arising from a procedure, cataract fragments in the eye following cataract surgery, and air embolism. However, panelists felt that most of these codes were of questionable clinical significance, variably reported, and not of interest for inclusion in this indicator. As a result, panelists suggested retaining only the two codes for accidental puncture, cut, perforation or hemorrhage during a procedure.

Concerns not addressable through changes. Panelists noted that even with the retained codes, reporting is likely to be variable. Some panelists felt that only major situations are likely to be coded, and that this may be appropriate. However, it is unclear how the culture of quality improvement in a hospital would affect the coding of this complication. Some physicians may be reluctant to record the occurrence of this complication for fear of punishment. Panelists also noted that some of these occurrences are not preventable. However, panelists noted that a high rate may be indicative of poor quality of care.

Summary

Panelists rated the overall usefulness of this indicator favorably, although they were less sure that this complication was reflective of medical error. Given the overall rating, this indicator was retained in the Accepted provider level indicator set.

This indicator includes children, which was not specifically discussed by the panel. It should be noted that the smaller anatomy of children may increase the technical complexity of procedures.

Transfusion Reaction

This indicator is intended to flag cases of major reactions due to transfusions (ABO and Rh). The area level indicator is intended to capture all cases of transfusion reactions, not only those occurring in-hospital. The hospital level indicator is restricted to patients who have a secondary diagnosis of transfusion reaction, as is intended to flag cases occurring during hospitalization.

Final Definition

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM codes for **[transfusion reaction]** in any secondary diagnosis field per 100 discharges.
Denominator	All **[medical]** and **[surgical]** discharges.

Post-Conference Call Panel Ratings[a]

Question	*Median (MS)*	*Agreement status (MS)*	*Median (S)*	*Agreement status (S)*
Overall rating	8	Agreement	7.8	Agreement
Not present on admission	7	Agreement	7.5	Agreement
Preventability	7	Disagreement	8	Indeterminate
Due to medical error	7	Indeterminate	5.3	Disagreement
Charting by physicians	8	Indeterminate	7.5	Agreement
Bias (lower rating favorable)	6	Disagreement	2.5	Agreement

[a]Multi-specialty Panel – Surgical Complications 3
Surgical Panel – Surgical Complications 3

Multi-specialty Panel Results

Changes to the indicator. Panelists expressed concern that the code 999.8, "other transfusion reaction," was nebulous and may include reactions caused by minor antigens in patients with complex hematologic histories who may have been sensitized by multiple prior transfusions. These complications were seen as less preventable than Rh or ABO incompatability reactions, and clinically different. For this reason this panel suggested that this code be removed from this indicator.

Panelists also noted that while trauma patients may be at higher risk for developing transfusion reactions, as it may be occasionally appropriate to use blood without cross-matching, reactions in these patients should be monitored and may be preventable. For this reason panelists suggested that trauma patients be added to the population at risk, but that this subgroup should be examined closely.

Concerns not addressable through changes. No other concerns were reported by this panel.

Surgical Panel Results

Changes to the indicator. The surgical panel suggested the same changes to this indicator as the multi-specialty panel for similar reasons.

Concerns not addressable through changes. No other concerns were reported by this panel.

Summary Across Panels

Both panels rated the overall usefulness of this indicator highly and suggested similar changes to the definition. The indicator is part of the Accepted provider level indicator set. An area level analog of this indicator was included in the Accepted area level indicator set.

This indicator only includes those events which actually result in additional medical care. Thus, near misses and errors in which no harm or little harm results are not included in this indicator. Some minor reactions may be missed, although the panel suggested that these minor reactions are less clearly due to medical error than the Rh or ABO reactions included in the indicator.

Accepted Obstetric Indicators

Birth Trauma – Injury to Neonate

This indicator is intended to flag cases of birth trauma for infants born alive in a hospital. It excludes patients born pre-term, as birth trauma in these patients may be less preventable than for full-term infants.

Final Definition

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM codes for **[birth trauma]** in any diagnosis field per 100 liveborn births.
Denominator	All **[liveborn]** infants. Exclude infants with a subdural or cerebral hemorrhage (subgroup of birth trauma coding) AND any diagnosis code of **[pre-term infant]** (denoting a birth weight of less than 2,500 g and less than 37 weeks gestation). Exclude infants with injury to skeleton (767.3, 767.4) AND any diagnosis code of osteogenesis imperfecta (756.51).

Post-Conference Call Panel Ratings[a]

Question	*Median*	*Agreement status*
Overall rating	8	Agreement
Not present on admission	8	Agreement
Preventability	7	Indeterminate agreement
Due to medical error	6	Disagreement
Charting by physicians	7	Indeterminate agreement
Bias (lower rating is favorable)	4	Indeterminate agreement

[a] Obstetric Complications of Delivery 1 Panel

Changes to the indicator. Panelists felt that injury to the brachial plexus often includes injuries that are transient and minor, and therefore may be reported variably. Thus, they suggested removing this code.

Panelists suggested two specific exclusions. First, they suggested that pre-term infants with low birth weight be excluded from the population at risk for intracranial hemorrhage, due to concern that some of these injuries would not be preventable in pre-term infants, who have very fragile bridging veins and may also be at risk for hypoxic injury. Second, they suggested that infants with osteogenesis imperfecta be excluded from the population at risk for injury to skeleton, as these complications are not preventable in these infants.

Concerns not addressable through changes. Panelists noted that some infants are prone to birth injuries, such as babies with shoulder dystocia or large babies. Panelists suggested that predicting these types of deliveries is difficult, and such complications in these babies are often not preventable. Panelists also felt that patients with no or little prenatal care should be treated differently than those with prenatal care. However, these patients cannot be accurately identified using administrative data.

Summary

Panelists felt that this indicator was very useful. Although it may not indicate medical error, it does capture potentially preventable complications. It should be noted that panelists were particularly conflicted about the ability of this indicator to detect medical error, with some panelists feeling that it clearly does and others that it clearly does not. Given the relatively high overall rating, this indicator was retained as part of the Accepted provider level indicator set.

Obstetric Trauma (All Delivery Types Reviewed in One Indicator)

This indicator is intended to flag cases of potentially preventable trauma during delivery in women delivering during the index hospitalization.

Final Definition: Obstetric Trauma - Vaginal With Instrument

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM codes for **[obstetric trauma]** in any diagnosis or procedure field per 100 instrument assisted vaginal deliveries.
Denominator	All **[vaginal delivery]** discharges with any procedure code for **[instrument assisted delivery]**.

Final Definition: Obstetric Trauma - Vaginal Without Instrument

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM codes for **[obstetric trauma]** in any diagnosis or procedure field per 100 instrument assisted vaginal deliveries.
Denominator	All **[vaginal delivery]** discharges. Exclude **[instrument assisted delivery].**

Final Definition: Obstetric Trauma - Cesarean Section

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM codes for **[obstetric trauma]** in any diagnosis or procedure field per 100 cesarean deliveries.
Denominator	All **[cesarean delivery]** discharges.

Post-Conference Call Panel Ratings[a]

Question	***Median***	***Agreement status***
Overall rating	7	Indeterminate agreement
Not present on admission	Not applicable	Not applicable
Preventability	7	Agreement
Due to medical error	5	Disagreement
Charting by physicians	8	Agreement
Bias (lower rating is favorable)	4	Indeterminate agreement

[a] Obstetric Complications of Delivery 1 Panel

Changes to the indicator. The original definition of this indicator included both 3rd and 4th degree lacerations. Panelists, citing some evidence, felt that 3rd degree lacerations are variably reported, and thus rates would be more reflective of reporting than of the actual rate. If reporting were standardized, panelists were interested in retaining 3rd degree lacerations, but as standardization cannot be guaranteed with administrative data, this indicator was limited to 4th degree lacerations as well as other major lacerations.

Panelists noted that the risk of trauma varies substantially by delivery type, and that indications for different modes of delivery may vary systematically between hospitals. Thus, panelists suggested that this indicator be split into 3 different indicators – vaginal delivery without instrument, instrument assisted delivery, and cesarean section.

Concerns not addressable through changes. Panelists noted that while this indicator is of use (with one panelist dissenting), it is not a pure indicator of medical error. Many cases of trauma will not be preventable, but an unusually high rate would be worth investigating for potential quality problems. Specifically, panelists noted that overuse of episiotomy, may be associated with high rates of obstetrical trauma.

Panelists noted that the obstetrical trauma rate is best interpreted in the context of additional data. Notably, since providers may shift more patients to cesarean sections rather than perform instrument assisted deliveries, which may increase trauma rates, a provider's cesarean section rate should be monitored simultaneously. In addition, providers may want to interpret this indicator in the context of epidural anesthesia rate and perinatal mortality.

Summary

Panelists rated the overall usefulness of this indicator favorably, although they suggested that this indicator be stratified. Panelists rated this indicator as one entity, although it was eventually split into three indicators: vaginal delivery with instrument, vaginal delivery without instrument, and cesarean section. Given the high overall rating, all three indicators were retained as part of the Accepted provider level indicator set. Also, a JCAHO 3rd and 4th degree laceration indicator was tested in the empirical analyses as part of the Experimental indicator set.

Experimental Indicators

Aspiration Pneumonia

This indicator is intended to flag cases of perioperative aspiration pneumonia. It is based on an indicator developed as part of the Complications Screening Program,[7] although this indicator adds two "E-codes". This indicator limits aspiration pneumonia codes to secondary diagnosis codes in order to eliminate aspiration pneumonia that was present on admission. It further excludes patients with a primary diagnosis of seizure, trauma, drug overdose or poisoning, as these patients may have aspiration pneumonia or a precursor condition present on admission.

Final Definition

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM codes for **[aspiration pneumonia]** in any secondary diagnosis field per 100 surgical discharges.
Denominator	All **[elective] [surgical]** discharges. Exclude patients with a principal diagnosis of **[seizure]**, **[trauma]**, **[drug overdose]**, or **[poisoning]**. Exclude all obstetric admissions (MDC 14 and 15).

Post-Conference Call Panel Ratings[a]

Question	*Median (MS)*	*Agreement status (MS)*	*Median (S)*	*Agreement status (S)*
Overall rating	6	Indeterminate	6.5	Indeterminate
Not present on admission	7	Agreement	8	Indeterminate
Preventability	6	Indeterminate	6	Indeterminate
Due to medical error	6	Disagreement	5.3	Indeterminate
Charting by physicians	7	Indeterminate	5.3	Agreement
Bias (lower rating favorable)	5	Indeterminate	3	Indeterminate

[a]Multi-specialty panel – Surgical Complications 3
Surgical panel – Surgical Complications 3

Multi-specialty Panel Results

Changes to the indicator. The panel suggested that the population at risk may be too broad, as patients undergoing emergent or urgent surgery may not have adequate time before surgery to screen patients for risk factors, including having food matter in the stomach. These patients are more susceptible to aspirating perioperatively. For this reason, this panel suggested the population at risk be limited to patients undergoing elective surgery only.

Concerns not addressable through changes. Panelists expressed concern about the diagnosis of this complication. Different physicians diagnose pneumonia differently, with some relying on clinical factors such as chest x-ray and sputum analysis, and others requiring broncoscopy to verify the diagnosis. In addition, some physicians may not label the pneumonia as due to "aspiration" but simply as pneumonia. Panelists noted that such differences may lead to bias for this indicator.

Panelists also noted that the preventability of aspiration pneumonia varies depending on the timing of the aspiration. Aspirations occurring during surgery and in the recovery room are often preventable using preoperative interventions. Pneumonia resulting from these aspirations may be further preventable through administration of medications peri-operatively. However, aspirations that occur later in a hospitalization, for instance in an intensive care unit while a patient is intubated, are less preventable. Because it is impossible to distinguish the timing of the complication using administrative data, this concern cannot be addressed through changes to the indicator definition.

Surgical Panel Results

Changes to the indicator. The surgical panel suggested limiting the population at risk to patients undergoing elective surgery for similar reasons as the multi-specialty panel. They also added that even with the exclusions of trauma, seizure, drug overdose and poisoning patients that it is impossible to tell whether patients admitted emergently or urgently aspirated before admission or perioperatively.

Concerns not addressable through changes. The surgical panel also expressed concern regarding the diagnosis of aspiration pneumonia for similar reasons as the multi-specialty panel. Also like the multi-specialty panel, the surgical panel expressed concern about the varied preventability of this complication. They suggested, in addition, that the timing of the aspiration be tracked carefully, if at all possible. They expanded that elderly and highly medicated patients are more likely to aspirate later in a hospitalization.

Summary Across Panels

Both panels expressed equivocation about this indicator. While the idea of tracking preventable aspiration pneumonia was of interest, the panels expressed skepticism about whether or not it can be done with administrative data. Both panels suggested the same revisions to this indicator, which are incorporated in the definition of this indicator. The overall rating of this indicator did not meet criteria for full acceptance, and thus this indicator was retained only in the Experimental indicator set.

CABG Following PTCA

This indicator is intended to flag cases where CABG follows a PTCA in the same hospitalization, presumably due to complications of that procedure. This indicator was adapted from several published studies, which used CABG after PTCA to examine operator proficiency in relation to procedure volume. [127-134, 160]

Final Definition

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM codes for **[CABG]** in any procedure field per 100 discharges with PTCA in any procedure field. CABG must occur on the same day or the day after the PTCA procedure.
Denominator	All discharges with ICD-9-CM code for **[PTCA]** in any procedure field.

Post-Conference Call Panel Ratings[a]

Question	***Median***	***Agreement status***
Overall rating	7	Agreement
Not present on admission	Not reported	Not reported
Preventability	Not reported	Not reported
Due to medical error	Not reported	Not reported
Charting by physicians	Not reported	Not reported
Bias (lower rating is favorable)	Not reported	Not reported

[a]Procedural Complication 1 Multi-specialty Panel

Summary

Overall this indicator was rated as useful, although the panelists were interested in having more cardiologists consulted. The only cardiologist on the panel rated the indicator as very poor. As the other panelists do not perform or care for PTCA patients, and since we were unable to review this indicator with a panel of cardiologists, we assigned this indicator as to the Experimental indicator set, requiring further review. The remaining results from the multi-specialty panel are not reported due to panelists' concerns about rating this indicator.

The denominator for this indicator includes children that receive PTCA, however, this is rare, except in the setting of underlying coronary artery anomalies or cardiac transplantation.

Decubitus Ulcer in High Risk Patients

(See "Decubitus ulcer" in Accepted indicators section. This Experimental indicator was not rated by panelists.)

In-Hospital Fractures Possibly Related to Falls

(See "In-hospital hip fracture" in Accepted indicators section.)

Intraoperative Physical Injuries

(Re-named to: "Intraoperative nerve compression injuries," after exclusion of corneal abrasions and lip lacerations)

This indicator is intended to flag cases of minor physical trauma caused by the handling of patients in the peri-operative period, particularly the unconscious and/or anesthetized patient. Trauma patients are excluded as these patients may have such complications on admission.

Final Definition

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM code for **[nerve compression injuries]** AND a diagnosis code of 997.09 in any secondary diagnosis field per 100 surgical discharges.
Denominator	All **[surgical]** discharges. Exclude patients with a principal diagnosis of **[trauma].** Exclude patients with a principal diagnosis of **[disorders of the peripheral nervous system]** or **[dorsopathies].**

Post-Conference Call Panel Ratings[a]

Question	***Median (MS)***	***Agreement status (MS)***	***Median (S)***	***Agreement status (S)***
Overall rating	8	Agreement	8	Agreement
Not present on admission	7	Agreement	8	Agreement
Preventability	8	Agreement	8	Agreement
Due to medical error	7	Agreement	5	Disagreement
Charting by physicians	7	Agreement	5	Indeterminate
Bias (lower rating favorable)	5	Disagreement	4	Indeterminate

[a]Multi-specialty panel – Surgical Complications 3
Surgical panel – Surgical Complications 1

Multi-specialty Panel Results

This indicator was suggested by the multi-specialty panel in lieu of the complications of anesthesia. It was not rated in the initial evaluation, and was briefly discussed for operationalization reasons during the conference call. The panelists suggested that lip lacerations, corneal abrasions and brachial plexopathy be used as complications of surgery.

Surgical Panel Results

Changes to the indicator. The surgical panel felt that superficial injuries to the cornea were not of interest to track, as they are temporary and clinically less significant injuries. In addition, this panel suggested that potentially minor lip lacerations be eliminated, leading to the elimination of the code for uncomplicated open wound to the lip.

The surgical panel suggested that additional nerve compression injuries, such as injuries to the ulnar nerve, as they felt that these injuries are important to track as well.

Concerns not addressable through changes. Panelists felt that if these injuries could be accurately detected, it would be of great interest to track. They noted that these injuries, while they often resolve, are distressing to patients, and rather preventable. Panelists did suggest however, that some of these injuries would not be reliably charted by the physician.

Summary Across Panels

Both panels agreed that the indicator captured complications that affected the patient, and that were likely to be preventable with careful patient handling. The indicator was slated for the Accepted indicator set, but further information about specification based on coding input raised concerns. For example, lip laceration could not be reliably detected through administrative data, leading to the renaming of this indicator to better reflect the remaining codes, nerve compression injuries. In addition, corneal abrasions were included in the specification rated by the panelists, but ophthalmology specialists would need to be consulted to assess the face validity of including this complication. Concerns about charting from the panelists, along with coding conventions related to a relatively new pertinent code used in the indicator (997.09) resulted in demoting the indicator to the Experimental indicator set.

Recent evidence has suggested that patient factors, such as previous subclinical nerve dysfunction, may play a large role in nerve compression injuries.[167] In exploring this indicator, attention should be paid to the potential preventability of these complications. In addition, these conditions are much less common among children than among adults.

Malignant Hyperthermia

This indicator is intended to flag cases of malignant hyperthermia. Cases of trauma are excluded, as these patients may be more susceptible to complications.

Final Definition

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM codes for malignant hyperthermia (995.86) in any diagnosis field per 100 surgical discharges.
Denominator	All **[surgical]** discharges. Exclude all obstetric admissions (MDC 14 and 15).

Post-Conference Call Panel Ratings[a]

Question	*Median (MS)*	*Agreement status (MS)*	*Median (S)*	*Agreement status (S)*
Overall rating	7	Agreement	7.5	Indeterminate
Not present on admission	8	Agreement	8.8	Agreement
Preventability	7	Indeterminate	5.5	Indeterminate
Due to medical error	6	Disagreement	3.3	Indeterminate
Charting by physicians	8	Agreement	8.5	Agreement
Bias (lower rating favorable)	2	Agreement	1.5	Agreement

[a]Multi-specialty panel – Surgical Complications 3
Surgical panel – Surgical Complications 3

Multi-specialty Panel Results

Changes to the indicator. No changes were suggested for this indicator.

Concerns not addressable through changes. This indicator was created by the panel during the conference call. As a result panelists only commented on this indicator through written comments. Some panelists noted that this complication is only preventable if a family or personal history of malignant hyperthermia is detected preoperatively. If the question is not asked, or the history ignored, then the complication is undoubtedly due to medical error. However, when the family history is not known or reported by the patient when asked, then the complication is not preventable. Therefore, this rare complication would need to be examined on a case by case basis.

Surgical Panel Results

Changes to the indicator. No changes were suggested for this indicator.

Concerns not addressable through changes. Panelists expressed similar concern about two opposing aspects of this indicator, with the complication almost entirely preventable or impossible to prevent based on prior knowledge of family history. They also noted that this rare complication must be considered on a case by case basis.

Panelists also noted that a more appropriate denominator would be all procedures in which anesthesia is used. However, it is impossible to define the denominator as all procedures with anesthesia using administrative data. Thus some complications may be missed, as a result of limiting the population at risk to surgical cases.

Summary Across Panels

The overall usefulness of this indicator was rated relatively highly by both panels, with the caveat that some cases are not entirely preventable. Panelists appeared to have conflicting

opinions about this indicator, although the final rating did not reflect disagreement. While most panelists agreed that when a family history is known and proper screening and/or preventative measures are not taken, that this is a clearly preventable complication. However, the frequency of this complication occurring under those circumstances is likely to be rare. More frequently, a family history is unknown or unclear, and in these cases there is no link to quality of care. It has been suggested that death due to malignant hyperthermia may be a better measure than malignant hyperthermia alone, however, this idea was not reviewed by the panels, nor empirically examined. This code was implemented in 1998, and thus this indicator could not be analyzed empirically using available data. For this reason this indicator was assigned to the Experimental indicator set.

Postoperative Acute Myocardial Infarction (AMI)

This indicator is intended to flag cases of postoperative AMI. It is similar to an indicator developed as part of the Complications Screening Program.[7] Codes denoting a "subsequent episode of care" for AMI are not included. This indicator limits AMI codes to secondary diagnosis codes in order to eliminate AMIs that were present on admission. It includes only patients undergoing elective surgery, and excludes patients who are undergoing cardiac surgery, as these patients may be more likely to develop an AMI perioperatively.

Final Definition

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM codes for **[Acute Myocardial Infarction]** in any secondary diagnosis field per 100 non-cardiac surgical discharges.
Denominator	**[Elective]**, **[surgical]** discharges. Exclude patients undergoing **[cardiac surgery]**. Exclude all obstetric admissions (MDC 14 and 15).

Post-Conference Call Panel Ratings[a]

Question	*Median (MS)*	*Agreement status (MS)*	*Median (S)*	*Agreement status (S)*
Overall rating	4	Indeterminate	7	Indeterminate
Not present on admission	7	Indeterminate	8	Agreement
Preventability	5	Indeterminate	6	Disagreement
Due to medical error	4	Indeterminate	5	Indeterminate
Charting by physicians	7	Indeterminate	8	Agreement
Bias (lower rating favorable)	5	Disagreement	6	Indeterminate

[a]Multi-specialty panel – Surgical Complications 1
Surgical panel – Surgical Complications 1

Multi-specialty Panel Results

Changes to the indicator. Panelists felt that the risk of acute myocardial infarction varies greatly depending on the comorbidities of the patient, the type of procedure, and the

urgency of the procedure. While preventative interventions (e.g., use of beta-blockers in high risk patients) may decrease the postoperative AMI rate, these interventions may be impossible to implement for urgent cases, where there is not adequate time for appropriate screening and risk stratification. In addition, beta-blockers may be inappropriate for trauma patients. Due to these concerns, the panel felt it was best to limit the population at risk to elective surgical patients, who could be appropriately assessed before surgery.

Concerns not addressable through changes. Panelists expressed concerns over the preventability of this complication in some patients. Some patients may be appropriately screened, and assessed, but may have some risk factors. However, the benefits of surgery may outweigh the risk of AMI. Panelists advocated that some established algorithms of AMI risk, such as that adopted by the American Society of Anesthesiologists, may be helpful in appropriately risk adjusting this indicator. However, the clinical detail required for these algorithms is not available in administrative data. As a result, this panel strongly encouraged the use of this indicator only for internal reporting, noting the caveat that many AMIs may not have been preventable. Some panelists felt that examining the appropriate use of beta-blockers directly would be a more appropriate indicator.

In addition to the known risk factors in patients, unknown coronary artery disease may predispose a patient to having a non-preventable postoperative AMI.

Surgical Panel Results

Changes to the indicator. The surgical panel questioned the exclusion of MDC 5, as this MDC included vascular surgery patients. Unlike patients undergoing cardiac surgery, for whom it is difficult to establish whether or not an AMI actually occurred, AMI in vascular patients can be established. Panelists felt that vascular surgery patients were an important population at risk for this complication, and thus should not be excluded. The exclusion of MDC 5 was removed, and cardiac surgery patients were excluded using the existing exclusion criteria based on DRGs and ICD-9-CM codes.

The surgical panel advocated for the limitation of the population at risk to elective surgery for similar reasons as the multi-specialty panel. However, they noted that many of the AMIs in this risk group would not be preventable, since they would be unexpected.

Concerns not addressable through changes. The surgical panel also expressed concern over the variable preventability of this complication. They noted that the preventability of this complication depends on the risk factors of the patient. Interventions exist to reduce the chance of AMI in patients with known cardiac artery disease. However, some patients may have unknown disease, or other unknown risk factors. These patients could not receive preventative interventions. In addition, the panel noted that older patients are at higher risk, and advocated for stratification of older patients.

Summary Across Panels

The two panels reached different conclusions regarding the usefulness of this indicator (i.e., rejected by multi-specialty panel, accepted by surgical panel). Neither panel was considered to carry more weight because of their unique knowledge of the complication. As a result, the panel scoring was combined, which resulted in this indicator being assigned to the Experimental indicator set. In addition, the multi-specialty panel did not discuss the removal of the exclusion

of MDC 5. However, the objection to the exclusion appeared clinically sound. For this reason it was retained in the final definition.

Many patients experiencing postoperative AMI have pre-existing subclinical or clinical coronary artery disease. These diseases are rare in children.

Postoperative Iatrogenic Complications

(All complications reviewed in one indicator)

This indicator is intended to flag cases of postoperative iatrogenic complications. It is closely related to an indicator developed as part of the Complications Screening Program.[7] This indicator limits complication codes to secondary diagnosis codes in order to eliminate complications that were present on admission.

Final Definition: Postoperative Iatrogenic Complications - Nervous System Complications

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM codes of **[iatrogenic nervous system complications]** in any secondary diagnosis field per 100 surgical discharges.
Denominator	All **[surgical]** discharges. Exclude all obstetric admissions (MDC 14 and 15).

Final Definition: Postoperative Iatrogenic Complications - Cardiac Complications

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM codes of 997.1 in any secondary diagnosis field per 100 surgical discharges.
Denominator	All **[surgical]** discharges. Exclude all obstetric admissions (MDC 14 and 15).

Final Definition: Postoperative Iatrogenic Complications –Digestive System Complications

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Secondary dx codes of iatrogenic complication of digestive system (997.4)
Denominator	**[Surgical]** patients

Final Definition: Postoperative Iatrogenic Complications – Respiratory Complications

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Secondary dx code of iatrogenic complication of respiratory system (997.3)
Denominator	**[Surgical]** patients

Final Definition: Postoperative Iatrogenic Complications – Urinary Complications

Quality Measure	**Number of events per 100 discharges of population at risk**
Numerator	Secondary dx code of iatrogenic complications of urinary system (997.5)
Denominator	**[Surgical]** patients

Final Definition: Postoperative Iatrogenic Complications – Vascular Complications

Quality Measure	**Number of events per 100 discharges of population at risk**
Numerator	Secondary dx code of iatrogenic peripheral vascular complication (997.2)
Denominator	**[Surgical]** patients

Post-Conference Call Panel Ratings[a]

Question	*Median*	*Agreement status*
Overall rating	Not reported	Not reported
Not present on admission	Not reported	Not reported
Preventability	Not reported	Not reported
Due to medical error	Not reported	Not reported
Charting by physicians	Not reported	Not reported
Bias (lower rating is favorable)	Not reported	Not reported

[a] Procedural Complications 1 Multi-specialty Panel

After the panelists rated this indicator, the project team received additional pertinent details about coding conventions for iatrogenic complications coded with 997.xx. These conventions would have been important to the discussion of the indicator, and would have likely influenced the ratings by panelists. As a result, the actual ratings are not reported. The indicator also included 6 distinct clinical areas that could be defined separately: urinary, digestive, respiratory, vascular, cardiac, and nervous system. Empirical analysis of patients who receive these codes was used to determine that four of the six were capturing clinically minor complications that may not be of interest to track. The remaining two areas, cardiac and nervous system, appeared to be identifying cases of potentially serious clinical complications. Thus, cardiac and nervous system iatrogenic complications were retained on the experimental indicator list for further empirical evaluation. However, it would have not been appropriate to include these two indicators in the Accepted indicator set since a clinical panel did not fully assess their face validity. Thus, these two indicators were assigned to the Experimental set, and all others were not considered further.

Reopening of Surgical Site

This indicator is intended to flag cases where a surgical site is reopened. It is closely related to an indicator developed as part of the Complications Screening Program.[7] This indicator limits reopening codes to secondary procedure codes in order to eliminate scheduled reopening of surgical sites. To further ensure that the reopening of a surgical site is associated with a principal procedure, the reopening must occur at least one day after the principal procedure.

Final Definition

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM codes for **[reopening of a surgical site]** in any secondary procedure field per 100 surgical discharges. Reopening of surgical site must occur at least one day after the principal procedure. Revision of vascular procedure 39.49 must occur within 24 hours of principal procedure.
Denominator	All **[surgical]** discharges.

Post-Conference Call Panel Ratings[a]

Question	*Median (MS)*	*Agreement status (MS)*	*Median (S)*	*Agreement status (S)*
Overall rating	6	Indeterminate	7	Indeterminate
Not present on admission	7	Agreement	7	Indeterminate
Preventability	7	Indeterminate	7	Indeterminate
Due to medical error	6	Indeterminate	6	Indeterminate
Charting by physicians	7.5	Agreement		Agreement
Bias (lower rating favorable)	3.5	Agreement	5	Indeterminate

[a]Multi-specialty panel – Surgical Complications 2
Surgical panel – Surgical Complications 2

Multi-specialty Panel Results

Changes to the indicator. Panelists felt the codes for revision of the heart or a vascular procedure were inherently different from other reopening of surgical site codes. Therefore these codes were removed from the definition. Panelists also felt that trauma patients may undergo reopening of surgical sites as a planned procedure. For this reason they suggested that trauma patients be excluded from this indicator. Finally, this panel felt that immunocompromised patients may undergo reopening of surgical site that is not preventable due to wound infection or other complications. Therefore these patients were excluded.

Concerns not addressable by changes. Panelists felt that the preventability of this indicator depends on the reason for reopening. In addition, panelists felt that patient factors such as comorbidities or immunocompromised state may increase the likelihood that a patient would develop this complication.

Surgical Panel Results

Changes to the indicator. Panelists suggested the removal of the code for a correction procedure on the heart, for similar reasons as the multi-specialty panel. However, they rejected the removal of the code for revision of vascular procedure, instead opting for the limitation to procedures occurring within 24 hours of the principal procedure. It was felt that these early complications are most likely preventable, due to poor technique or poor patient selection.

Concerns not addressable by changes. Panelists noted that some procedures are purposely staged procedures, and that these procedures should be removed. However, it is impossible to remove all staged procedures using ICD-9-CM codes. In addition, some patients may be at higher risk of reopening, such as when a patient undergoes the removal of failed hardware after an orthopedic surgery.

SummaryAcross Panels

The definition of this indicator relies on ICD-9-CM codes which are defined as reopenings that cannot be defined using another ICD-9-CM code. Thus, reopenings that result in a more complicated procedure than simply a reopening of the surgical site would not be captured by this indicator. Panelists were not aware of this caveat when rating this indicator, and it was

felt then that their ratings did not truly reflect the actual nature of this indicator. In addition, panelists requested that planned reopenings such as staged procedures be excluded. The operationalization of this suggestion was beyond the scope of this study, as it would have required a full review of ICD-9-CM procedure codes. Thus, this indicator was retained only in the Experimental indicator set.

Suture of Laceration

This indicator is intended to flag cases of lacerations during a surgical procedure, which result in a suturing procedure. It is closely related to a indicator developed as part of the Complications Screening Program,[7] although it does add codes for the suture of laceration of diaphragm, blood vessel, small intestine, and anus. This indicator limits suture of laceration codes to secondary procedure codes in order to isolate those lacerations that can truly be linked to a surgical procedure. For the same reason, this indicator eliminates all sutures of lacerations that take place before the principal procedure.

Final Definition

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM codes for **[suture of laceration]** in any secondary procedure field per 100 surgical discharges. Suture of laceration must occur on the same day or after the principal procedure.
Denominator	All **[surgical]** discharges. Exclude patients with any diagnosis code for **[foreign body]** or **[trauma].** Exclude all obstetric admissions (MDC 14 and 15).

Post-Conference Call Panel Ratings[a]

Question	*Median (MS)*	*Agreement status (MS)*	*Median (S)*	*Agreement status (S)*
Overall rating	8	Agreement	5	Indeterminate
Not present on admission	7	Agreement	7	Agreement
Preventability	8	Agreement	6	Indeterminate
Due to medical error	7	Indeterminate	6	Indeterminate
Charting by physicians	8	Indeterminate	6	Indeterminate
Bias (lower rating favorable)	4	Indeterminate	5	Indeterminate

[a]Multi-specialty panel – Surgical Complications 2
Surgical panel – Surgical Complications 2

Multi-specialty Panel Results

Changes to the indicator. Panelists expressed concern that lacerations vary in morbidity. Some lacerations, minor in nature, would be considered routine during a procedure, and may not be reported, depending on the detail of the surgical notes. Some surgeons, however, may report these minor lacerations leading to bias in reporting of lacerations. Panelists agreed

that some more serious lacerations are important complications to track. To ensure that lacerations are consistently reported and are of sufficient morbidity to cause concern, this panel suggested that the indicator be limited to lacerations that require a return to the operating room. Administrative data do not allow for tracking returns to the operating room that occur on the same day of the principal procedure. The only option to implement the suggestion would be to limit suture of laceration codes to those occurring the day following the procedure or later.

Concerns not addressable by changes. No additional concerns were raised during the conference call of surgical panels.

Surgical Panel Results

Changes to the indicator. Unlike the multi-specialty panel, the surgical panel disagreed with the exclusion requiring a return to the operating room, because this required that the suture of laceration occur one day after or following. They felt that this exclusion would limit the number of flagged complications to a very small number making the indicator less useful.

The panel noted that the listed lacerations do not include lacerations that may occur during all procedures. As a result, they suggested several types of lacerations that should be included in the indicator, including obstetric and gynecological lacerations. Obstetric lacerations are included in another indicator. For this reason these codes were not added. However gynecological lacerations were added as were urological and nerve suture of laceration codes.

Concerns not addressable by changes. The surgical panel also noted that many lacerations occurring during surgery are trivial in nature. They thought that these lacerations are less likely to be recorded by the physician, and are less important to track. Many panelists felt that the exclusion of the trivial lacerations from this indicator would be desirable, as this restriction would limit complications to those causing significant morbidity for the patient.

Panelists noted that patient characteristics and procedure type greatly affect risk of a laceration occurring. Lacerations may occur as an expected complication of the procedure, during complex procedures on complicated structures, such as some types of hand surgery. It was also noted that re-surgery or repeat surgery is the major risk factor for suture of laceration, due to a build up of scar tissue. They noted that this case-mix difference is not addressable by limiting the indicator to elective surgery. Since re-surgery cannot be adjusted for using administrative data, panelists recommended that re-surgery rates be examined when using this indicator.

Summary Across Panels

The two panels arrived at slightly different definitions. The first panel required a return to the operating room, which was rejected by the second all surgeon panel. Empirical analysis revealed that this restriction significantly lowers the number of cases. Since the second panel had more expertise, the surgical panel's definition was retained for further analysis. The surgical panel rated the overall usefulness of this indicator relatively low and the multi-specialty panel rated this definition very highly, so this indicator was assigned to the Experimental indicator set.

Experimental Obstetric Indicators

Obstetric Wound Complications - Cesarean Section Delivery

This indicator is intended to flag cases of potentially preventable delivery wound complications in women delivering by cesarean section during the index hospitalization.

Final Definition

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM codes for **[cesarean wound complications]** in any diagnosis field per 100 deliveries.
Denominator	All **[cesarean delivery]** discharges.

Post-Conference Call Panel Ratings[a]

Question	*Median*	*Agreement status*
Overall rating	7.5	Agreement
Not present on admission	8.5	Agreement
Preventability	6.5	Indeterminate agreement
Due to medical error	2.5	Indeterminate agreement
Charting by physicians	7	Indeterminate agreement
Bias (lower rating is favorable)	5	Agreement

[a] Obstetric Complications 2 Panel

Changes to the indicator. This indicator was originally presented as a combined indicator of all obstetric wound complications (cesarean and vaginal). Panelists felt that wound complications of cesarean delivery differed substantially from those of vaginal delivery in both cause and preventability. For this reason they suggested that these complications be split into two separate indicators, and that the more useful indicator would be limited to cesarean deliveries.

Concerns not addressable through changes. Panelists expressed concern that the severity and layer of the wound dehiscence could not be determined using this indicator. Thus both superficial disruptions and deep fascial disruptions are combined into one indicator. If possible, panelists felt that the deeper wound disruptions should be tracked more closely than superficial disruptions. However, this is not possible with the current coding conventions.

Panelists noted that wound complications are less preventable in some subgroups, such as patients with overall poor tissue health, diabetics, and those having had a prior c-section, and that these risk factors are more common in patients with lower socioeconomic status. Thus, panelists expressed concern that some bias may be present for this indicator based on patient case mix.

Finally, some panelists felt that the use of this indicator could lead to the inappropriate overuse of antibiotics.

Summary

Panelists rated the overall usefulness of this indicator favorably. However, they rated the extent to which this indicator reflected medical error as very poor. Because these indicators are intended to identify potential patient safety problems, the lack of literature supporting this

indicator and the panel's equivocality regarding the indicator, this indicator was assigned to the Experimental indicator set.

Obstetric Wound Complications - Vaginal Delivery

This indicator is intended to flag cases of potentially preventable delivery wound complications in women delivering during the index hospitalization.

Final Definition

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM codes for **[perineal wound complications]** in any diagnosis field per 100 deliveries.
Denominator	All **[vaginal delivery DRGs].**

Post-Conference Call Panel Ratings[a]

Question	*Median*	*Agreement status*
Overall rating	6.5	Indeterminate agreement
Not present on admission	8	Agreement
Preventability	4	Indeterminate agreement
Due to medical error	3	Indeterminate agreement
Charting by physicians	6	Indeterminate agreement
Bias (lower rating is favorable)	5	Indeterminate agreement

[a]Obstetric Complications 2 Panel

Changes to the indicator. This indicator was originally presented as a combined indicator of all obstetric wound complications (cesarean and vaginal). Panelists felt that wound complications of cesarean delivery differed substantially from that of vaginal delivery in both cause and preventability. For this reason they suggested that these complications be split into two separate indicators. For patients who deliver vaginally, panelists agreed that diagnosis codes for vulval and perineal hematoma should be added as they felt that these complications may be preventable.

Concerns not addressable through changes. Panelists felt that some case mix bias may result from differing preventability of this complication. Patients having poor tissue health, poor nutrition, underlying conditions such as diabetes, or undergoing operative vaginal delivery would be more susceptible to this complication. Panelists also noted that many perineal wound disruptions are not apparent until after hospital discharge. Thus a large percentage of these wound disruptions would be missed using inpatient administrative data. Finally, panelists expressed concern that the use of this indicator may lead to a higher cesarean section rate, as physicians avoid operative delivery or episiotomies.

Summary

Panelists were uncertain about the usefulness of this indicator and they clearly noted that this complication is not reflective of medical error. Because of the ambiguity of this indicator, this indicator was retained in the Experimental indicator set for further investigation.

Other Obstetric Complications

Uterine Rupture

This "other obstetric complications" indicator is intended to flag cases of potentially preventable delivery complications in women delivering during the index hospitalization. The "Uterine rupture" indicator became a separate indicator based on panel input, and is intended to flag cases of uterine rupture in women who have undergone a trial of labor.

Final Definition: Other Obstetric Complications

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM codes for **[other obstetrical complications]** in any diagnosis field per 100 deliveries.
Denominator	All **[deliveries]**.

Final Definition: Uterine rupture

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM codes for **[rupture of uterus during or after labor]** in any diagnosis field per 100 deliveries with trial of labor.
Denominator	All deliveries with a **[trial of labor].**

Post-Conference Call Panel Ratings[a]

Question	*Median*	*Agreement status*
Overall rating	6.5	Indeterminate Agreement
Not present on admission	8	Agreement
Preventability	5	Indeterminate Agreement
Due to medical error	5	Indeterminate Agreement
Charting by physicians	8	Agreement
Bias (lower rating is favorable)	5	Indeterminate Agreement

[a] Obstetric Complications 2 Panel

Changes to the indicator. Panelists suggested that the rate of uterine rupture be adjusted for vaginal birth after cesarean section (VBAC) rate, as these patients are well documented to be at higher risk of uterine rupture. To address the intent of this suggestion, a separate indicator was specified to measure the rate of uterine rupture only for patients who have a trial of labor. Panelists rated the "Other obstetric complications" indicator, with uterine rupture included, but adjusted for VBAC rate. The implementation of the "Uterine rupture" indicator occurred after the panelists' final evaluation.

Concerns not addressable through changes. Panelists expressed concern that the preventability of these heterogeneous and relatively rare complications varies by the complication. They noted that a majority of these complications are not easily preventable, although some are minimized if a diagnosis is made and treatment promptly started. They noted that patient comorbidities and factors influence some of these complications, and that referral centers receive more of these patients than other centers.

Panelists were concerned that differences in coding may affect this indicator. For instance, some benign uterine ruptures, so called uterine windows, may be coded, when they are clinically insignificant. Panelists were not interested in tracking these minor complications, but the restrictions of administrative data make tracking only severe complications impossible.

Summary

Panelists were uncertain about the usefulness of this indicator and they clearly noted that this complication is not reflective of medical error. Because of the ambiguity of this indicator, this indicator was retained in the Experimental indicator for further investigation. Also stemming from this indicator was a separate uterine rupture indicator. Although panelists requested that uterine rupture be combined with other complications, such that this currently widely discussed complication would not be singled out, the requested risk adjustment for trial of labor after cesarean was not easily operationalized when uterine rupture was combined with other complications for which this risk adjustment was inappropriate. The uterine rupture indicator was also retained in the Experimental indicator set.

Post-partum Urinary Tract Infection (UTI)

This indicator is intended to flag cases of potentially preventable puerperal urinary tract infections in women delivering during the index hospitalization. This indicator excludes patients with infection of the amniotic cavity, as infection in these patients is more likely to be present on admission or non-preventable. This indicator was suggested by one of the obstetric complication panels.

Final Definition

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM code of 646.62 or 646.64 in any diagnosis per 100 deliveries.
Denominator	All **[cesarean delivery]** and **[vaginal delivery]** discharges

Post-Conference Call Panel Ratings[a]

Question	***Median***	***Agreement status***
Overall rating	7	Indeterminate agreement
Not present on admission	5	Indeterminate agreement
Preventability	7	Indeterminate agreement
Due to medical error	3.5	Indeterminate agreement
Charting by physicians	7	Indeterminate agreement
Bias (lower rating is favorable)	3.5	Indeterminate agreement

[a] Obstetric Complications 2 Panel

Changes to the indicator. This indicator was suggested and created by the panel, due to the interest in tracking post-partum urinary tract infections.

Concerns not addressable through changes. Several concerns about this indicator were raised, although most panelists remained interested in tracking this complication, since its use may decrease unnecessary catheterization. Panelists felt that some hospitals may have a

higher rate of these complications due to patient case mix. Specifically, they noted that patients with other infections or overall poor health are more likely to develop these complications. These factors vary systematically with socioeconomic status. Also, patients that undergo operative delivery or regional anesthesia may be at higher risk of developing post-partum UTI. Further, they noted that many of these complications develop after discharge. Thus, there may be significant underreporting resulting from the exclusive use of inpatient data. Finally, panelists expressed concern that the use of this indicator would lead to the inappropriate overuse of antibiotics.

Summary

Panelists rated the overall usefulness of this indicator favorably. However, they rated the extent to which this indicator reflected medical error as very poor. Because these indicators are intended to identify potential patient safety problems, the lack of literature supporting this indicator and the panels equivocality regarding the indicator, this indicator was assigned to the Experimental indicator set.

Third or Fourth Degree Obstetric Laceration

(This indicator was not reviewed. See "Obstetric trauma" in Accepted indicators section for discussion.)

Uterine Rupture

(See "Other obstetric complications.")

Section 3E. Comparative Empirical Results

Extensive empirical analyses were conducted on indicators accepted by the clinical panels as having met minimum criteria for face validity (i.e., Accepted Hospital Level Indicators, Accepted Area Level Indicators). These analyses were intended to provide additional information about indicators, rather than as decision making tools regarding the validity of these indicators. Additional research exploring the validity of these indicators is discussed in Chapter 4. The analyses included in this report are intended to provide guidance for future research and use of these indicators, and include statistical measures of reliability, bias, relatedness of indicators and persistence over time, in addition to adjusting for demographics, DRG and comorbidities. MSX methods, correlation analysis and factor models investigated relationships among the set of accepted indicators in order to identify potential underlying constructs (e.g., processes of care or structural characteristics) common to some or all of the indicators.[1]

[1] The empirical analyses reported, except for raw rates, reflect a prior version of the indicator definitions (e.g., specified software) than specified in Appendices D and E. In this prior version of the software used in this report three differences were present. First, for the indicator "Postoperative hemorrhage or hematoma," procedure codes for control of hemorrhage and hematoma were combined into a single category, applied to either diagnosis, resulting in a 20% increase in this indicator's rate compared to the final definition. Second, "Postoperative hip fracture" included pediatric patients, a group seldom experiencing this condition. Third, in the comorbidity software, when fifth digits specified the presence of more than one comorbidity, only one comorbidity was assigned (renal failure, if present, or congestive heart failure, if renal failure was not present). It is anticipated that these minor changes would not affect the overall results of these analyses.

Less extensive empirical analyses were conducted on the Experimental Hospital Level Indicators, including statistical measures of reliability and bias, with adjustments for demographics, DRG and comorbidities. Because there was no a priori reason to suspect an underlying construct common to these heterogeneous measures, no attempt was made to identify one. Therefore each of the experimental indicators are meant to be evaluated separately and subjected to further investigation and refinement. Although there are exceptions, in general the experimental indicators tend to have less systematic hospital level variation than the accepted indicators, but do not appear to be more or less biased.

All of the findings on bias reflect the level of information available for risk adjustment using HCUP SID data, and may therefore not apply to data sets that have more clinically detailed data elements. The presence of "high bias" mentioned in this section suggests that risk adjustment, using administrative data elements, is necessary to interpret hospital level differences in the rates of these indicators. However, for all indicators, the risk adjustment that is possible using HCUP data may or may not be adequate to correct potential bias.

The text in this section makes reference to numbered tables that can be found in Appendix G. The figures and tables contained in this section graphically or categorically summarize the numerical results in the Appendix G tables.

The empirical evidence presented here is intended to guide future use and development of these PSIs. As such, the relevance on any particular piece of empirical evidence will depend on the purpose of the analysis being conducted. However, among the accepted non-obstetric hospital level indicators, five of the measures that appear to perform well on several different dimensions, including reliability, bias, relatedness of indicators, and persistence over time, are the following: "Complications of anesthesia," "Postoperative wound dehiscence," "Postoperative hemorrhage or hematoma," "Death in low mortality DRGs," and "Postoperative hip fracture." The other 11 non-obstetric accepted indicators often perform well, and provide useful information for their intended purpose. The obstetric indicators ("Birth trauma," "Obstetric trauma - vaginal delivery with instrumentation," "Obstetric trauma - vaginal delivery without instrumentation," "Obstetric trauma – cesarean section,") also tend to perform well, though partly because of the higher rates and consequently large amount of variation among providers in these indicators; and partly because only age and gender risk adjustment was applied, so that the indicators showed little apparent bias.

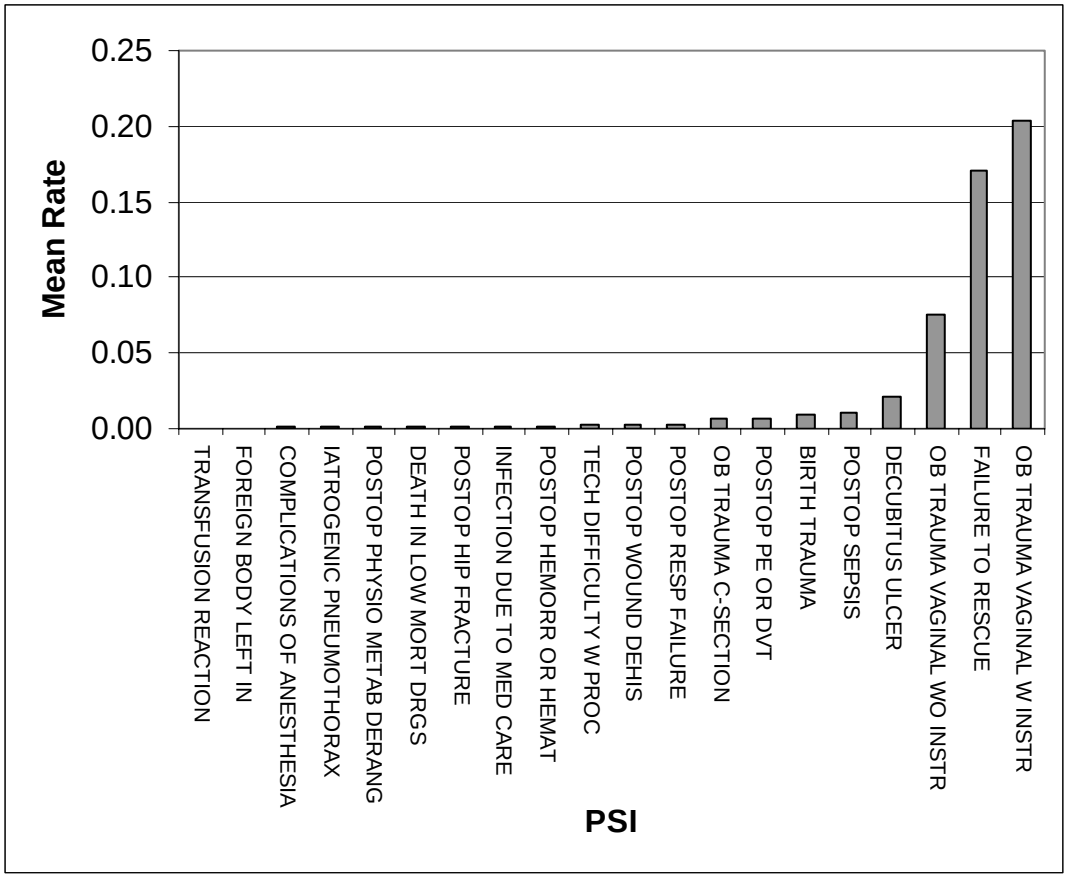
Accepted Hospital Level Indicators

An analysis of the overall rates of PSIs in the National SID found that the least frequent PSI is Transfusion Reaction, with only 16 cases in Florida and 129 cases in the National SID in 1997. The most frequent PSIs are "Obstetric trauma – vaginal delivery without instrumentation" and "Failure to rescue," with 120,858 and 135,085 cases in the National SID, respectively. The total number of adverse events (numerator), the total number of patients at risk (denominator), and the overall rate in Florida and the National SID for each accepted patient safety indicator can be found in Appendix G Table 1. The rates for the Florida SID used for initial testing, and the National SID were generally similar.

The mean hospital rates for each indicator in the National SID are depicted in Figure 1 below. A comparison of the National SID mean hospital rates and the Florida SID show that these rates are similar (see Appendix G Table 2), although the standard deviation and skew statistic (which is a measure of the symmetry of the hospital level distribution) are greater in the

National SID than in Florida, especially for the relatively rare PSI. This is likely true for most individual states; the greater number of the hospitals in the National SID increases the detection of occurrence for infrequent events. Also noteworthy in this analysis is that some indicators have a substantial number of hospitals that do not have any discharges in the denominator. For the obstetric indicators in particular, about one-fourth of hospitals have no deliveries at risk.

Figure 1. Summary of Mean Hospital Level Rates

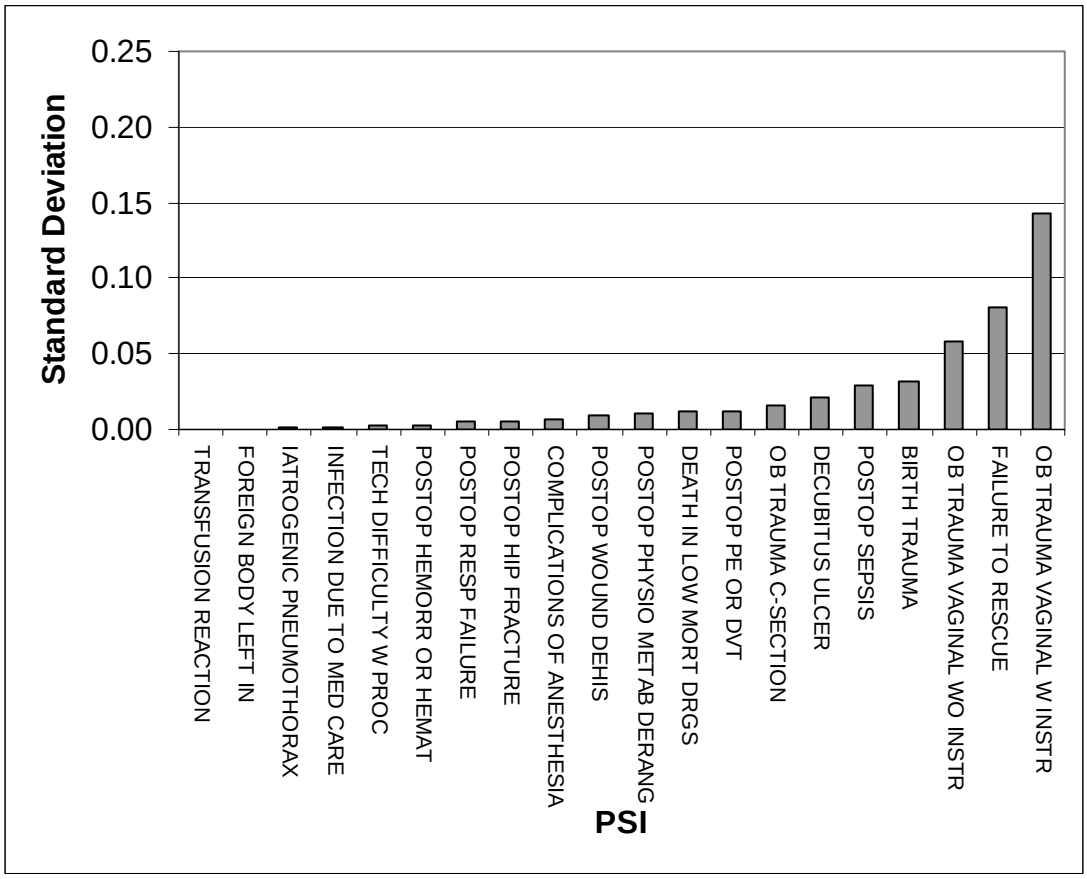


The rates vary considerably across measures, from a high of 20.3% for "Obstetric trauma – vaginal delivery with instrumentation" to a low of 0.001% for "Transfusion reaction" (which represents 129 cases in the National SID in 1997). "Obstetric trauma – vaginal delivery without instrumentation" and "Failure to rescue" also have much higher rates than the other PSI, which are generally 2% or less.

The apparent standard deviations, as shown in Figure 2, (unadjusted for risk or reliability) also vary considerably among the measures, from a high of 14.2 percentage points for "Obstetric trauma - vaginal delivery with instrumentation" (relative to a mean of 20.3 percentage points) to a low of less than 0.1 percentage points for "Iatrogenic pneumothorax," "Transfusion reaction" and "Foreign body left during procedure." The non-obstetric measures with the greatest amount of hospital level variation in absolute magnitude are "Failure to rescue," "Postoperative sepsis" and "Decubitus ulcer." Among the obstetric indicators, "Obstetric trauma (with and without

instrumentation)" has the most variance. Relative to the mean hospital level rate, the measures with the greatest hospital level variation are "Postoperative physiological and metabolic derangement," and "Death in low mortality DRGs." In other words, some of these measures have low rates of occurrence, so the absolute magnitude of the variance is small, but the degree of spread in the rates is relatively large.

Figure 2. Summary of Standard Deviations in Hospital Level Rates



The hospital level variation tends to be skewed toward the right, meaning that there is a long right-hand tail of hospitals with higher rates (see Appendix G, Table 3). The most highly skewed measures are "Complications of anesthesia," "Postoperative physiological and metabolic derangement," and "Death in low mortality DRGs," with a median skew statistic for all indicators of 10.0. Examples of the distributions may be found in Appendix G, Figures 1 and 2. These figures show the distribution of hospital level rates for "Decubitus ulcer" (with a median rate of 1.6%, a mean rate of 2.1% and skew statistic of 3.57) and "Birth trauma" (with a median rate of 0.25%, a mean rate of 0.94% and a skew statistic of 11.85). Hospitals with zero rates are excluded from the figures, which comprise 10% and 25% for "Decubitus ulcer" and "Birth trauma," respectively.

Risk Adjustment

Three levels of risk adjustment were applied to the measures using a logistic model. First, the hospital level measures were adjusted for age, gender and age-gender interactions. The age groups are the standard age categories used by the National Center for Health Statistics (NCHS) in their descriptive statistics, namely 0, 1-4, 5-14, 15-24, 25-34, 35-44, 45-54, 55-64, 65-74, 75-84 and 85+. Next, the measures were adjusted for age, gender, and modified DRG category. The categories were modified to combine separate DRGs with and without complications, and to exclude the super-MDC DRGs (e.g., Tracheostomies). Finally, the measures were adjusted for age, gender, DRG and comorbidity, using a modified version of the AHRQ comorbidity software. Details are provided in Section 2E Empirical Methods.

Overall, age-gender risk adjustment tended to *increase* the level of apparent hospital level variation by about 2% (see Appendix G, Table 3). Given the low rates of occurrence, "Transfusion reaction" and "Foreign body left in during procedure" were not risk adjusted for technical reasons, although there may be conceptual reasons to risk adjust these indicators. The impact was greatest on "Postoperative respiratory failure," "Postoperative hemorrhage or hematoma," "Postoperative wound dehiscence," and "Death in low mortality DRGs," and minimal on most other indicators. The rates tend to be slightly more skewed, meaning that differences in the age-gender mix were masking differences in rates, but several measures are slightly more skewed, meaning that some of the higher rates could be accounted for by differences in the age-gender mix of the population at-risk.

In addition to age-gender risk adjustment, DRG and comorbidity risk adjustment was performed (see Appendix G Table 4). The obstetric measures are not adjusted for DRG. The "Death in low mortality DRGs" indicator is also not adjusted for DRG. Rather, the indicator is stratified by DRG group, namely medical (adult and pediatric), surgical (adult and pediatric), neonatal, obstetric and psychiatric (See Appendix G, Table 1). Relative to age-gender adjustment, the overall impact of DRG adjustment was greater, *decreasing* hospital level variation by 4.1%. Comorbidity adjustment decreased variation by 1.6%. Most of the variation among hospitals explained by the risk adjustment was accounted for by DRG, with incremental amounts accounted for by the comorbidity categories, although comorbidity adjustment was relatively more important for some indicators. DRG risk adjustment had the biggest impact on "Technical difficulty with procedure," "Failure to rescue," "Infection due to medical care," and Postoperative PE or DVT." Comorbidity risk adjustment had the biggest impact on "Postoperative respiratory failure," "Infection due to medical care," "Decubitus ulcer," and "Postoperative sepsis." Variation in "Postoperative hemorrhage or hematoma" and "Death in low mortality DRGs" actually increased slightly.

Reliability Adjustment

The effect of the reliability adjustment was examined by the statistics on the signal standard deviation, signal share and signal ratio (see Appendix G, Table 5). Hospitals with fewer than three patients in the denominator were not included in the reliability adjustment. Multivariate methods (taking into account correlations among indicators in order to extract additional 'signal') were applied to most of the accepted indicators. The exceptions were "Death in low mortality DRGs" and "Failure to rescue." Only univariate smoothing methods were applied to these two indicators. Overall, the reliability adjustment reduced the hospital level

variation dramatically. On average, over one-half of the apparent hospital level variation, even after risk adjustment, was estimated to be attributable to noise. The measures that were affected the most by reliability adjustment in terms of reduction in the hospital level standard deviation were "Postoperative physiological and metabolic derangement," "Postoperative sepsis," and "Postoperative hemorrhage or hematoma." The measures that were affected the least were "Birth trauma," "Iatrogenic pneumothorax" and "Technical difficulty with procedure." (For examples of the distribution of indicators see Appendix G, Figures 3 and 4.) These figures show the distribution of hospital rates for "Decubitus ulcer" and "Birth trauma" after risk and reliability adjustment.

MSX Statistics

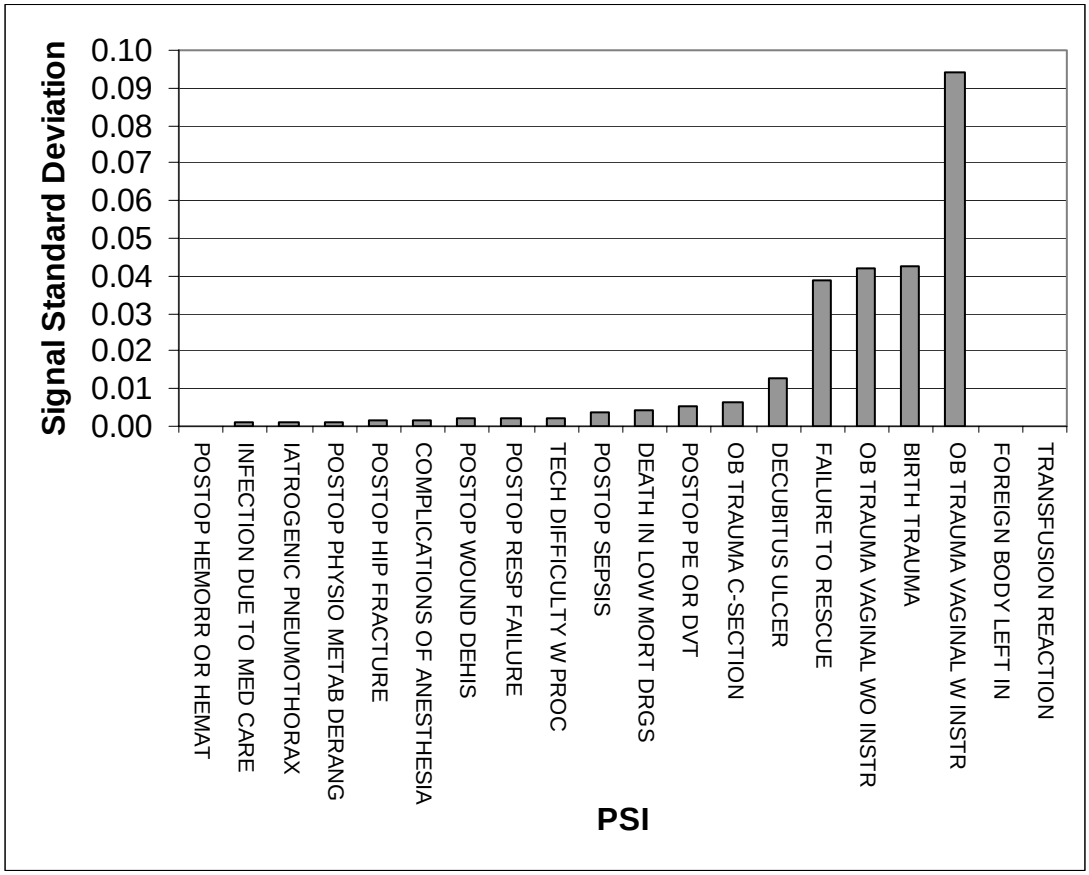
The MSX statistics give estimates of the degree of total hospital level variation accounted for by signal and noise, and the degree of total variation (hospital and patient) accounted for by signal. Signal standard deviation is an estimate of the systematic variation ('signal') among hospitals (See Figure 3). The higher the signal standard deviation, the greater the opportunity to identify hospital characteristics associated with higher (or lower) rates. The non-obstetric measures with the most signal are "Failure to rescue," "Decubitus ulcer" and "Postoperative PE or DVT." Among the obstetric measures, "Obstetric trauma - vaginal delivery (with and without instrumentation)" and "Birth trauma" have the most signal. For "Decubitus ulcer," the signal variance represents a difference of 60 adverse events (20 to 80 with a mean of 50) per hospital between the bottom and top hospitals in the middle two-thirds of the distribution. The measures with the least signal are "Postoperative hemorrhage or hematoma," "Infection due to medical care" and "Iatrogenic pneumothorax. The measures "Transfusion reaction" and "Foreign body left during procedure" have no signal, meaning no detectable systematic hospital level variation.

The signal share (see Figure 4) is a measure of the share of total variation (hospital and patient) accounted for by the signal (hospital). The higher the share is, the relatively more important the hospital in accounting for the rate. The lower the share is, the less important the hospital, and the more important other potential factors (e.g., patient characteristics). The non-obstetric measures with the higher signal share are "Death in low mortality DRGs," "Decubitus ulcer" and "Failure to rescue." "Birth trauma" and "Obstetric trauma - vaginal delivery (with and without instrumentation)" have the highest share among the obstetric indicators. The overall low levels of the share of total variation accounted for by hospitals is an indication that there are many other factors that influence these rates besides the hospital.

Finally, signal ratio is a measure of how much of the observed variation is signal and how much is noise (see Figure 5). The ratio is affected both by the amount of signal and by the amount of noise. In other words, the signal ratio will be high even in the absence of much signal, if the amount of noise is also low. For the PSIs, the ratios tend to be high even with little signal because the hospital sample sizes are very large for most of the indicators, which makes the hospital estimates precise (i.e., low noise). The higher the signal ratio, the more likely that observed differences in risk adjusted rates reflect true differences in hospital performance. The lower the signal ratio, the more likely that observed differences in risk adjusted rates reflect a large degree of noise. Non-obstetric indicators with the highest signal ratio are "Death in low mortality DRGs," "Decubitus ulcer" and "Iatrogenic pneumothorax." Among the obstetric indicators, "Birth trauma - injury to neonate" and "Obstetric trauma - vaginal delivery without

instrumentation" have the highest ratio. Indicators with the lowest signal ratio are "Postoperative hemorrhage or hematoma," "Postoperative sepsis" and "Postoperative wound dehiscence."

Figure 3. Summary of Signal Standard Deviation in Hospital Level Rates



Minimum Bias

The effect of age, gender, DRG and comorbidity risk adjustment on the relative ranking of hospitals, compared to no risk adjustment, was assessed using five measures of impact. Both the unadjusted and risk adjusted measures were adjusted for reliability, in order to remove the impact of noise on the assessment of potential bias. Also, even if risk adjustment reduces the apparent level of hospital level variation, the relative rank may not be affected if the distribution of the adjusters does not vary systematically across hospitals. A large impact on the relative ranking means that the measures are biased based on the patient characteristics we observe from the administrative data. Minimal or no impact means that the measures are not biased based on the characteristics we observe (although there might be characteristics that we do not observe using administrative data that are related to the patient's risk of experiencing an adverse event).

The first measure is a relative rank correlation statistic (a measure of the impact of adjustment on the assessment of relative hospital performance). The second measure is the average absolute magnitude of the change in unadjusted – adjusted rate for each hospital (a measure of the relative importance of adjustment). The third and fourth measures are the

percentage of hospitals that remain in the top (or bottom) 10% of the distribution after adjustment (measures of the impact on the highest and lowest hospitals). The last measure is the percentage of hospitals that change more than two deciles in the distribution after adjustment (a measure of the impact throughout the distribution). According to the rank correlation, the indicators most affected in terms of the relative ranking of hospitals are "Failure to rescue," "Decubitus ulcer," "Technical difficulty with procedure," "Postoperative PE or DVT," "Death in low mortality DRGs," "Iatrogenic pneumothorax," "Postoperative sepsis" and "Postoperative respiratory failure." The least affected indicators are "Birth trauma - injury to neonate," "Obstetric trauma - vaginal delivery without instrumentation" and "Complications of anesthesia." DRG risk adjustment could not be applied to the obstetric indicators, because obstetric DRGs are divided only by the mode of delivery and the presence or absence of complications or comorbidities. Also, comorbidity adjustment may not be as applicable to the obstetric population, and in some specific instances (see Appendix D) could not be applied to obstetric indicators, as applicable ICD-9-CM codes were not available.

Figure 4. Summary of Signal Share in Hospital Level Rates

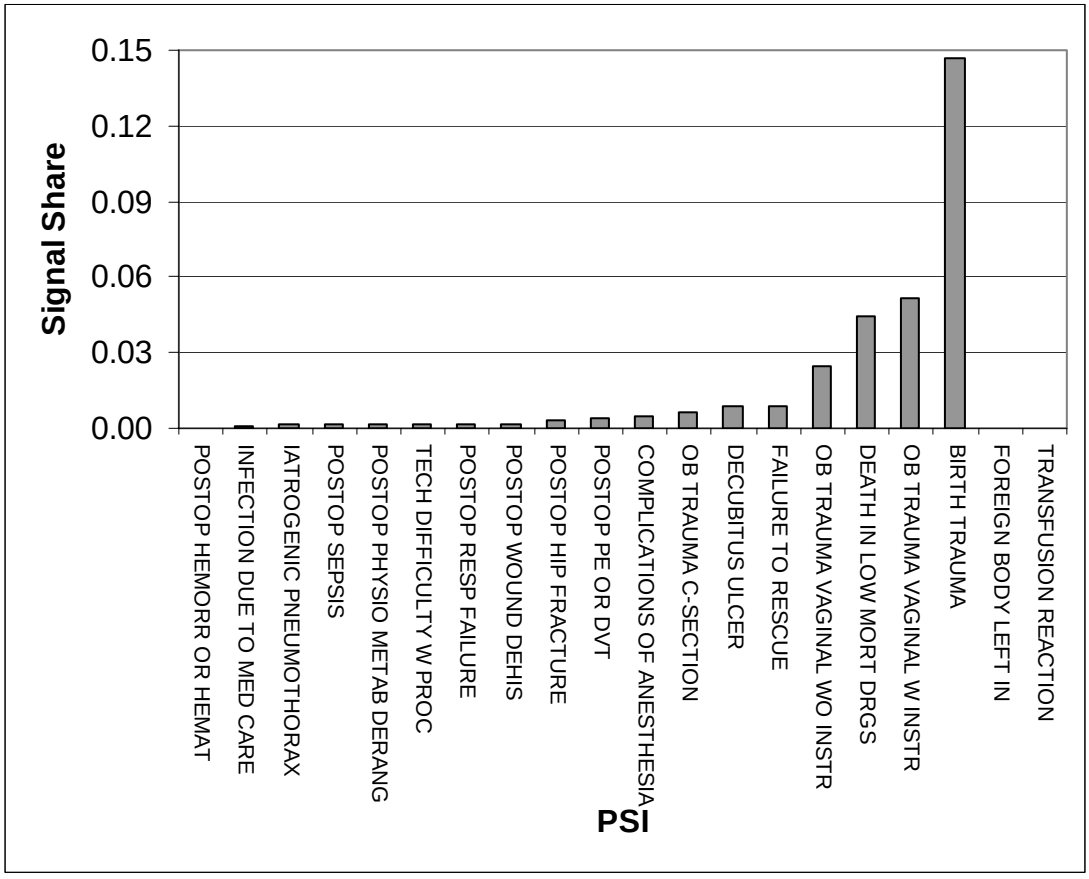
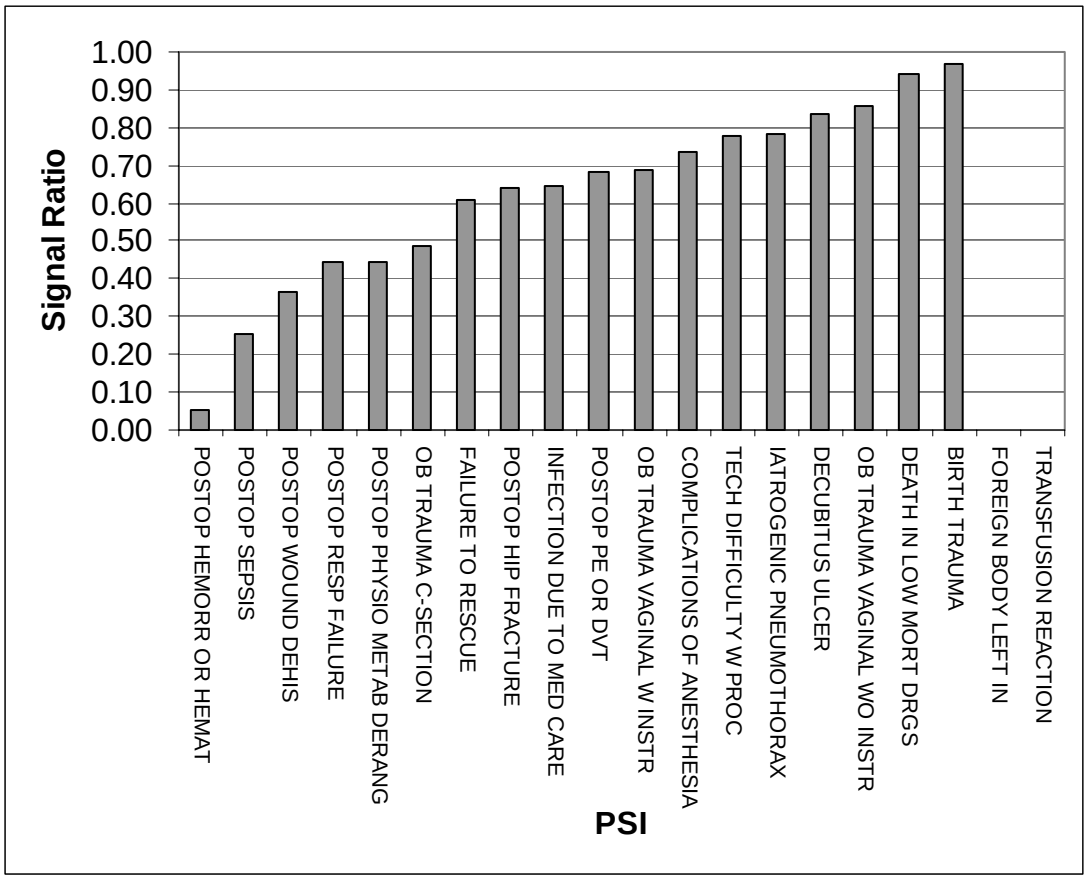


Figure 5. Summary of Signal Ratio in Hospital Level Rates



In terms of absolute magnitude of the change in adjusted rate, the impact is greatest for "Failure to rescue," "Technical difficulty with procedure," and "Death in low mortality DRGs." Along with "Decubitus ulcer," "Failure to rescue," "Technical difficulty with procedure" and "Death in low mortality DRGs" also have the greatest impact at the upper tail of the distribution, meaning that accounting for these patient characteristics accounts for the very high rates of these indicators for some hospitals.

Overall, if one were to create a simple score based on the five measures of potential bias (e.g., ranking the indicators 1 to 20 for each bias measures, and summing the ranks), the most biased measures would be "Failure to rescue," "Technical difficulty with procedure," "Decubitus ulcer" and "Postoperative PE or DVT." The least biased measures would be "Postoperative hemorrhage and hematoma" and "Complications of anesthesia." This is summarized in Table 18. Obstetric measures in general also demonstrate little bias, although these indicators were subjected to less risk adjustment than the other indicators. However, these categories are not definitive. Each bias measure stands on its own as a measure of performance, depending on the purpose of the analysis. Also, as mentioned in the introduction, more clinically detailed information than is available in the HCUP SID may yield different conclusions. What is certain is that unadjusted rates for the 'high' bias measures are likely to be misleading.

Table 18. Summary of Minimum Bias in Hospital Level Rates

High Bias	Medium Bias	Low Bias
Failure to rescue	Postoperative hip fracture	Postoperative hemorrhage or hematoma
Technical difficulty with procedure	Iatrogenic pneumothorax	Complications of anesthesia
Decubitus ulcer	Postoperative physiological and metabolic derangement	
Postoperative PE or DVT	Infection due to medical care	
Death in low mortality DRGs	Postoperative wound dehiscence	
Postoperative sepsis		
Postoperative respiratory failure		

Relatedness of Indicators

To investigate the relationship between indicators, we examine the hospital level Spearman correlations among the measures, and conduct a factor analysis using principal factor analysis based on the Spearman correlations (with a varimax rotation in order to maximize the loadings on each factor). The correlations between the measures can be found in Appendix G Table 7. If a measure is valid, it should be correlated with related measures that reflect similar aspects of hospital performance or hospital characteristics. For example, "Obstetric trauma – vaginal delivery without instrumentation" is correlated with "Obstetric trauma – vaginal delivery with instrumentation" (a correlation of 0.545, $p<.0001$). For the most part the measures are positively correlated ($p<.05$), with the exception of "Postoperative respiratory failure" and "Failure to rescue," which are negatively correlated with several other indicators. "Technical difficulty with procedure" is positively correlated with several other measures, including "Infection due to medical care" (0.306, $p<.0001$) and "Iatrogenic pneumothorax" (0.318, $p<.0001$). It is not expected that all indicators would be strongly correlated with each other, as different aspects of quality may be reflected by each indicator.

Two factor analyses were conducted to examine the relationship and possible underlying "factors." The first analyses combined obstetric and non-obstetric indicators. This factor analysis reflects the correlation results and suggests that there are two "factors" or underlying constructs common among all the PSI. Appendix G, Table 8 shows the factor loadings and share of variation explained for each factor and for each PSI. There are two factors that explain almost all of the systematic variation among the PSIs (the remaining, unexplained variation is unique to each PSI). The first factor tends to be associated with the obstetric indicators and the surgical indicators, while the second factor tends to be associated with medical indicators, although two post-operative PSIs are included. The indicators with the highest loadings on the first factor, which explains about 10-20% of the variation for those PSIs and over one-half of the systematic variation among all PSIs, include "Infection due to medical care," "Technical difficulty with procedure," and "Obstetric trauma – vaginal delivery (with and without instrumentation)," "Decubitus ulcer," "Postoperative respiratory failure," " and "Postoperative sepsis" indicators load most heavily on the second factor, which explains about one-third of the systematic

variation. A second factor analysis was conducted, removing the obstetric indicators. The removal of the obstetric indicators did not result in an obvious change to the factor results.

Overall, there is significant hospital level variation common among the patient safety indicators, and that variation is concentrated into two independent dimensions. Some underlying construct is potentially identifiable. However, most of the variation is unique to each PSI, meaning that to a large degree the indicators each measure an independent dimension of performance.

Persistence of Rates Over Time

Persistence was examined using the Florida SID from 1995-1997 (See Appendix G, Table 8). Two important points emerged from this examination. First, the rates are consistent from year to year, suggesting that at least for the years considered no fundamental changes in coding or practice confound comparison across years. The exception is "Postoperative hemorrhage or hematoma" which relies on ICD-9-CM codes adopted in October, 1996. Second, hospital performance is consistent from year to year for many of the indicators. "Decubitus ulcer," "Technical difficulty with procedure," "Obstetric trauma - vaginal delivery without instrumentation," and "Infection due to medical care," all have year to year correlations in excess of 0.70 for 1995-96 and 1996-97. "Decubitus ulcer" and "Technical difficulty with procedure" have correlations across a two year time period in excess of 0.70. But most of the indicators are correlated from year to year, meaning that hospitals that are above average tend to remain above average, at least over a three year period.

Experimental Hospital Level Indicators

Analyses of the experimental indicators show that the least frequent PSI is "Intra-operative nerve compression injury," with only 7 cases in Florida and 102 cases in the National SID in 1997. The most frequent PSIs are "Postoperative iatrogenic complication – cardiac," and "3rd or 4th degree obstetric laceration," with 83,502 and 99,383 cases in the National SID, respectively. The total number of adverse events (numerator), the total number of patients at risk (denominator), and the overall rate in Florida and the National SID for each experimental PSI can be found in Appendix G Table 9. The rates vary considerably across measures, from a high of 6.1% for "Decubitus ulcer in high risk patients" to a low of 0.001% for "Intra-operative nerve compression injury" (which represents 7 cases in the National SID in 1997). Like the accepted PSIs, the rates between the Florida and National SID are similar.

The apparent standard deviations (unadjusted for reliability) also vary considerably among the measures, from a high of 6.5 percentage points for "Decubitus ulcer in high risk patients" (relative to a mean of 6.2 percentage points) to a low of less than 0.37 percentage points for "Uterine rupture" and "Intra-operative nerve compression injury." "Malignant Hyperthermia," which relies on an ICD-9-CM code that was not in use in 1997 was not assessed. The measures with the greatest amount of hospital level variation in absolute magnitude are "Decubitus ulcer in high risk patients," "3rd or 4th degree obstetric laceration" and "In-hospital fractures related to falls."

Also like the accepted PSIs, the hospital level variation tends to be skewed toward the right, meaning that most hospitals are slightly less than the mean, with a long right-hand tail of hospitals with higher rates. The most highly skewed measures are "In-hospital fractures possibly

related to falls," "Wound complication of vaginal delivery," "Uterine rupture," and "Aspiration pneumonia," with a median skew statistic among all indicators of 9.2 which primarily reflects the low rates of occurrence, meaning that most providers have rates near zero, giving little latitude for a left-hand tail to the distribution.

Risk Adjustment

Overall, age-gender risk adjustment tended to reduce the level of apparent hospital level variation by about 0.4% (see Appendix G, Table 11). Given the low rate of occurrence, "Intra-operative nerve compression injury" was not included in the risk adjustment. The impact was greatest on "Postoperative iatrogenic complication – nervous system" and "Reopening of a surgical site," and least on "Post-Operative AMI." The rates tend to be slightly more skewed, meaning that differences in the age-gender mix of the population at-risk masked some of the difference in rates.

Relative to age-gender adjustment, the overall impact of DRG adjustment on the hospital level variation was much greater, reducing variation by about 3.8% (see Appendix G, Table 12). Comorbidity adjustment decreased the apparent variation among hospitals by 1.1%. DRG risk adjustment had the biggest impact on "Postoperative iatrogenic complications – cardiac," "Decubitus ulcer in high risk patients" and "Reopening of a surgical site." Comorbidity risk adjustment had the biggest impact on "Decubitus ulcer in high risk patients," "Other obstetric complications" and "Reopening of a surgical site."

Reliability Adjustment

The effect of the reliability adjustment, based only on univariate smoothing methods, was examined along with the statistics on the signal standard deviation, signal share and signal ratio (See Appendix G, Table 13). Hospitals with fewer than three patients in the denominator were not included in the reliability adjustment. Overall, the reliability adjustment reduced the hospital level variation dramatically. On average, one-half of the apparent hospital level variation, even after risk adjustment, was estimated to be attributable to noise. The measures that were affected the most by reliability adjustment were "Uterine rupture," "In-hospital fractures possibly related to falls" and "Wound complication of vaginal delivery." "Aspiration pneumonia," "Postoperative AMI" and "Intra-operative nerve compression injury" had no signal, meaning no systematic hospital level variation. The measures that were impacted the least were "3rd or 4th degree obstetric laceration," "Other obstetric complications" and "Postoperative iatrogenic complication – cardiac."

Univariate Smoothing Statistics

Like the MSX statistics, the univariate smoothing statistics give estimates of the degree of total hospital level variation accounted for by signal and noise, and the degree of total variation (hospital and patient) accounted for by signal. Signal standard deviation is an estimate of the systematic variation ('signal') among hospitals. The measures with the most signal are "Decubitus ulcer in high risk patients," "3rd or 4th degree obstetric laceration" and "Postoperative iatrogenic complications - cardiac." The measures with the least signal are "Uterine rupture" and "Wound complication of vaginal delivery," in addition to "Aspiration

pneumonia," "Postoperative AMI" and "Intra-operative nerve compression injury" which had no signal.

The signal share is a measure of the share of total variation (hospital and patient) accounted for by the signal. The measures with the higher signal share are "3rd or 4th degree obstetric laceration," "Decubitus ulcer in high risk patients" and "Postoperative iatrogenic complications - cardiac." The overall low level of the share of total variation accounted for by hospitals is an indication that there are many other factors that influence these rates besides the hospital.

Finally, signal ratio is a measure of how much of the observed variation is signal and how much is noise. The higher the signal ratio, the more likely that observed differences in risk adjusted rates reflect true differences in hospital performance. Indicators with the highest signal ratio are "3rd or 4th degree obstetric laceration," "Postoperative iatrogenic complication – cardiac" and "Other obstetric complication." Indicators with the lowest signal ratio are "Uterine rupture," "Wound complication of vaginal delivery" and "CABG after PTCA."

Minimum Bias

Bias was measured using the same techniques as were used in the analyses of the accepted indicators (See Appendix G, Table 14). The same caveats apply to the experimental indicators as the accepted indicators. According to the rank correlation, the indicators most affected in terms of relative rank are "Postoperative iatrogenic complications – cardiac," "Decubitus ulcer in high risk patients" and "Reopening of a surgical site." The least affected indicators are "CABG after PTCA" and "3rd or 4th degree obstetric laceration," which was not included in the DRG risk adjustment, because obstetric DRGs are divided only by the mode of delivery and the presence or absence of complications or comorbidities. "CABG after PTCA" is similar.

Overall, if one were to create a simple score based on the five measures of potential bias (ranking each indicator 1 to 17, and summing the ranks), the most biased measures are "Postoperative iatrogenic complications – cardiac," "Decubitus ulcer in high risk patients," "Reopening of a surgical site" and "Postoperative iatrogenic complication - nervous system." The least biased measures are "CABG after PTCA" and "3rd or 4th degree obstetric laceration." Similar to the accepted indicators, caveats about interpretation of bias are necessary. In addition, the experimental indicators are not considered a related set, so comparisons across indicators are not as appropriate as in the case of accepted indicators where they are at least related based on their more likely detection of potentially preventable adverse events.

Accepted Area Indicators

Unadjusted and adjusted area level rates were also calculated for the area level indicators (see Appendix G, Table 15). The unit of analysis is the MSA or county (in rural areas). These six indicators are accepted patient safety indicators that were modified into area indicators to assess the total incidence of the adverse event within geographic areas. The modification generally was to use principal rather than secondary diagnosis codes, and to use the area population as the denominator. The number of additional adverse events identified using the area definition is listed in Table 19.

Table 19. Additional Cases Identified by Area Level Indicators

Indicator	Number of adverse events		% Increase
	Hospital Definition	Area Definition	
Iatrogenic pneumothorax	16,815	19,892	16.8%
Transfusion reaction	131	142	8.1%
Infection due to medical care	27,457	49,419	58.8%
Wound dehiscence	2,401	2,609	8.3%
Foreign body left in during procedure	1,631	1,943	17.5%
Technical difficulty with procedure	46,707	50,659	8.1%

The rates vary considerably across measures, from a high a 23.5 per 100,000 population for "Infection due to medical care" to a low of 0.08 per 100,000 for "Transfusion reactions" (which represents 142 cases in the National SID in 1997) (See Appendix G, Table 15).

The apparent standard deviations (unadjusted for reliability) also vary considerably among the measures, from a high of 43.7 per 100,000 for "Technical difficulty with procedure" (relative to a mean of 23.5 per 100,000) to a low of less than 2.1 per 100,000 for "Foreign body left in during procedure" and "Transfusion reaction." The measures with the greatest amount of area level variation in absolute magnitude are "Technical difficulty with procedure," "Infection due to medical care," and "Iatrogenic pneumothorax."

Risk Adjustment

Only age and gender risk adjustment, with age-gender interactions, was applied to the area measures. The age groups are the standard age categories used by the Census Bureau in their descriptive statistics, namely 0-4, 5-9, 10-14, 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, 70-74, 75-79, 80-84, and 85+.

Overall, age-gender risk adjustment tended to *increase* the level of apparent hospital level variation by about 8% (See Appendix G, Table 15). A similar increase was noted for all six area level indicators. The rates tend to be slightly more skewed after adjustment for age and gender, meaning that the age and gender distribution among the counties was obscuring some of the true differences in rates.

Chapter 4. Conclusions

This project took a four pronged approach to the identification, development and evaluation of PSIs. First, literature was reviewed for general background about patient safety measures that are or could be specified from administrative data. Second, a diverse group of clinicians assessed the face validity of potential PSIs, using an adaptation of the RAND/UCLA Appropriateness methods. Third, professionals who abstract the medical records to assign ICD-9-CM codes and other resources on coding were consulted for specific concerns about whether the intent of an indicator could be implemented well based on current coding guidelines. Finally, the most promising measures were statistically analyzed using routinely collected discharge data from hospitals in order to determine rates, examine effects of risk and reliability adjustments, and to make comparisons among the indicators.

When examining the results of this report, it is useful to return to the original framework in which two types of potential indicators were discussed. The first type of indicator is that which is likely to reflect medical error. These indicators are difficult to define using administrative data. Few adverse events are clear cut enough for this designation, with most having a variety of causes in addition to potential medical error leading to the adverse event, including underlying patient health and factors that do not vary systematically. As expected, physician panelists rated few indicators as very likely to reflect medical error. Six indicators were rated as such by most panelists: "Decubitus ulcer," "Iatrogenic pneumothorax," "Transfusion reaction," "Complications of anesthesia," "Foreign body accidentally left during procedure," and "In-hospital fracture." However, two of these indicators could not be defined using administrative data exactly as the panel specified in order to reduce contamination with less preventable complications ("Iatrogenic pneumothorax," and "In-hospital fracture"), and two suffer from serious concerns regarding coding, presence on admission and heterogeneous severity included within the code ("Decubitus ulcer" and "Complications of anesthesia"). Thus, only two indicators remained that could be defined as "most likely to reflect medical error," those being "Transfusion reaction" and "Foreign body left in during a procedure." As is expected for indicators of this type, these indicators proved to be very rare with less than 1 per 10,000 cases at risk. Application of statistical tests of precision was limited by the fact that these indicators had no systematic variation. This confirms that these indicators are best used as case-finding indicators, or as area indicators to examine prevalence of these errors, as the rates of these indicators are mostly driven by non-systematic variation.

All other indicators that were rated as acceptable by panelists, fall into that more broad category of indicators which do not clearly identify medical error, but may reflect some quality concerns, including a potential for medical error. In general these indicators fall somewhere on a spectrum of preventability, with not every case being avoidable given optimal quality of care. Some indicators have a higher degree of preventability than others, but factors such as provider case mix and non-systematic variation may influence the overall preventability inherent in an indicator. For this reason it is impossible to "rank" these indicators as "more likely to reflect medical error" to "less likely to reflect medical error", although panelists' ratings of preventability may provide some guidance from one source of face validity. In addition, the source of "error" may vary by provider and over time, reinforcing the screening use of these indicators – some may be primarily caused by human error and others by system problems. Because of these variations within each indicator, a single case "flagged" by any of these

indicators may or may not have been preventable through optimal care, and thus these indicators are less efficient as case finding tools.

Despite the relative difficulty of these indicators in identifying specific cases where medical error may have occured, they can be rather useful when examining rates of events. Inasmuch as rates are somewhat stable over time and represent systematic differences, these differences are likely to reflect true differences in the occurrence of a complication in patient populations. Individual complexities of each case influence the overall rate of a complication much less than the specific outcome for that case, and thus, non-systematic differences in patient complexity are more likely to be "washed out." Systematic differences due to causes besides true quality problems (e.g., case mix or coding practices) remain a concern for these indicators, as such bias may cause good quality providers to appear poor. Adequate risk adjustment, or refraining from comparing dissimilar providers would aid in this problem, but perfect methods are unlikely even with the best of data. In addition, while these indicators demonstrated some systematic variation, much of the variation between providers remains at the discharge level. This means that small differences between providers, even with perfect risk adjustment, may not actually reflect true differences in performance for these indicators. However, larger differences and differences that persist over time are more likely to reflect true differences, and are useful in identifying probable areas of concern for further investigation. Simply put, because of the nature of these indicators, they should not be used as a metric of absolute performance (e.g., for grading of providers or public reporting that compares providers). However, these indicators may be particularly useful as a low cost screen for potential quality and safety problems. Where a provider has a higher rate for a particular indicator than a benchmark, an extraction of additional information on the patients flagged by the indicator would likely lead to either of two positive outcomes – 1.) reassurance that there is not a quality problem, but a data gathering inadequacy that perhaps could be improved at the local or national level to improve the ability to detect quality problems, or 2.) identification of the source of the high rate that requires improvement in processes or systems of care, which would benefit the quality of care for future patients.

During the course of the study, it became apparent that the obstetric indicators should be viewed differently than the other non-obstetric indicators. In general, these indicators had a higher rate, more variation, and thus higher precision. Risk adjustment available for these indicators was minimal, and thus, systematic bias related to case mix could not be assessed. Finally, examination of the panel results and comparison of decisions made by non-obstetric panels with those made by the obstetric panels suggested that the obstetric indicators included complications expressly rejected by the other panels. The complications may have less association with medical error or process failures, although this assertion cannot be verified with this study.

For the best-performing subset of PSIs, this project has demonstrated that rates of adverse events differs substantially and significantly across hospitals. The literature review and the findings from the clinical panels provide evidence to suggest that a number of discharge-based PSIs may be useful screens for organizations, purchasers, and policymakers to identify potential safety problems at the hospital level, as well as to document systematic area level differences in potential patient safety problems.

Potential Uses of PSIs

At the national or state level, these indicators could be used to monitor the frequency of potential patient safety problems, to determine whether the rates are increasing or decreasing over time, and to explore large variations among settings of care. As noted by panelists, not all indicators are equally poised to identify potential patient safety problems. This report was intended to provide evidence on the development and face validity of these indicators, and the evidence available does not allow for fine tuned classifications of indicators which are very likely to detect patient safety problems from those that are less likely. Future research will provide additional evidence that will inform the best uses of these indicators.

While the indicators were primarily developed at the hospital level, some were also implemented to provide an analogous area level measure, and analyses show that additional cases are in fact identified that correspond to care received at one institution, and the potentially iatrogenic complication addressed in another hospital. Clearly, the locus of control and the ability to study the potential underlying causes for an adverse event is simpler in the case of the hospital level PSIs. However, trends over time in area rates, as well as aggregations of the hospital level rates are likely to reveal points of leverage outside of individual institutions. No measure is ideally suited to every purpose. Methods of aggregating across groups of PSIs still need to be tested. This report provides the background for "safe" use of a tool that has the potential to guide prevention of medical error, reductions of potentially preventable complications, and quality improvement in general. Table 20 summarizes additional information on uses of the PSIs.

Because the PSIs are intended for use as an initial, efficient screen to target areas for further data exploration, the primary goal is to find indicators that guide those interested in quality improvement and patient safety to areas where there are systematic differences between hospitals or geographic areas. These systematic differences may relate to underlying processes or structures that an organization could change to improve patient care and safety. These errors may be attributed to human error on the part of physicians or nurses, or system deficiencies or both. On the other hand, the systematic differences will sometimes correspond to coding practices, patient characteristics not captured by administrative data, or other factors. These will be dead ends to some degree. In the application of these PSIs, users will have an opportunity to determine how well patient safety problems are identified at the level of groups of patients. Sharing experiences with these PSIs, researchers and health care practitioners will have a chance to build on the information highlighted in this report about each indicator, as well as the set of PSIs.

Thus, application of these indicators to a variety of settings and additional data gathering will accomplish two vital next steps for patient safety. First, these attempts will shed light on which indicators and under what circumstances PSIs provide useful information. Second, in those cases where potentially preventable errors are identified with relative ease through these tools, health care providers and managers will have an opportunity to implement potential preventative strategies ranging from technologies to processes to new ways of organizing care. The effectiveness of these strategies can be assessed at many levels, including the effects on the PSI rates.

Table 20. Use of Patient Safety Indicators

User	Inappropriate Use Scenario	Appropriate Use Scenario	Potential Uses
Case-finding indicators			
Provider	A hospital uses the transfusion reaction indicator to punish a physician involved in the incident. PROBLEM: Flagging of the case does not necessarily guarantee that a medical error has occurred at the physician or system level. Further such punishment may reduce voluntary reporting of errors.	A hospital identifies a case of transfusion reaction occurring in-hospital. They undertake a root-cause analysis to highlight potential problems that may be resolved in order to prevent future events.	Identification of events for further investigation.
Public Health	A public health organization uses provider level indicators for use in formal evaluation of providers in area. PROBLEM: Flagging of cases does not ensure medical error and such use may decrease reporting.	A state health department uses the area level indicator for foreign body to survey the incidence of such events in that state.	Surveillance of events.
Research	Researchers compare rates of case-based indicators to identify providers with more medical error to those with less. PROBLEM: Lack of signal between providers makes such comparisons unreliable.	Researchers use these indicators to identify cases in a large database where events related to medical error may have occurred. They examine the characteristics of patients flagged compared to matched patients not flagged.	Flagging of cases for use in research studies.
Rate-based indicators			
Provider	A hospital uses an indicator to identify differences in rates between physicians within the hospital. PROBLEM: The number of cases by physician is likely to be zero or very small. Even if such rates are used for purely quality improvement initiatives, physician level rates for most indicators are likely to be unreliable.	A teaching hospital observes that their rate of decubitus ulcer is consistently higher than the peer group average for other teaching hospitals in their region. After ruling out such explanations as differences in coding or screening practices, and assuring that case mix is comparable to other teaching hospitals, the hospital uses resources such as peer-reviewed literature and government reports to identify processes of care or system failures that may account for the higher rate.	Surveillance of rates for internal quality improvement investigations.
Public Health	A state health department publishes the rate for each indicator by provider in a report to highlight quality concerns by provider. PROBLEM: These indicators are not designed to be used for public reporting by provider, and such use may lead to incorrect conclusions about provider quality.	A state health department uses the area level infection due to medical care indicator to examine the overall rate of this indicator in the state. They compare the result of the area level indicator to the provider level indicator to determine how many of these complications occur post-discharge or on an outpatient basis, and are serious enough to require hospitalization later.	Surveillance of rates. Examination of area rates over time, by region, by hospital type.
Research	Researchers use quality indicators as a definitive measurement of quality. PROBLEM: Many factors besides quality may contribute to rate differences.	Researchers use quality indicators to examine the relationship between high rates on PSIs with high rates on other quality measures, such as mortality measures.	Use with other measures of quality to determine relationships of PSIs with structural, process or other aspects of care.

Relationship of This Project to Other Quality Initiatives

This report is one of many efforts to clarify the problem of patient safety in the national health care system. Together these efforts are likely to provide a more complete picture of medical error. Other indicator or measurement sets have been developed, some of which were used in the development of this measure set. Table 21 describes these measures and their relationship to the PSIs.

Another USCF-Stanford Evidence-based Practice Center report evaluated the practices that may improve patient safety in a hospital setting. Some practices evaluated in the report are designed to reduce the events measured in some indicators. Table 22 outlines the overlap between these reports. As users of the PSIs identify potential safety problems, references to scientific evaluations such as *Making Health Care Safer: A Critical Analysis of Patient Safety Practices*[2] will be vital in determining appropriate interventions and potential failures in processes.

Table 21. Relationship of PSIs to Other Indicator Sets

	Description	Relationship to PSIs
VA National Surgical Quality Improvement Program (NSQIP)[148]	An ongoing QI program by VA since 1994. Standardized data collection on adverse events following surgery.	Data collection utilizes standardized definitions which include clinical criteria in some cases. Although definitions differ, some indicators are similar to the PSIs . Adverse events have been added over the years. Data on post operative pneumonia, AMI, neurologic deficit, renal failure, DVT, PE, wound dehiscence, and systemic sepsis capture some of the same complications as potential PSIs, but operationalizations are vastly different.
Miller et al PSIs (published in Health Services Research)[17]	A set of 12 PSIs and a summary measure designed to maximize potential of identifying medical error through administrative data.	PSIs were designed as case finding tools for the most part. PSIs were used as a starting point for the PSIs in this report, although final definitions differ between the two sets. Some PSIs were rejected by the panels. Details are available in Appendix H.
Complications Screening Program[7]	A set of indicators designed to flag complications that occur in-hospital (e.g., in-hospital hip fracture, post-operative pneumonia). This set has been validated and studied widely.	The CSP indicators that have been shown to be adequate in identifying in hospital complications were used as a starting point for the PSIs in this report, although final definitions differ between the two sets. Some CSP indicators were rejected by the panel. Details are available in Appendix H.
National Quality Forum's (NQF) reportable events[5]	A set of case-finding tools designed to flag cases of potential medical error. These events are defined to be serious adverse events resulting in death or disability (e.g., wrong site surgery, serious medication error).	The NQFs reportable events are based on detailed clinical information, unlike the PSIs. Most of the reportable events are not identifiable using administrative data. Definitions of foreign body accidentally left during a procedure, transfusion reaction, and decubitus ulcer are included, but differ from PSI definitions.
National Quality Report (NQR)[168]	A Congressionally mandated report outlining the nationwide state of healthcare quality. This report will not compare providers. The first set of indicators and the accompanying report are due in 2003.	The NQR is separate from the PSIs, although some PSIs are likely to be considered for the report. The report will cover additional topics besides patient safety, and will utilize a variety of data sources.

Table 22. Indicator Level Practices Included in *Making Health Care Safer* [a]

Indicator name	Corresponding chapter in practices report	Practices reviewed
Complications of anesthesia	None	None
Death in low mortality DRGs	None	None
Decubitus ulcer	Prevention of Pressure Ulcers in Older Patients (Chapter 27)	Pressure relieving devices
Failure to rescue	None	None
Foreign body accidentally left during procedure	The Retained Surgical Sponge (Chapter 22)	Sponge and instrument counts
Iatrogenic pneumothorax	Ultrasound Guidance of Central Vein Catheterization (Chapter 21)	Ultrasound guidance of central vein catheterization
Infection due to medical care	Prevention of Intravascular Catheter-Associated Infections (Chapter 16)	Maximum barrier precautions during central venous catheter insertion, use of central venous catheters coated with antibacterial or antiseptic agents, use of chlorhexidine gluconate at the central venous catheter insertion site, other practices.
Postoperative hip fracture	Prevention of Falls in Hospitalized or Institutionalized Older People (Chapter 26)	ID bracelets for high-risk patients, interventions that decrease the use of physical restraints, bed alarms, special floor materials to reduce injuries, hip protectors.
Postoperative hemorrhage or hematoma	None	None
Postoperative physiological and metabolic derangement	None	None
Postoperative respiratory failure	None	None
Postoperative pulmonary embolism or deep venous thrombosis	Prevention of Venous Thromboembolism (Chapter 31)	Graduated elastic stockings, intermittent pneumatic compression, low dose unfractionated heparin, low molecular weight heparin, warfarin and aspirin.
Postoperative wound dehiscence	Prevention of Surgical Site Infections (Chapter 20)	(Wound dehiscence only accounts for some of the outcomes considered in this chapter.) Prophylactic antibiotics, perioperative normothermia, supplemental perioperative oxygen, perioperative glucose control.
Postoperative sepsis	None	None
Technical difficulty with procedure	None	None
Transfusion reaction	None (Mentioned in context of Chapter 43. Prevention of Misidentifications, a major cause of transfusion reactions)	None
Birth trauma – injury to neonate	None	None
Obstetric trauma (all delivery types)	None	None
Obstetric wound complications – c-section	Prevention of Surgical Site Infections (Chapter 20)	Reviewed in the context of all surgical wounds. See notation for wound dehiscence.
Post-partum urinary tract infection	Prevention of Nosocomial Urinary Tract Infections (Chapter 15)	Reviewed in the context of all hospitalized patients.

[a] This table outlines practices reviewed in the EPC Evidence Report, *Making Health Care Safer: A Critical Review of Patient Safety Practices.*[2] This report was written independently of indicator development, therefore chapters listed may only briefly address the adverse event described by the indicator, and may not examine practices for the entire population at risk.

Limitations and Future Research

The methodology of this report included several key choices that led to some limitations. The goal of this study was to identify and evaluate indicators that could be constructed using administrative data, because these data are readily available and less costly than more detailed clinical data. We chose to limit our search to indicators that could be operationalized currently, instead of identifying indicators which have the potential for being operationalized with administrative data in the future. As a result, those patient safety concerns addressed in this indicator set are only a subset of the most prevalent, important or preventable problems. Many important concerns cannot currently be monitored well using administrative data (e.g., adverse drug events). As administrative data improves, many more important and potentially more useful indicators are likely to emerge.

Just as administrative data limited specific indicators chosen, the use of administrative data tends to favor specific types of indicators. The PSIs evaluated in this report contain a large proportion of surgical indicators, rather than medical or psychiatric. This is not to imply that patient safety is not a concern outside of surgery, rather, these indicators tend to be more feasible to define using administrative data for surgical populations. Medical complications are often difficult to distinguish from comorbidities that are present on admission.[13] In addition medical populations tend to be more heterogeneous than surgical, especially elective surgical populations, making it difficult to account for case-mix. Panelists often felt that indicators were more likely to reflect preventable events when limited to elective surgical admissions. As data become better, the addition of patient safety indicators for the medical and psychiatric populations will be critical.

The intended purpose of these indicators guided the choices made in specifying them. Specifically, tradeoffs between specificity (e.g., the likelihood that the indicator will not flag cases that do not qualify as a patient safety event) and sensitivity (e.g., the likelihood that the indicator will flag cases that do qualify as a patient safety event) were considered in conjunction with the use or misuse of these indicators as they move into the public sector. Many complications included in these indicators are more likely in some specified subpopulation. For instance, decubitus ulcers are more likely in patients with paralysis. Since they are more likely to occur, complications in these populations may also be less preventable or be more likely to be present on admission. Nonetheless, interventions to prevent complications may be particularly important in these high risk groups – it is these very patients for which providers need to be particularly vigilant in preventing that complication from occurring. The inclusion of high risk patients, given the limitations of these indicators, would ultimately mean a decrease in the specificity of these indicators, or the ability to have a high yield of patients in whom true safety problems are present. However, to exclude these patients, as was done for many indicators, would sacrifice the sensitivity of these indicators, or the ability to identify as many patients as possible for whom true safety problems may be present.

The evaluation of indicators included in this report reflects only part of the validity testing needed. The structured panel review was intended to assess the face validity of the indicators. However, limitations of such a review should be noted. Several panels were utilized in the review of the indicators; thus panel level differences may be

present, leading to differences in the evaluation of indicators. Further, panelists were not required to support opinion with empirical evidence from the literature, thus panelists' review represents the opinions of these clinicians. Also, panelists may have interpreted the questions about characteristics of the indicators differently, which is particularly problematic for small sample sizes. Finally, although children were included in the population at risk for most indicators, clinicians that care for children were not included in the non-obstetric panels. Team members that specialize in pediatrics (PSR, MM) advised regarding the applicability of these indicators along the way. However, further panelist review and research into the applicability of these indicators to children is necessary. The empirical analyses were intended to demonstrate the precision and bias of the indicator; these tests are more descriptive then evaluative in nature. The tests of precision are affected by the frequency of an event; thus higher frequency indicators tend to have higher precision. This does not imply that these indicators are in fact superior to other indicators. In addition, bias tests were not intended to rule out all potential bias, as indicators that are not affected by risk adjustment may be biased in a way that is not captured by the limited risk adjustment utilized in this study. This is a particular problem for obstetric indicators, where risk adjustment often only accounted for the age of the mother, as other appropriate risk adjustment factors were generally not available in the data.

These initial evaluations of these indicators demonstrated that they are promising, both in terms of face validity and relative precision. Further research should continue to explore the validity of these indicators, such as the construct validity of these indicators. This research should validate the indicators using other data, such as detailed chart data. Validation should focus on the sensitivity and specificity of these indicators in detecting the occurrence of a complication, the extent to which failures in processes of care at the system or individual level are captured using these indicators, the relationship of these indicators with other measures of quality, such as mortality, and explorations of bias and risk adjustment. A recent study examined the relationship between ICD-9-CM identified complications and those identified through standardized clinical data collection.[148] Similar efforts, comparing these PSIs with other measures of patient safety using other data sources will shed additional light on the comparative validity of these indicators. Research may also utilize additional data elements, such as "present on admission coding" available in some states to identify the ability of these indicators to detect complications occurring in-hospital. All validity research must include thoughtful deliberations about the standard of validity for these types of indicators. Given that these indicators are intended for screening purposes, a lower standard of construct validity (the ability of these indicators to detect patient safety problems) may be appropriate than indicators intended as definitive measures.

In addition to research aimed at validating these PSIs, future research should focus on the appropriate and practical application of these indicators. Effort should be put forth in establishing appropriate and potentially flexible benchmarks for the PSIs, such as means, medians, modes, or points of inflection (i.e., point where the slope of the distribution changes) of peer group, regional or statewide providers. Careful attention should also be paid to the understanding of these indicators by clinicians and other end users to ensure that data are appropriately interpreted and fully utilized.

The future of patient safety measurement depends in part on the improvement of administrative data. The addition of timing variables may prove particularly useful. In identifying complications it is necessary to determine whether or not a complication was present on admission, or occurred during the hospitalization. While some of the complications that are present on admission may indeed reflect adverse events of care in a previous hospitalization or outpatient care, many may reflect comorbidities instead of complications. Some states have included a "sixth digit," present on admission designation. These are promising for use in quality indicators. Additional timing distinctions were mentioned during the panel discussions. Specifically, for some complications, occurring in close temporal proximity to surgery or admission was more or less desirable than timing that was more remote. For instance, panelists suggested that aspirations leading to pneumonia that occurred during or immediately after surgery were potentially preventable complications, but that aspirations that occur later in the hospitalization were less preventable. Thus, while administrative data do not currently contain such distinctions, the timing of an adverse event may prove to be a useful data element.

The second area of data improvement would be to allow the linking of hospital data over time and with outpatient data. Many complications may not occur or be diagnosed until after discharge, especially when length of stays are relatively short. Presumably these complications either result in another admission, or are diagnosed and treated on an outpatient basis. For example, the area-level indicators "Infection due to medical care" identified almost twice as many complications as the provider-level indicator, suggesting that many infections occur after discharge or following outpatient care and eventually result in hospitalization. Currently, these complications are not detected by the provider-level PSIs, potentially producing misleading results. The inclusion of complications that occur after discharge would increase the sensitivity of the PSIs.

As highlighted during the structured panel review, it is essential that users understand the limitations and benefits of these indicators in practical use. Clarification about data, vigilance in ensuring the proper use of these indicators, updating indicators to reflect new evidence and practices, and continuous, open communication between clinicians, medical coders and users of these indicators will be essential for their continued success.

The current development and evaluation effort will best be augmented by a continuous communication loop between users of these measures, researchers interested in improving these measures, and policy makers with influence over the resources aimed at data collection. Surely, some indicators will be more useful than others, based on further information and research about them. The conclusions of the companion technical report on quality indicators from the EPC, and published by AHRQ [http://www.achq.gov/data/hcup/qirefine.htm], offers further pertinent detail about future research and activities aimed at improvements in the ability to measure the consequences – intended and unintended—of medical care.

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Appendix A

Inventory of Potential Patient Safety Indicators

This appendix lists the indicators identified by the literature review and personal contacts of the project team. To qualify for this list, the indicator needs to measure a potentially preventable complication of care. In addition, it must be possible or likely that the indicator could be defined based on administrative, unlinked data. For each indicator, the current users or developer are shown, whether the indicator was reviewed by a clinical panel in this project, whether the indicator was evaluated empirically, and why it was selected for or excluded from panel review.

APPENDIX A. INVENTORY OF POTENTIAL PATIENT SAFETY INDICATORS

Measure Type and Clinical Domain	Indicator Name	Current Users or Developers	Panel	Empirical	Reason for selection for or exclusion from clinician panel review.
Proxy-Outcome measures:					
	All discharges, length of stay	• HQI ValiData			Conceptually less connected to patient safety compared with next two.
	Conditional length of stay	• Literature Silber	x		Adequate previous validation.
	Unexpected length of stay	• Literature Kuykendall[1]	x		Adequate previous validation.
Outcomes measures:					
	Aspiration pneumonia	• Complications Screening Program • Needleman and Buerhaus[2] • University HealthSystem Consortium	x	e	Adequate previous validation.
	Bacteraemia	• Literature: Ansari (Australia)[3]			Related to septicemia indicator.
	CABG following PTCA	• University HealthSystem Consortium • Literature[4-12]	x	e	Adequate previous validation.
	Cardiac event or emergency	• Complications Screening Program			No previous validation.

See References at end of table.

Note: Almost without exception, original indicator definition differs from final tested definition, based on panel feedback and coding changes. An "x" in the "Panel" column means that the indicator, in some form, was reviewed by the clinical panels for this project. The "Empirical" column distinguishes between indicators that were accepted ("x") from those classified as experimental ("e").

Cellulitis	• Complications Screening Program			No previous validation.
Complications of anesthesia/ Anesthesia related events	• Complications Screening Program	x	x	Final definition differs substantially from original CSP indicator.
Death in low mortality DRGs	• Hannan et al.[13]	x	x	Adequate previous validation.
Death within one or two days of surgical procedure	• Hannan et al.[13] • University HealthSystem Consortium			
Decubitus Ulcer	• Complications Screening Program • Needleman and Buerhaus[2] • American Nurses Association • California Nursing Outcomes Coalition		x	Subset of cellulitis indicator. Created after review of ICD-9-CM codes.
Decubitus Ulcer in High Risk Patient	• none		e	Suggested by panelists.
Dosage complications	• none	x		Created after review of ICD-9-CM codes.
Failure to rescue (2 alternative definitions)	• Silber et al.[14] • Needleman and Buerhaus[2]	x	x	Adequate previous validation.
Foreign body left in during procedure	• Miller et al.[15] • McKesson Health Systems Solutions	x	x	Created from codes in sentinel event codes and a review of ICD-9-CM codes.
Iatrogenic hypotension	• Miller et al PSIs[15]	x		Created after review of ICD-9-CM codes.

See References at end of table.

Note: Almost without exception, original indicator definition differs from final tested definition, based on panel feedback and coding changes. An "x" in the "Panel" column means that the indicator, in some form, was reviewed by the clinical panels for this project. The "Empirical" column distinguishes between indicators that were accepted ("x") from those classified as experimental ("e").

Iatrogenic pneumothorax	• Miller et al PSIs[15]	x	x	Created after review of ICD-9-CM codes.
Infection due to medical care	• Miller et al PSIs[15]	x	x	Created after review of ICD-9-CM codes and Complications Screening program.
In-hospital burns	• Hannan et al.[13]			Inadequate previous validation.
In-hospital fractures possibly related to falls	• None	x	e	Suggested by panel as expansion to hip fracture indicator.
In-hospital hip fracture (and falls)	• Complications Screening Program • Needleman and Buerhaus[2] • American Nurses Association • California Nursing Outcomes Coalition	x	x	Adequate previous validation. Final definition excluded falls.
Intestinal infection due to *C. difficile*	• None	x		Subset of postoperative infection indicator. Created after review of ICD-9-CM codes.
Intraoperative nerve compression injuries	• None	x	e	Suggested by panelists.
Malignant hyperthermia	• None	x	e	Suggested by panelists based on discussion of complications of anesthesia indicator.
Mechanical complication (Device implant)	• Complications Screening Program • University HealthSystem Consortium • HCUP			Poor validity in published reports.

See References at end of table.

Note: Almost without exception, original indicator definition differs from final tested definition, based on panel feedback and coding changes. An "x" in the "Panel" column means that the indicator, in some form, was reviewed by the clinical panels for this project. The "Empirical" column distinguishes between indicators that were accepted ("x") from those classified as experimental ("e").

Miscellaneous complications	• Complications Screening Program			Inadequate previous validation.
Nosocomial/iatrogenic disease	• Sagamore Health			Requires additional data.
Peri-operative complications	• IMSystem • University HealthSystem Consortium			Proprietary measures.
Perforation diagnosis	• Miller et al[15]			Eliminated due to coding concerns
Post- or intraoperative shock due to anesthesia	• Complications Screening Program			Included in original complications of anesthesia indicator.
Postoperative acute myocardial infarction (AMI)	• Complications Screening Program • University HealthSystem Consortium • HCUP	x	e	Adequate previous validation.
Postoperative cardiac anomaly	• Complications Screening Program			No previous validation.
Postoperative central nervous system (CNS) or peripheral (PNS) complication	• Complications Screening Program • University HealthSystem Consortium			No previous validation.
Postoperative cerebral infarction	• Complications Screening Program • University HealthSystem Consortium			Poor validity in published reports.

See References at end of table.

Note: Almost without exception, original indicator definition differs from final tested definition, based on panel feedback and coding changes. An "x" in the "Panel" column means that the indicator, in some form, was reviewed by the clinical panels for this project. The "Empirical" column distinguishes between indicators that were accepted ("x") from those classified as experimental ("e").

Postoperative coma	• Complications Screening Program • Needleman and Buerhaus[2]			No previous validation.
Postoperative GI hemorrhage or ulceration following non-GI surgery	• Complications Screening Program • University HealthSystem Consortium • HCUP • Needleman and Buerhaus[2]			Poor validity in published reports.
Postoperative hemorrhage or hematoma	• Complications Screening Program • HCUP • University HealthSystem Consortium	x	x	Adequate previous validation.
Postoperative iatrogenic complications - Nervous	• Complications Screening Program • University HealthSystem Consortium • HCUP	x	e	Adequate previous validation. Subset of CSP/UHC/HCUP indicator.
Postoperative Iatrogenic Complications -Cardiac	• Originally part of general iatragenic complications indicator (see above)	x	e	See above
Postoperative Iatrogenic Complications -Urinary	• See above	x		See above

See References at end of table.

Note: Almost without exception, original indicator definition differs from final tested definition, based on panel feedback and coding changes. An "x" in the "Panel" column means that the indicator, in some form, was reviewed by the clinical panels for this project. The "Empirical" column distinguishes between indicators that were accepted ("x") from those classified as experimental ("e").

Postoperative Iatrogenic Complications -Respiratory	• See above	x		See above
Postoperative Iatrogenic Complications -Digestive	• See above	x		See above
Postoperative Iatrogenic Complications -Vascular	• See above	x		See above
Postoperative infections (not pneumonia or wound infection)	• Complications Screening Program • University HealthSyste Consortium • Needleman and Buerhaus[2]			Poor validity in published reports.
Postoperative physiologic and metabolic derangements	• Complications Screening Program • University HealthSystem Consortium • Needleman and Buerhaus[2] • Hannan et al.[13]	x	x	Adequate previous validation.
Postoperative pneumonia	• Complications Screening Program • University HealthSystem Consortium • HCUP	x		Adequate previous validation.

See References at end of table.

Note: Almost without exception, original indicator definition differs from final tested definition, based on panel feedback and coding changes. An "x" in the "Panel" column means that the indicator, in some form, was reviewed by the clinical panels for this project. The "Empirical" column distinguishes between indicators that were accepted ("x") from those classified as experimental ("e").

Postoperative pulmonary compromise	• Complications Screening Program • University HealthSystem Consortium • HCUP • Needleman and Buerhaus[2]	x	x	Adequate previous validation.
Postoperative thrombosis and embolism	• Complications Screening Program • Ansari (Australia)[3] • HCUP • Needleman and Buerhaus[2] • CMS[16]	x	x	Adequate previous validation.
Postoperative urinary tract complications	• Complications Screening Program • HCUP			No previous validation.
Postoperative wound dehiscence	• Hannan et al.[13]	x	x	Subset of the CSP indicator "Reopening of Surgical Site"
Primary blood infection	• IMSystem			Related to septicemia indicator.
Reopening of surgical site	• Complications Screening Program • University HealthSystem Consortium	x	e	Adequate previous validation.

See References at end of table.

Note: Almost without exception, original indicator definition differs from final tested definition, based on panel feedback and coding changes. An "x" in the "Panel" column means that the indicator, in some form, was reviewed by the clinical panels for this project. The "Empirical" column distinguishes between indicators that were accepted ("x") from those classified as experimental ("e").

Return to operating room	• Maryland Quality Indicator • University HealthSystem Consortium • Ansari (Australia) [3]			Requires additional data.
Septicemia	• Complications Screening Program • Needleman and Buerhaus[2]	x	x	Adequate previous validation.
Sentinel events	• Complications Screening Program			Many specific events included in separate indicators.
Shock or cardiopulmonary arrest in hospital	• Complications Screening Program • Needleman and Buerhaus[2]			Inadequate previous validation.
Specific drug events/ Complications relating to drugs	• Complications Screening Program • Hannan[13]			Poor validity in published reports.
Surgical patient injury	• University HealthSystem Consortium			Proprietary measure.
Surgical technical difficulty	• University HealthSystem Consortium			Proprietary measure.

See References at end of table.

Note: Almost without exception, original indicator definition differs from final tested definition, based on panel feedback and coding changes. An "x" in the "Panel" column means that the indicator, in some form, was reviewed by the clinical panels for this project. The "Empirical" column distinguishes between indicators that were accepted ("x") from those classified as experimental ("e").

	Suture of laceration (Laceration, perforation injury)	• Complications Screening Program • Miller et al.[15] • University HealthSystem Consortium	x	e	Suture of laceration is a subset of the CSP indicator.
	Technical difficulty with care (procedure)	• Complications Screening Program • University HealthSystem Consortium • McKesson Health Solutions • Miller et al.[15]	x	x	Adequate previous validation.
	Transfer to other hospital	• Literature: Bates et al.[17]			Requires additional data.
	Transfusion Reaction/ Complications with blood products	• Complications Screening Program • Miller et al.[15]	x	x	Adequate previous validation.
	Vent Pneumonia	• IMSystem			Requires additional data.
	Wound Infection/ Surgical site infection	• Complications Screening Program • IMSystem • Ansari (Australia) • CARE • HCUP			Poor validity in published reports.
Obstetric					
	Fetal death	• none	x		Created after review of ICD-9-CM codes, but not actually feasible to implement with HCUP data.

See References at end of table.

Note: Almost without exception, original indicator definition differs from final tested definition, based on panel feedback and coding changes. An "x" in the "Panel" column means that the indicator, in some form, was reviewed by the clinical panels for this project. The "Empirical" column distinguishes between indicators that were accepted ("x") from those classified as experimental ("e").

	Complications of therapeutic abortion	• none	x		Created after review of ICD-9-CM codes, but removed due to operationalization concerns.
	Birth trauma-injury to neonate	• Miller et al.[15] • McKesson Health Solutions	x	x	Created after review of ICD-9-CM codes.
	Third or fourth degree obstetric laceration	• JCAHO • McKesson Health Solutions		e	Panelists preferred to restrict to fourth degree lacerations (part of obstetric trauma indicator).
	Obstetric trauma - vaginal without instrument	• none	x	x	Created after review of ICD-9-CM codes.
	Obstetric trauma, - vaginal with instrument	• none	x	x	Created after review of ICD-9-CM codes.
	Obstetric trauma - cesarean section	• none	x	x	Created after review of ICD-9-CM codes.
	Obstetric wound complications - cesarean section delivery	• none	x	x	Created after review of ICD-9-CM codes.
	Obstetric wound complications – vaginal delivery	• none	x	e	Created after review of ICD-9-CM codes.
	Obstetric vascular complications	• none	x		Created after review of ICD-9-CM codes.
	Other obstetric complications of delivery	• Miller et al.[15]	x	e	Created after review of ICD-9-CM codes.
	Post-partum urinary tract infection	• none	x	x	Suggested by panelists.
	Puerperal infection	• none	x		Created after review of ICD-9-CM codes.
	Uterine Rupture	• none	x	e	Suggested by panelists.
Psychiatric					
	Attempted suicide	• Sagamore Health			Requires additional data.

See References at end of table.

Note: Almost without exception, original indicator definition differs from final tested definition, based on panel feedback and coding changes. An “x” in the “Panel” column means that the indicator, in some form, was reviewed by the clinical panels for this project. The “Empirical” column distinguishes between indicators that were accepted (“x”) from those classified as experimental (“e”).

Psychiatric hospital termination AMA (Against medical advice)	• JCAHO • University HealthSystem Consortium			Requires additional data.

See References at end of table.

Note: Almost without exception, original indicator definition differs from final tested definition, based on panel feedback and coding changes. An "x" in the "Panel" column means that the indicator, in some form, was reviewed by the clinical panels for this project. The "Empirical" column distinguishes between indicators that were accepted ("x") from those classified as experimental ("e").

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Appendix B

Clinician Review Panels

This appendix includes information about the composition of the eight multi-specialty panels, and the three surgical panels. Following the identifying name for each panel, the indicators reviewed are shown, and then the members of the panel are listed. Finally, the professional organization that nominated the panelist is listed.

APPENDIX B. CLINICIAN REVIEW PANELS

MEDICAL COMPLICATIONS 1 (MULTISPECIALTY)

Indicators Reviewed
Decubitus ulcer
Infection due to medical care
Intestinal infection due to *C. difficile*
In-hospital hip fracture and falls
In hospital fractures possibly related to falls
Septicemia

Desmond Birkett, MD, Surgeon
Burlington, MA
Department of General Surgery, Lahey Clinic
Nominated by the American College of Surgeons

Eric A. Coleman, MD, MPH, Geriatrician
Denver, CO
University of Colorado Health Science Center
Nominated by the American Geriatric Society

John Crabtree, MD, Surgeon
Bellflower, CA
Kaiser Permanente Bellflower Medical Center
Nominated by the American College of Surgeons

Kathleen Ellstrom, MS, PhD, Critical care nurse
Grand Terrace, CA
Kaiser Foundation Hospital – Riverside
Nominated by the American Association of Critical-Care Nurses

Sunil Kripalani, MD, MSc, Hospitalist
Atlanta, GA
Emory University School of Medicine
Nominated by the National Association of Inpatient Physicians

Peter Lindenauer MD, MSc**,** Hospitalist
Springfield, MA
Baystate Medical Center, Division of Healthcare Quality
Tufts University School of Medicine
Nominated by the National Association of Inpatient Physicians

Jim Webster, MD, MS, Internist
Chicago, IL
Northwestern University Medical School
Nominated by the American College of Physicians

MEDICAL COMPLICATIONS 2 (MULTISPECIALTY)

Indicators Reviewed
Dosage complications
Unexpected LOS / Conditional LOS
Failure to rescue (2 definitions)
Death in low mortality DRGs

Michael Barrett, MD, Internist and Cardiologist
Blue Bell, PA
Medical College of Pennsylvania Hospital
Nominated by the American College of Physicians

William Golden, MD, Professor of medicine, Internist
Little Rock, AR
University of Arkansas for Medical Sciences
Nominated by the American College of Physicians

Constantine Manthous, MD, Critical care physician
Hamden CT
Yale University
Nominated by the American Thoracic Society

Brenda Snyder, RN, MS, CNS, CCRN, Critical care nurse
Evans, CO
University of Northern Colorado
Nominated by the American Association of Critical-Care Nurses

Mark W. Thomas, RPh, MS, Pharmacist, Pediatrics
Minneapolis, MN
Children's Hospital and Clinics-Minneapolis, St. Paul
Nominated by the American Society of Health-system Pharmacists

Mark Williams, MD, Hospitalist
Atlanta, GA
Emory University of Medicine
Nominated by the National Association of Inpatient Physicians

Charles Yowler, MD, Surgeon, Critical Care - Burn Surgery
Cleveland, OH
Case Western Reserve University
Nominated by the American College of Surgeons

OBSTETRIC COMPLICATIONS OF DELIVERY 1 (MULTISPECIALTY)

Indicators Reviewed
Birth trauma - injury to neonate
Complications of therapeutic abortion (removed due to operationalization concerns)
Fetal Death (removed due to operationalization concerns

Obstetric trauma - cesarean section
Obstetric trauma - vaginal with instrument
Obstetric trauma - vaginal without instrument

Patricia Creehan, RNC, MSN, Perinatal clinical nurse specialist
Palos Heights, IL
Palos Community Hospital
Nominated by the Association of Women's Health - Obstetric and Neonatal Nurses

Neal F. Devitt, MD, Family practitioner
Santa Fe, NM
University of New Mexico
Nominated by the American Academy of Family Physicians

Robert B. Gherman, MD, Obstetrician - maternal, fetal medicine
Chesapeake, VA
Uniformed Services
University of the Health Sciences
Nominated by the American College of Obstetricians and Gynecologists

Stephen Ratcliffe, MD, MSPH, Family practitioner
Salt Lake City, UT
University of Utah
Nominated by the American Academy of Family Physicians

Allan T. Sawyer, MD, Obstetrician
Glendale, AZ
Thunderbird Samaritan Medical Center
Nominated by the American College of Obstetricians and Gynecologists

Joan Slager, CNM, MSN, Certified nurse-Midwife
Kalamazoo, MI
Bronson Women's Service
Nominated by the American College of Nurse-Midwives

Naomi Stotland, MD, Clinical Instructor, Obstetrician
San Francisco, CA
Institute for Health Policy Studies, University of California San Francisco
Nominated by the EPC Contact

OBSTETRIC COMPLICATIONS 2 (MULTISPECIALTY)

Indicators Reviewed

Puerperal infection
Obstetric vascular complications
Obstetric wound complications - cesarean section
Obstetric wound complications - vaginal delivery
Other obstetric complications of delivery
Urinary tract infection

Mark Deutchman, MD, Family practitioner
Denver, CO
University of Colorado
Nominated by the American Academy of Family Physicians

Jan Kriebs, CNM, FACNM, Certified nurse-Midwife
Bowie, MD
University of Maryland, Assistant Professor
Nominated by the American College of Nurse-Midwives

David Nagey, MD, PhD, Obstetrician, maternal-fetal medicine
Baltimore, MD
Johns Hopkins University
Nominated by the American College of Obstetricians and Gynecologists

Nancy Petit, MD, Obstetrician
Newark, DE
Uniformed Services - University of the Health Sciences
Nominated by the American College of Obstetricians and Gynecologists

Vickie Waymire, RNC, MSN, Perinatal clinical nurse specialist
Lincoln, NE
Saint Elizabeth Regional Medical Center
Nominated by the Association of Women's Health - Obstetric and Neonatal Nurses

Cynthia Woo, MD, Obstetrician
Bay Area, CA
Stanford Hospital
EPC Contact

PROCEDURAL COMPLICATIONS 1 (MULTISPECIALTY)

Indicators Reviewed
Iatrogenic hypotension
Iatrogenic pneumothorax
CABG following PTCA
Technical difficulty with procedure
Postoperative iatrogenic complications – (cardiac, nervous, respiratory, digestive, vascular, urinary)

W. Barton Campbell, M.D, FACC, Cardiologist and critical care physician
Nashville, TN
Vanderbilt University
Nominated by the American College of Cardiology

Curtis A. Lewis, MD, Interventional radiologist
Atlanta, GA
Emory University School of Medicine
Nominated by the American College of Radiology

Patricia A. Numann, MD, Surgeon
Syracuse, NY
State University of New York – Upstate Medical University
Nominated by the American College of Surgeons

Patricia O'Malley, RN, PhD, CCRN, CNS, Clinical nurse specialist, Cardiology services
Dayton, OH
Miami Valley Hospital
Nominated by the American Association of Critical-Care Nurses

Paul V. O'Moore, MD, Interventional radiologist
Abington, PA
Abington Memorial Hospital
Nominated by the American College of Radiology

Josh Ofman, MD, MSHS, Internist and Gastroenterologist
Beverly Hills, CA
University of California- Los Angeles School of Medicine
Nominated by the American College of Physicians

Jean M. Reeder, PhD,RN, FAAN, Perioperative nurse & Healthcare consultant
Anacortes, WA
Nominated by the Association of Peri-Operative Registered Nurses

Stephen D. Small, MD, Anesthesiologist
Chicago, IL
University of Chicago
Nominated by the American Society of Anesthesiologists

SURGICAL COMPLICATIONS 1 (MULTISPECIALTY)

Indicators Reviewed
Postoperative acute myocardial infarction
Postoperative hemorrhage and hematoma
Postoperative pneumonia
Postoperative pulmonary embolism or deep vein thrombosis

Charles Bethea, MD, Cardiologist
Oklahoma City, OK
Duke Clinical Research Institute
Nominated by the American College of Cardiology

John Hunt, MD, MPH, Trauma surgeon, critical care
New Orleans, LA
Health Science Center - Louisiana State University
Nominated by the American College of Surgeons

Franco Laghi, MD, Critical care physician
Maywood, IL
Loyola University

Nominated by the American Thoracic Society

John Nelson, MD, FACP, Internist/Hospitalist
Bellevue, WA
Overlake Hospital Medical Center
Nominated by the National Association of Inpatient Physicians

Carol A. Petersen, RN, BSN, MAOM, CNOR, Perioperative nursing specialist
Denver, CO
Center for Nursing Practice
Nominated by the Association of Peri-Operative Registered Nurses

Bruce Williams, MSN, RN, Critical care nurse specialist
Orangeburg, SC
The Regional Medical Center - of Orangeburg and Calhoun Counties
Nominated by the American Association of Critical-Care Nurses

Preston Winters, MD, FACP, Internist
White Plains, NY
White Plains Hospital Center
Nominated by the American College of Physicians

SURGICAL COMPLICATIONS 2 (MULTISPECIALTY)

Indicators Reviewed

Postoperative pulmonary compromise
Reopening of surgical site
Suture of laceration
Postoperative wound dehiscence
Foreign body left in during procedure

Robert Kozol, MD, MSA, Surgeon
Farmington, CT
University of Connecticut
Nominated by the American College of Surgeons

Steven Liu, MD, Hospitalist
Atlanta, GA
Emory University School of Medicine
Nominated by the National Association of Inpatient Physicians

Lenora Maze, MSN, Critical care nurse
Indianapolis, IN
Wishard Health Services
Nominated by the Substitute for American Association of Critical-Care Nurses Nominee

Valerie Palda, MD, MSc, Internist
Toronto, ON
University of Toronto
Nominated by the American College of Physicians

Sanjay Saint, MD, MPH, Hospitalist
Ann Arbor, MI
University of Michigan Medical School
Nominated by the National Association of Inpatient Physicians

Patrice Spera, RN, MS, Perioperative nurse
Seminole, FL
Tampa General Hospital
Nominated by the Association of Peri-Operative Registered Nurses

SURGICAL COMPLICATIONS 3 (MULTISPECIALTY)

Indicators Reviewed
Aspiration pneumonia
Transfusion reaction
Postoperative physiologic and metabolic derangements
Complications of anesthesia
Malignant hyperthermia
Intraoperative physical injuries

Janet Davies, MSN, Critical care nurse
Mt. Laurel, NJ
South Jersey Hospital System
Nominated by the American Association of Critical-Care Nurses

Jesse Hall, MD, Critical care physician
Chicago, IL
University of Chicago
Nominated by the American Thoracic Society

Jeanne M. Huddleston, MD, Hospitalist
Rochester, MN
Mayo Clinic
Nominated by the National Association of Inpatient Physicians

Deborah G. Spratt, CNOR, CNAA, Nurse manager- surgery
Avon, NY
University of Rochester
Nominated by the Association of Peri-Operative Registered Nurses

Mary Ellen Warner, MD, Anesthesiologist
Rochester, MN
Mayo Clinic
Nominated by the American Society of Anesthesiologists

SURGICAL COMPLICATIONS 1 (SURGICAL)

Indicators Reviewed
Postoperative acute myocardial infarction

Postoperative pulmonary embolism or deep vein thrombosis
Postoperative pneumonia
Intraoperative physical injuries
Post-surgical hemorrhage or hematoma

Rodney Appell, MD, Female urologist
Houston, TX
Baylor College of Medicine
Nominated by the American Urologic Association

Alan Freeland, MD, Orthopedic surgeon
Jackson, MS
University of Mississippi Medical Center
Nominated by the American Academy of Hand Surgeon)

Patricia Howson, MD, MSc, Orthopedic surgeon
Redwood City, CA
Kaiser Permanente
Nominated by the American Academy of Orthopedic Surgeons

William Hozak, MD, Orthopedic surgeon
Philadelphia, PA
Jefferson Medical School
Nominated by the American Association of Hip and Knee Surgeons

Mathew Indeck, MD, General Surgeon -trauma surgery
Danville, PA
Jefferson College of Medicine
Nominated by the American College of Surgeons

Bruce Kaufman, MD, Pediatric neurosurgeon
Milwaukee, WI
Medical College of Wisconsin
Nominated by the American Association of Neurological Surgeons

SURGICAL COMPLICATIONS 2 (SURGICAL)

Indicators Reviewed

Foreign body left in during procedure
Postoperative pulmonary compromise
Reopening of surgical site
Suture of laceration
Postoperative wound dehiscence

Joseph Basler, MD, PhD, Urologist
San Antonio, TX
University of Texas Health Science Center
Nominated by the American Urologic Association

John Fung, MD, Transplant surgeon
Pittsburgh, PA
University of Pittsburgh
Nominated by the American Society of Transplant Surgeons

Charles Kenny, MD, Orthopedic surgeon
Stockbridge, MA
Fairview Hospital
Nominated by the American Academy of Orthopedic Surgeons

John Kestle, MD, MSc, Pediatric neurosurgeon
Salt Lake City, UT
University of Utah
Nominated by the American Association of Neurological Surgeons

Michael Klassen, MD, Joint and arthroscopic surgeon
Monterey, CA
Community Hospital of the Monterey Peninsula
Nominated by the American Academy of Orthopedic Surgeons

George Lucas, MD, Orthopedic surgeon - hand surgery
Wichita, KS
University of Kansas, Wichita
Nominated by the American Academy of Hand Surgeon

Dennis Maiman, MD, PhD, Neurosurgeon- spine surgery
Milwaukee, WI
Froedert Memorial Lutheran Hospital
Nominated by the North American Spine Society

Richard Nelson, MD, Colon and rectal surgeon
Chicago, IL
University of Illinois
Nominated by the American Society of Colon and Rectal Surgeons

Michael Stamos, MD, Colon and rectal surgeon
Torrance, CA
University of California - Los Angeles School of Medicine
Nominated by the American College of Surgeons

SURGICAL COMPLICATIONS 3 (SURGICAL)

Indicators Reviewed

Aspiration pneumonia
Complications of anesthesia
Postoperative physiologic and metabolic derangements
Transfusion reaction
Malignant Hyperthermia

Robert Florin, MD, Spine surgeon
Whittier, CA
University of Southern California School of Medicine
Nominated by the American Association of Neurological Surgeons

Stephen Haines, MD, Pediatric neurosurgeon - skull base lesions
Charleston, SC
Medical University of South Carolina
Nominated by the American Association of Neurological Surgeons

Goran Klintmalm, MD, PhD, Transplant surgeon - liver transplantation
Dallas, TX
Baylor Institute of Transplantation Sciences
Baylor University Medical Center
Nominated by the American Society of Transplant Surgeons

Steven Kraus, MD, Female urologist
San Antonio, TX
University of Texas Health Science Center
Nominated by the American Urologic Association

Deborah Nagle, MD, Colon and rectal surgeon
Philadelphia, PA
Graduate Hospital MCP-Hahnemann
Nominated by the American Society of Colon and Rectal Surgeons

Richard Strain, MD, Orthopedic surgeon
Hollywood, FL
University of Miami Medical School
Nominated by the American Academy of Orthopedic Surgeons

Appendix C

Sample of Information Sent to Panelists

This appendix duplicates materials sent to panelists.

Section 1 includes the instructions and definitions sent to panelists, as well as a key illustrating the indicator definitions in Sections 2 and 3.

Section 2 includes a sample indicator definition sheet sent prior to the conference call.

Section 3 includes a sample indicator definition sheet sent after the conference call.

Section 4 includes the questionnaire for rating each indicator sent before and after the conference call.

APPENDIX C. SAMPLE OF INFORMATION SENT TO PANELISTS

Section 1. Directions sent to panelists

The questionnaires in this packet each describe one potential patient safety indicator and ask for your feedback on specific aspects of that indicator. You must fill out one questionnaire for each indicator. Please answer all questions on this form. You may comment in the sections provided below each question, or on a separate sheet of paper. Comments are not required. We expect that completing each form will take about 15-20 minutes to complete.

All indicators are defined using ICD-9-CM diagnostic and procedure codes, obtained from administrative data. We do not expect that most physicians or nurses will be familiar with these codes and thus we provide explanations of all codes.

- ICD-9-CM codes are usually assigned using the physician's charted notes by trained coders.
- Each patient discharged from an inpatient facility is given a principal diagnosis, which represents the condition principally responsible for occasioning the patient's admission, and a list of secondary diagnosis codes.
- Major procedures that involve use of the operating room or risk to the patient are also coded.
- Codes between 996 and 999 are always "complications of surgical and medical care."
- Codes beginning with 'E' refer to the external cause of any injury that the patient sustained.

Some indicators limit eligible patients to certain groups, including DRGs and MDCs.

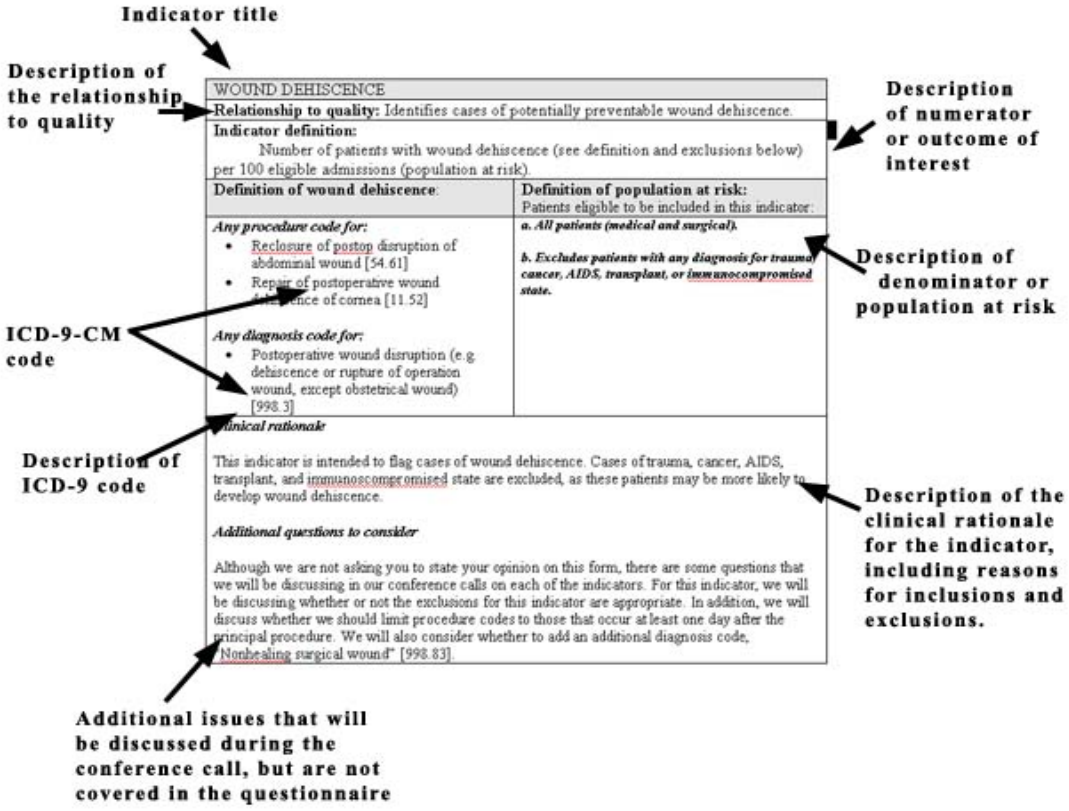
- DRGs are "Diagnostic Related Groups." They are defined by the Health Care Financing Administration (HCFA). One DRG is assigned to each patient per admission. The assigned DRG reflects many factors including the principal diagnosis, listed secondary diagnoses, age, and major procedures.
- MDCs are "Major Diagnostic Categories" and are defined using DRGs. DRGs involving the same body system are generally grouped together to form one MDC.
- All other eligible patient limitations (e.g. trauma, immunocompromised) are derived from ICD-9 codes alone.

For the purpose of this study we will use the definitions of Brennan et al[1] of negligence and complications (adverse events). We have created a standard definition of preventable.

- Negligence (medical error): Care that falls below the standard reasonably expected of average physicians in their community.
- Complication: An injury that is caused by medical management (rather than the underlying disease) and that prolongs the hospitalization, or produces a disability at the time of discharge, or both.
- Preventable: Condition for which reasonable clinical steps may reduce (but not necessarily eliminate) the risk of that complication occurring.

[1] Brennan, TA, Leape, LL, Laird, NM, Herbert, L et al. Incidence of adverse events and negligence in hospitalized patients. Results of the Harvard Medical Practice Study I. *New Engl J Med*, 1997 Feb 7;324(6):370-6.

KEY TO INDICATOR DEFINITION SHEET



Section 2. Example indicator definition sheet sent to panelists prior to conference call

<table>
<tr><td colspan="2">POSTOPERATIVE ACUTE MYOCARDIAL INFARCTION</td></tr>
<tr><td colspan="2">Relationship to quality: Identifies cases of potentially preventable myocardial infarction following a surgical procedure.</td></tr>
<tr><td colspan="2">Indicator definition:
Number of patients with postoperative AMIs (see definition and exclusions below) per 100 eligible surgical admissions (population at risk).</td></tr>
<tr><td>Definition of AMI:</td><td>Definition of population at risk:
Patients eligible to be included in this indicator:</td></tr>
<tr><td>Secondary diagnosis code for AMI:
• Acute myocardial infarction (includes only unspecified or initial episode of care for cardiac infarction, coronary embolism, occlusion, rupture or thrombosis) [410.00-410.91 except if 5th digit = 2]</td><td>a. All non-cardiac surgical patients.

b. Patient must not be undergoing cardiac surgery.

c. Patient must not be in the following MDCs:
• Diseases and Disorders of the Circulatory System [5]</td></tr>
<tr><td colspan="2">Clinical rationale

This indicator is intended to flag cases of postoperative AMI. It is identical to an indicator developed by Lisa Iezzoni as part of the Complications Screening Program. Codes denoting a “subsequent episode of care” for AMI are not included. This indicator limits AMI codes to secondary diagnosis codes in order to eliminate AMIs that were present on admission. It further excludes patients which have major circulatory disorders, or who are undergoing cardiac surgery, as these patients may be more likely to develop an AMI peri-operatively.</td></tr>
</table>

Section 3. Example indicator definition sheet sent to panelists after conference call

Note: Bold "**Changes to indicator**" text was added for post-panel conference call review.

<table>
<tr><td colspan="2">POSTOPERATIVE ACUTE MYOCARDIAL INFARCTION</td></tr>
<tr><td colspan="2">Relationship to quality: Identifies cases of potentially preventable myocardial infarction following a surgical procedure.</td></tr>
<tr><td colspan="2">Indicator definition:
Number of patients with postoperative AMIs (see definition and exclusions below) per 100 eligible surgical admissions (population at risk).</td></tr>
<tr><td>Definition of AMI:</td><td>Definition of population at risk:
Patients eligible to be included in this indicator:</td></tr>
<tr><td>Secondary diagnosis code for AMI:
• Acute myocardial infarction (includes only unspecified or initial episode of care for cardiac infarction, coronary embolism, occlusion, rupture or thrombosis) [410.00-410.91 except if 5th digit = 2]</td><td>a. All non-cardiac elective surgical patients.

b. Patient must not be undergoing cardiac surgery.</td></tr>
<tr><td colspan="2">Clinical rationale

This indicator is intended to flag cases of postoperative AMI. It is identical to an indicator developed by Lisa Iezzoni as part of the Complications Screening Program. Codes denoting a "subsequent episode of care" for AMI are not included. This indicator limits AMI codes to secondary diagnosis codes in order to eliminate AMIs that were present on admission. It further excludes patients which have major circulatory disorders, or who are undergoing cardiac surgery, as these patients may be more likely to develop an AMI peri-operatively.

Changes to indicator

1. The eligible population was restricted to elective surgeries only. The panel was concerned that this complication is less preventable after emergency surgery than after elective surgery, because there is little opportunity for preoperative assessment and risk reduction before emergency surgery. The weighing of risks and benefits in high-risk patients does not apply to emergency surgery. Therefore, we have now proposed focusing this indicator only on elective surgery patients, for whom postponement or cancellation of surgery, and perioperative beta blockade, are usually viable options.

2. The exclusion for patients in MDC 5 was eliminated, such that vascular surgery patients would be included. Panelists felt that this was a group for which postoperative AMI was a serious complication that could be preventable in some cases. Patients undergoing cardiac surgery continue to be excluded from this indicator.</td></tr>
</table>

Section 4. Questionnaire sent before and after panel discussion

Panelist name:

Indicator name: POSTOPERATIVE ACUTE MYOCARDIAL INFARCTION

1. To what extent is this indicator likely to identify the occurrence of an adverse event or complication (as opposed to *having the condition present on admission*)?

1	2	3	4	5	6	7	8	9
Not at all likely								Very likely

Comments:

2. To what extent is the occurrence of this complication likely to be preventable (as opposed to being an expected result of the patient's underlying conditions and/or procedures)?

1	2	3	4	5	6	7	8	9
Not at all likely								Very likely

Comments:

3. To what extent is this complication likely to represent true medical error or negligence (as opposed to lack of ideal or perfect medical care)?

1	2	3	4	5	6	7	8	9
Not at all likely								Very likely

Comments:

Panelist name:

Indicator name: POSTOPERATIVE ACUTE MYOCARDIAL INFARCTION

4. How often is this complication, *when it occurs*, clearly charted in medical records by physicians?

1	2	3	4	5	6	7	8	9
Never charted								Always charted

Comments:

5. To what extent is this indicator subject to bias (meaning that some hospitals will be judged as low quality because they systematically differ from other hospitals in some aspect, such as severity of the case mix, that is not due to poor quality care)?

1	2	3	4	5	6	7	8	9
Not at all biased								Very biased

What are the factors that contribute to the bias?

6. Are there ways that providers or health systems could easily appear to better their performance on this indicator, without actually improving the quality of care that they provide?

7. Are there adverse outcomes that could result from implementing this indicator?

Panelist name:

Indicator name: POSTOPERATIVE ACUTE MYOCARDIAL INFARCTION

8. What is your overall rating of the usefulness of this indicator?

1	2	3	4	5	6	7	8	9
Highly discourage use								Highly recommend use

Please discuss you reasons for assigning the overall rating above.

9. Would you suggest any changes to the definition of this indicator? Please specify changes and give rationale supporting proposed changes.

10. Is there anything else that you would like us to know about this indicator?

Appendix D

Empirical Methods Details

This appendix gives details about risk adjustment (DRG and comorbidity) and death in low mortality DRGs.

Section 1 lists adjacent DRGs which differ by the distinction of “with comorbidities and complications” as opposed to “without comorbidities and complications” that were grouped for the purpose of risk adjustment.

Section 2 lists the super-MDC categories and non-valid DRGs that were excluded from risk adjustment.

Section 3 lists details of the adaptation of the AHRQ Comorbidity Software, with the rationale for each adaptation.

Section 4 lists the DRGs included in the denominator of the indicator “Death in low mortality DRGs” by stratification.

APPENDIX D. EMPIRICAL METHODS DETAILS

Section 1. DRG Categories Grouped in the PSI Risk Adjustment

DRG	DRG Label
007 008	PERIPH & CRANIAL NERVE & OTHER NERV SYST PROC W CC W/O CC
010 011	NERVOUS SYSTEM NEOPLASMS W CC W/O CC
016 017	NONSPECIFIC CEREBROVASCULAR DISORDERS W CC W/O CC
018 019	CRANIAL & PERIPHERAL NERVE DISORDERS W CC CRANIAL & PERIPHERAL NERVE DISORDERS W/O CC
024 025	SEIZURE & HEADACHE AGE >17 W CC W/O CC
028 029	TRAUMATIC STUPOR & COMA, COMA <1 HR AGE >17 W CC W/O CC
031 032	CONCUSSION AGE >17 W CC W/O CC
034 035	OTHER DISORDERS OF NERVOUS SYSTEM W CC W/O CC
046 047	OTHER DISORDERS OF THE EYE AGE >17 W CC W/O CC
068 069	OTITIS MEDIA & URI AGE >17 W CC W/O CC
076 077	OTHER RESP SYSTEM O.R. PROCEDURES W CC W/O CC
079 080	RESPIRATORY INFECTIONS & INFLAMMATIONS AGE >17 W CC W/O CC
083 084	MAJOR CHEST TRAUMA W CC W/O CC
085 086	PLEURAL EFFUSION W CC W/O CC
089 090	SIMPLE PNEUMONIA & PLEURISY AGE >17 W CC W/O CC
092 093	INTERSTITIAL LUNG DISEASE W CC W/O CC
094 095	PNEUMOTHORAX W CC W/O CC
096 097	BRONCHITIS & ASTHMA AGE >17 W CC W/O CC
099 100	RESPIRATORY SIGNS & SYMPTOMS W CC W/O CC
101 102	OTHER RESPIRATORY SYSTEM DIAGNOSES W CC W/O CC

DRG	DRG Label
110 111	MAJOR CARDIOVASCULAR PROCEDURES W CC W/O CC
121 122	CIRCULATORY DISORDERS W AMI & MAJOR COMP, DISCHARGED ALIVE W/O MAJOR COMP, DISCHARGED ALIVE
123 124	CIRCULATORY DISORDERS EXCEPT AMI, W CARD CATH & COMPLEX DIAG W/O COMPLEX DIAG
130 131	PERIPHERAL VASCULAR DISORDERS W CC W/O CC
132 133	ATHEROSCLEROSIS W CC W/O CC
135 136	CARDIAC CONGENITAL & VALVULAR DISORDERS AGE >17 W CC W/O CC
138 139	CARDIAC ARRHYTHMIA & CONDUCTION DISORDERS W CC W/O CC
141 142	SYNCOPE & COLLAPSE W CC W/O CC
144 145	OTHER CIRCULATORY SYSTEM DIAGNOSES W CC W/O CC
146 147	RECTAL RESECTION W CC W/O CC
148 149	MAJOR SMALL & LARGE BOWEL PROCEDURES W CC W/O CC
150 151	PERITONEAL ADHESIOLYSIS W CC W/O CC
152 153	MINOR SMALL & LARGE BOWEL PROCEDURES W CC W/O CC
154 155	STOMACH, ESOPHAGEAL & DUODENAL PROCEDURES AGE >17 W CC W/O CC
157 158	ANAL & STOMAL PROCEDURES W CC W/O CC
159 160	HERNIA PROCEDURES EXCEPT INGUINAL & FEMORAL AGE >17 W CC W/O CC
161 162	INGUINAL & FEMORAL HERNIA PROCEDURES AGE >17 W CC W/O CC
164 165	APPENDECTOMY W COMPLICATED PRINCIPAL DIAG W CC W/O CC
166 167	APPENDECTOMY W/O COMPLICATED PRINCIPAL DIAG W CC W/O CC
168 169	MOUTH PROCEDURES W CC W/O CC
170 171	OTHER DIGESTIVE SYSTEM O.R. PROCEDURES W CC W/O CC

DRG	DRG Label
172 173	DIGESTIVE MALIGNANCY W CC W/O CC
174 175	G.I. HEMORRHAGE W CC W/O CC
177 178	UNCOMPLICATED PEPTIC ULCER W CC W/O CC
180 181	G.I. OBSTRUCTION W CC W/O CC
182 183	ESOPHAGITIS, GASTROENT & MISC DIGEST DISORDERS AGE >17 W CC W/O CC
188 189	OTHER DIGESTIVE SYSTEM DIAGNOSES AGE >17 W CC W/O CC
191 192	PANCREAS, LIVER & SHUNT PROCEDURES W CC W/O CC
193 194	BILIARY TRACT PROC EXCEPT ONLY CHOLECYST W OR W/O C.D.E. W CC W/O CC
195 196	CHOLECYSTECTOMY W C.D.E. W CC W/O CC
197 198	CHOLECYSTECTOMY EXCEPT BY LAPAROSCOPE W/O C.D.E. W CC W/O CC
205 206	DISORDERS OF LIVER EXCEPT MALIG,CIRR,ALC HEPA W CC W/O CC
207 208	DISORDERS OF THE BILIARY TRACT W CC W/O CC
210 211	HIP & FEMUR PROCEDURES EXCEPT MAJOR JOINT AGE >17 W CC W/O CC
218 219	LOWER EXTREM & HUMER PROC EXCEPT HIP,FOOT,FEMUR AGE >17 W CC W/O CC
223	MAJOR SHOULDER/ELBOW PROC, OR OTHER UPPER EXTREMITY PROC W CC
224	SHOULDER,ELBOW OR FOREARM PROC,EXC MAJOR JOINT PROC, W/O CC
226 227	SOFT TISSUE PROCEDURES W CC W/O CC
228 229	MAJOR THUMB OR JOINT PROC,OR OTH HAND OR WRIST PROC W CC HAND OR WRIST PROC, EXCEPT MAJOR JOINT PROC, W/O CC
233 234	OTHER MUSCULOSKELET SYS & CONN TISS O.R. PROC W CC W/O CC
240 241	CONNECTIVE TISSUE DISORDERS W CC W/O CC
244 245	BONE DISEASES & SPECIFIC ARTHROPATHIES W CC W/O CC
250 251	FX, SPRN, STRN & DISL OF FOREARM, HAND, FOOT AGE >17 W CC W/O CC

DRG	DRG Label
253 254	FX, SPRN, STRN & DISL OF UPARM,LOWLEG EX FOOT AGE >17 W CC W/O CC
257 258	TOTAL MASTECTOMY FOR MALIGNANCY W CC W/O CC
259 260	SUBTOTAL MASTECTOMY FOR MALIGNANCY W CC W/O CC
263 264	SKIN GRAFT &/OR DEBRID FOR SKN ULCER OR CELLULITIS W CC W/O CC
265 266	SKIN GRAFT &/OR DEBRID EXCEPT FOR SKIN ULCER OR CELLULITIS W CC W/O CC
269 270	OTHER SKIN, SUBCUT TISS & BREAST PROC W CC W/O CC
272 273	MAJOR SKIN DISORDERS W CC W/O CC
274 275	MALIGNANT BREAST DISORDERS W CC W/O CC
277 278	CELLULITIS AGE >17 W CC W/O CC
280 281	TRAUMA TO THE SKIN, SUBCUT TISS & BREAST AGE >17 W CC W/O CC
283 284	MINOR SKIN DISORDERS W CC W/O CC
292 293	OTHER ENDOCRINE, NUTRIT & METAB O.R. PROC W CC W/O CC
296 297	NUTRITIONAL & MISC METABOLIC DISORDERS AGE >17 W CC W/O CC
300 301	ENDOCRINE DISORDERS W CC W/O CC
304 305	KIDNEY,URETER & MAJOR BLADDER PROC FOR NON-NEOPL W CC W/O CC
306 307	PROSTATECTOMY W CC W/O CC
308 309	MINOR BLADDER PROCEDURES W CC W/O CC
310 311	TRANSURETHRAL PROCEDURES W CC W/O CC
312 313	URETHRAL PROCEDURES, AGE >17 W CC W/O CC
318 319	KIDNEY & URINARY TRACT NEOPLASMS W CC W/O CC
320 321	KIDNEY & URINARY TRACT INFECTIONS AGE >17 W CC W/O CC

DRG	DRG Label
323 324	URINARY STONES W CC, &/OR ESW LITHOTRIPSY W/O CC
325 326	KIDNEY & URINARY TRACT SIGNS & SYMPTOMS AGE >17 W CC W/O CC
328 329	URETHRAL STRICTURE AGE >17 W CC W/O CC
331 332	OTHER KIDNEY & URINARY TRACT DIAGNOSES AGE >17 W CC W/O CC
334 335	MAJOR MALE PELVIC PROCEDURES W CC W/O CC
336 337	TRANSURETHRAL PROSTATECTOMY W CC W/O CC
346 347	MALIGNANCY, MALE REPRODUCTIVE SYSTEM, W CC W/O CC
348 349	BENIGN PROSTATIC HYPERTROPHY W CC W/O CC
354 355	UTERINE,ADNEXA PROC FOR NON-OVARIAN/ADNEXAL MALIG W CC W/O CC
358 359	UTERINE & ADNEXA PROC FOR NON-MALIGNANCY W CC W/O CC
366 367	MALIGNANCY, FEMALE REPRODUCTIVE SYSTEM W CC W/O CC
370 371	CESAREAN SECTION W CC W/O CC
398 399	RETICULOENDOTHELIAL & IMMUNITY DISORDERS W CC W/O CC
401 402	LYMPHOMA & NON-ACUTE LEUKEMIA W OTHER O.R. PROC W CC W/O CC
403 404	LYMPHOMA & NON-ACUTE LEUKEMIA W CC W/O CC
406 407	MYELOPROLIF DISORD OR POORLY DIFF NEOPL W MAJ O.R.PROC W CC W/O CC
413 414	OTHER MYELOPROLIF DIS OR POORLY DIFF NEOPL DIAG W CC W/O CC
419 420	FEVER OF UNKNOWN ORIGIN AGE >17 W CC W/O CC
434 435	ALC/DRUG ABUSE OR DEPEND, DETOX OR OTH SYMPT TREAT W CC W/O CC
442 443	OTHER O.R. PROCEDURES FOR INJURIES W CC W/O CC
444 445	TRAUMATIC INJURY AGE >17 W CC W/O CC

DRG	DRG Label
449 450	POISONING & TOXIC EFFECTS OF DRUGS AGE >17 W CC W/O CC
452 453	COMPLICATIONS OF TREATMENT W CC W/O CC
454 455	OTHER INJURY, POISONING & TOXIC EFFECT DIAG W CC W/O CC
463 464	SIGNS & SYMPTOMS W CC W/O CC
478 479	OTHER VASCULAR PROCEDURES W CC W/O CC
493 494	LAPAROSCOPIC CHOLECYSTECTOMY W/O C.D.E. W CC W/O CC
497 498	SPINAL FUSION W CC W/O CC
499 500	BACK & NECK PROCEDURES EXCEPT SPINAL FUSION W CC W/O CC
501 502	KNEE PROCEDURES W PDX OF INFECTION W CC W/O CC

Section 2. Super-MDC and Invalid DRGs Excluded from DRG Risk-Adjustment

DRG	DRG Label
214	NO LONGER VALID
215	NO LONGER VALID
221	NO LONGER VALID
222	NO LONGER VALID
438	NO LONGER VALID
468	EXTENSIVE O.R. PROCEDURE UNRELATED TO PRINCIPAL DIAGNOSIS
469	PRINCIPAL DIAGNOSIS INVALID AS DISCHARGE DIAGNOSIS
470	UNGROUPABLE
474	NO LONGER VALID
476	PROSTATIC O.R. PROCEDURE UNRELATED TO PRINCIPAL DIAGNOSIS
477	NON-EXTENSIVE O.R. PROCEDURE UNRELATED TO PRINCIPAL DIAGNOSIS
482	TRACHEOSTOMY FOR FACE, MOUTH & NECK DIAGNOSES
483	TRACHEOSTOMY EXCEPT FOR FACE, MOUTH & NECK DIAGNOSES

Section 3. AHRQ Comorbidity Software Coding Changes

Comorbidity Category	ICD-9 Code Deleted	ICD-9 Code Added
Congestive Heart Failure		40201, 40401, 40403
Peripheral Vascular Disorder		44100, 44101, 44102, 44103, 4411, 4412, 4413, 4414, 4415, 4416, 4417, 4419
Hypertension, uncomplicated		64200, 64201, 64202, 64203, 64204
Hypertension, complicated		4010, 40200, 40201, 40211, 40291, 40300, 40301, 40310, 40311, 40390, 40391, 40400, 40401, 40402, 40403, 40411, 40412, 40413, 40491, 40492, 40493, 40501, 40509, 64210, 64211, 64212, 64213, 64214, 64220, 64221, 64222, 64223, 64224, 64270, 64271, 64272, 64273, 64274, 64290, 64291, 64292, 64293, 64294
Paralysis		43820, 43821, 43822, 43830, 43831, 43832, 43840, 43841, 43842, 43850, 43851, 43852, 43853
Other neurological		3300, 3301, 3302, 3303, 3308, 3309, 3310, 3311, 3312, 3313, 3314, 3317, 33181, 33189,3452, 3453, 34560, 34561, 34570, 34571, 78039
Chronic pulmonary disease		49392
Diabetes		64800, 64801, 64802, 64803, 64804
Diabetes, complicated		25080, 25081, 25082, 25083
Renal failure		40301,40402, 40403, 40413, 40493,V561, V562
Liver disease		07022, 07023, 07044
Peptic ulcer disease including bleeding	V1271	53171, 53191, 53271, 53291, 53371, 53391, 53471, 53491
Lymphoma		20300, 20301, 20380, 20381
Blood loss anemia		64820, 64821, 64822, 64823, 64824
Alcohol abuse		2910, 2913, 30300, 30301, 30302, 30303
Drug abuse		64830, 64831, 64832, 64833, 64834

In selecting an appropriate comorbidity adjustment approach, we decided against the use of a pre-scored index, instead allowing the comorbidity weights to differ across indicators. In choosing among different approaches, we gravitated toward Elixhauser et al. (*Medical Care* 1998;36:8-27), because the comorbidity list is more complete than alternatives such as the Charlson list, incorporates earlier work by Iezzoni and Krakauer, and has passed peer review. The Elixhauser et al. list has been independently validated by Stukenborg (*Medical Care* 2001;39:727-39). Nonetheless, there are four issues with applying the Elixhauser et al. comorbidity list to the patient safety indicators:

1. Some of the comorbidity definitions are conditions likely to represent complications in certain settings, such as after elective surgery. The DRG screens help, but do not completely resolve this problem.

2. Several comorbidity definitions exclude "acute on chronic" comorbidities, even though there is no alternative code for the chronic component of the comorbidity. Unless the comorbidity definitions capture these "acute on chronic" comorbidities, some patients with especially severe comorbidities will be mislabeled as not having conditions of interest.

3. The comorbidity definitions do not include obstetric comorbidity codes, which are relevant for the obstetric indicators. The ICD-9-CM Coding Handbook instructs coders that

"Conditions classified in other chapters of ICD-9-CM are reclassified in chapter 11 when they complicate the obstetrical experience or are themselves complicated by the fact that the patient is pregnant...Some codes for such complications are very specific, and others are very broad. When a code from chapter 11 describes the condition adequately, only that code is assigned. It is appropriate, however, to assign an additional code (from a different chapter) when it provides needed specificity."

4. The comorbidity definitions need to be updated based on recent ICD-9-CM code changes.

Issue #1. Comorbidities as Complications

The following three comorbidities are the most likely to be complications in certain settings. The number refers to the order of the comorbidity definitions in the AHRQ software.

2. "Cardiac arrhythmias" includes some conditions which are generally considered trivial or inconsequential, such as first degree AV block (426.11), right bundle branch block (426.4), premature beats (427.60), unspecified tachycardia (785.0), and cardiac pacemaker in situ (V45.01). Because of the fact that these conditions are unlikely to affect treatment of hospitalized patients, they are unlikely to be coded. See, for example, Coding Clinic 1993;10(5):12, "although it can be argued that sick sinus syndrome is an ongoing condition...no code assignment is required if no attention or treatment is provided to the condition or device. This differs from the ongoing medication administration provided for conditions such as CHF, hypertension, or diabetes (which justifies code assignment)...the use of V45.0...is optional." It is impossible to generate an unbiased estimate of the true effect of these comorbidities using administrative data, due to nondifferential misclassification (i.e., information bias). Even more importantly, some cardiac arrhythmias are well described as postoperative complications - most notably paroxysmal SVT (427.0), atrial fibrillation (427.31), and unspecified tachycardia (785.0), although virtually all of these codes except V45.0x and V53.0x COULD represent complications. And even these V codes are problematic, because a properly functioning pacemaker (or prosthetic valve) should eliminate the patient's additional risk.

21. "Coagulopathy" includes several conditions that are well described as postoperative complications - most notably "hemorrhagic disorder due to circulating anticoagulants" (286.5), which is the code for excessive heparin, "defibrination syndrome" (286.6), which is the code for DIC (disseminated intravascular coagulation) syndrome, "acquired coagulation factor deficiency" (286.7), which is the code for hypoprothrombinemia due to warfarin, and "secondary thrombocytopenia" (287.4), which is the code for drug-induced or transfusion-induced thrombocytopenia. Although the approach could try to narrow the definition of this comorbidity to include only congenital disorders such as hemophilia, such a modification would substantially reduce its frequency and might eliminate its importance as a predictor.

24. "Fluid and electrolyte disorders" includes several conditions that are well described as postoperative complications - most notably hyponatremia (276.1) and fluid overload (276.6). Virtually all of these codes COULD represent complications.

SOLUTION: THESE THREE COMORBIDITIES WILL BE EXCLUDED FROM THE COMORBIDITY ADJUSTMENT FOR THE PATIENT SAFETY INDICATORS.

Issue #2. Acute on Chronic Comorbidities

The following comorbidities are acute complications of chronic conditions not coded separately. The number refers to the order of the comorbidity definitions in the AHRQ software.

1. "Congestive heart failure" excludes all codes for heart failure due to hypertension which is described as malignant during the current episode of care (402.01, 404.01, 404.03). This is problematic because these codes substitute for (and do not supplement) other codes for congestive heart failure (428.x). In adjusting for any increased risk that congestive heart failure may confer, the approach should not exclude any etiologic subset of such patients from the definition. As noted below, malignant hypertension almost always occurs in the setting of underlying chronic hypertension.

SOLUTION: CONGESTIVE HEART FAILURE WILL BE REDEFINED TO INCLUDE 402.01, 404.01, AND 404.03, IN ADDITION TO THE OTHER CODES CONTAINED IN ELIXHAUSER'S ORIGINAL DEFINITION.

5. "Peripheral vascular disorders" excludes all codes for ruptured or dissecting aneurysms. This is problematic because these codes substitute for (and do not supplement) other aneurysm codes. In adjusting for any increased risk that peripheral vascular disease may confer, the approach should not exclude the most severely affected patients from the definition. Aneurysm rupture may be an acute, occasionally preventable complication, but it occurs in the setting of an underlying aneurysm.

SOLUTION: PERIPHERAL VASCULAR DISORDERS WILL BE REDEFINED TO INCLUDE ALL 441.XX CODES, IN ADDITION TO THE OTHER CODES CONTAINED IN ELIXHAUSER'S ORIGINAL DEFINITION.

6. "Hypertension" excludes all codes for malignant hypertension (401.0x, 402.0x, 403.0x, 404.0x, 405.0x), and all codes for hypertension with either congestive heart failure (402.x1), renal failure (403.xx), or both (404.x1, 404.x2, 404.x3). This is problematic because these codes substitute for (and do not supplement) the codes for complicated hypertension. In other words, the current comorbidity definition would MISS a substantial proportion of patients with chronic hypertension, because they also have heart or renal disease secondary to their hypertension. Similarly, malignant hypertension arises in the setting of chronic hypertension, which the current comorbidity definition would miss. In adjusting for any increased risk that hypertension may confer, the approach should not exclude the most severely affected the patients from the definition.

SOLUTION: HYPERTENSION, COMPLICATED WILL BE REDEFINED AS: 401.0, 402.XX, 403.XX, 404.XX, 405.XX. THE DEFINITION OF HYPERTENSION, UNCOMPLICATED WILL REMAIN UNCHANGED. PATIENTS WHO HAVE CODES CONSISTENT WITH BOTH COMORBIDITIES WILL BE CLASSIFIED AS COMPLICATED.

8. "Other neurological disorders" excludes codes for "petit mal status" (345.2) and "grand mal status" (345.3), which are simply acute manifestations of underlying chronic comorbidities. In adjusting for any increased risk that epilepsy may confer, the approach should not exclude the most severely affected patients from the definition. Epileptic status may be an iatrogenic complication, but it occurs in the setting of an underlying neurologic disorder. Similarly, cerebral degeneration occurs in the setting of an underlying degenerative disorder.

SOLUTION: OTHER NEUROLOGICAL DISORDERS WILL BE REDEFINED TO INCLUDE ALL 330.X, 331.X, AND 345.XX CODES, IN ADDITION TO THE OTHER CODES CONTAINED IN ELIXHAUSER'S ORIGINAL DEFINITION (SEE ALSO CODING UPDATE BELOW).

11. "Diabetes" excludes codes for "diabetes with other specified manifestations" (250.8x), such as hypoglycemia. This is problematic because this code substitutes for (and does not supplement) other diabetes codes. In other words, the current comorbidity definition would MISS patients with diabetes who suffer from other specified complications, such as hypoglycemia, during their hospital stay. See *Coding Clinic* 1994;11(2):12 - "what is the appropriate diagnosis code for...necrotizing fasciitis secondary to NIDDM?...assign code 250.80...as the principal diagnosis." In adjusting for any increased risk that diabetes may confer, the approach should not exclude the most severely affected patients from the definition. Diabetic hypoglycemia may be an iatrogenic complication, but it occurs in the setting of an underlying endocrine disorder.

SOLUTION: DIABETES, COMPLICATED WILL BE REDEFINED AS 250.40-250.93 AND REFERS ONLY TO CHRONIC COMPLICATIONS; ACUTE HYPERGLYCEMIC COMPLICATIONS ARE CODED AS 250.10-250.33.
THE DEFINITION OF DIABETES, UNCOMPLICATED WILL REMAIN UNCHANGED. PATIENTS WHO HAVE CODES CONSISTENT WITH BOTH COMORBIDITIES WILL BE CLASSIFIED AS COMPLICATED. IF A PSI WILL BE APPLIED TO THE NEONATAL POPULATION, THEN THE DEFINITION OF DIABETES, COMPLICATED WILL ALSO INCLUDE 775.1 (NEONATAL DIABETES).

13. "Renal failure" excludes "hypertensive heart and renal disease with congestive heart failure and heart failure" (404.13, 404.93). These codes indicate the presence of BOTH renal failure and congestive heart failure in the same patient. They substitute for other renal failure codes (585-587) in all patients with hypertension, even if the patient's renal failure is not clearly attributable to hypertension. In addition, the current definition excludes any renal failure associated with malignant hypertension (403.01, 404.02, 404.03), even when the patient's renal failure is not clearly attributable to malignant hypertension. In adjusting for any increased risk that chronic renal failure may confer, the comorbidity definition does not want to exclude any etiologic subset of such patients from the definition. As noted above, malignant hypertension almost always occurs in the setting of underlying chronic hypertension.

SOLUTION: RENAL FAILURE WILL BE REDEFINED TO INCLUDE 403.01, 404.02, 404.03, 404.13, AND 404.93, IN ADDITION TO THE OTHER CODES CONTAINED IN ELIXHAUSER'S ORIGINAL DEFINITION (SEE ALSO CODING UPDATE BELOW).

14. "Liver disease" excludes "chronic viral hepatitis B with hepatic coma" with or without hepatitis delta (070.22-070.23) and "chronic hepatitis C with hepatic coma" (070.44), which are simply acute manifestations of underlying chronic comorbidities. In adjusting for any increased risk that chronic viral hepatitis may confer, the comorbidity definition does not want to exclude the most severely affected patients from the definition. Coma may be an acute, occasionally preventable complication, but it occurs in the setting of underlying chronic hepatitis.

SOLUTION: LIVER DISEASE WILL BE REDEFINED TO INCLUDE 070.22, 070.23, AND 070.44, IN ADDITION TO THE OTHER CODES CONTAINED IN ELIXHAUSER'S ORIGINAL DEFINITION.

15. "Peptic ulcer disease" excludes all acute ulcers, but also all chronic ulcers that present with hemorrhage, perforation, or obstruction (or any combination thereof). This is problematic because many chronic ulcers hemorrhage or obstruct. In fact, obstruction is a common presentation for chronic ulcers, and is relatively unusual among acute or iatrogenic ulcers. The problem here is that ICD-9-CM fails to distinguish "chronic" from "unspecified" ulcers. By contrast, all of the other comorbidities on this "acute on chronic" list are either inherently chronic (i.e., hypertension and cardiac/renal complications thereof, diabetes, peripheral vascular disease, epilepsy) or are clearly identified as chronic in ICD-9-CM (i.e., viral hepatitis). We cannot be certain that all ulcers labeled as "chronic or unspecified" are actually chronic. However, given the time required for an ulcer to cause obstruction, this finding strongly suggests chronicity (especially in the absence of hemorrhage or perforation).

SOLUTION: PEPTIC ULCER DISEASE WILL BE REDEFINED AS: 531.70-531.71, 531.90-531.91, 532.70-532.71, 532.90-532.91, 533.70-533.71, 533.90-533.91, 534.70-534.71, 534.90-534.91.

27. "Alcohol abuse" (291.8x) excludes alcohol withdrawal delirium (291.0) and alcohol withdrawal hallucinosis (291.3), despite the fact that these acute conditions occur only in the setting of chronic alcohol abuse. *Coding Clinic for ICD-9-CM* (Second Quarter 1991, p. 11) notes that code 291.0 and 291.3 take "precedence over 291.8," making it inappropriate to include 291.8x and omit 291.0 and 291.3. "If the patient is admitted in withdrawal or if withdrawal develops after admission, the withdrawal code is designated as the principal diagnosis." The current definition also excludes acute alcoholic intoxication superimposed on alcohol dependence (303.0x), which is the sole ICD-9-CM code used to describe chronic alcoholic patients who are intoxicated upon presentation. 303.0x substitutes for any other 303 or 305.0 code in this common situation. In adjusting for any increased risk that alcoholism may confer, the comorbidity definition does not want to exclude the most severely affected patients from the definition.

SOLUTION: ALCOHOL ABUSE WILL BE REDEFINED AS: 291.0-291.3, 291.5, 291.8X, 291.9, 303.00-303.93, 305.00-305.03.

Issue #3. Obstetric Codes

The obstetric comorbidity code is either an exact match, or broader or narrower than the comorbidity definition based on non-obstetric codes. When the match is exact or narrower (highlighted in **bold**), the obstetric code was added to the comorbidity definition for obstetric cases because coders are likely to use the obstetric code INSTEAD of the nonobstetric code. This is especially true when the nonobstetric codes are accompanied by specific "excludes" notes for pregnancy and the puerperium (highlighted in *italics*). When the match is broader, one might argue that the obstetric code does not "describe the condition adequately," and should therefore be accompanied by the more specific nonobstetric code (which would more effectively capture the cases of interest). In this situation, the obstetric code should NOT be added to the cormorbidity definition, because doing so might add numerous patients who do not actually have the condition of interest.

1-4. CHF/arrhythmias/valvular disease/pulmonary circulation - 648.6x ("other cardiovascular diseases"). Broader, in that all heart disease (390-398, 410-429) is included.

5. Peripheral vascular - 648.9x ("other current conditions classifiable elsewhere"). Broader, in that all nutritional and vascular problems (260-269, 440-459) are included.

6. Hypertension - Uncomplicated 642.0x ("benign essential hypertension..."). Complicated 642.1x ("hypertension secondary to renal disease..."), 642.2x ("other pre-existing hypertension..."), 642.7x ("pre-eclampsia or eclampsia superimposed on pre-existing hypertension"), 642.9x ("unspecified hypertension..."). Exact match (if comorbidity definition is expanded as I suggest in response to problem #2), with excludes notes for nonobstetric codes.

SOLUTION: ADD TO COMORBIDITY DEFINITION.

10. Diabetes - 648.0x ("diabetes mellitus"). Exact match (when comorbidity definition is expanded to 250.xx as I suggested above in response to issue #2).

SOLUTION: ADD TO COMORBIDITY DEFINITION.

12. Hypothyroidism - 648.1x ("thyroid dysfunction"). Broader, in that all thyroid disease (240-246) is included.

13. Renal failure - 646.2x ("unspecified renal disease in pregnancy..."). Broader, in that all renal disease is included.

14. Liver disease - 646.7x ("liver disorders in pregnancy"). Broader, in that all liver disease is included.

16. AIDS - 647.6x ("other viral diseases"). Broader, in that all viral diseases except rubella (042, 050-055, 057-079) are included.

20. Rheumatoid/collagen vascular diseases - 648.7x ("bone and joint disorders of back, pelvis, and lower limbs"). Narrower, in that lupus and other diffuse connective tissue diseases are excluded, but broader, in that all dorsopathies and arthropathies (711-738) are included.

SOLUTION: ADD TO COMORBIDITY DEFINITION

22. Obesity - 646.1x ("edema or excessive weight gain in pregnancy..."). Broader, in that edema is also included.

23. Weight loss - 648.9x ("other current conditions classifiable elsewhere"). Broader, in that all nutritional and vascular problems (260-269, 440-459) are included.

25-26. Blood loss/Deficiency anemias - 648.2x ("anemia"). Broader, in that all anemias (280-285) are included, but excludes notes apply to nonobstetric codes.

SOLUTiON: THE EXCLUDES NOTE REQUIRES THAT THE CODE BE ADDED TO THE COMORBIDITY DEFINITION.

27. Alcohol abuse - 648.4x ("mental disorders"). Broader, in that all mental disorders (290-303, 305-319) are included.

28. Drug abuse - 648.3x ("drug dependence"). Narrower (matches to 304.xx), in that nondependent abuse of drugs is omitted.

SOLUTION: ADD TO COMORBIDITY DEFINITION.

29. Psychoses - 648.41, 648.43 ("mental disorders"). Broader, in that all mental disorders (290-303, 305-319) are included.

The other comorbidites (e.g., neurologic, pulmonary, gastroenterologic, oncologic, coagulopathy, fluid/electrolyte) have no matching obstetric codes in Chapter 11.

Issue #4. Coding Updates

ICD-9 coding changes affect the following comorbidities, although the current AHRQ comorbidity software is robust to most of these coding changes:

2. Cardiac arrhythmias - V45.0 is now V45.0x (or V45.00-V45.09) to identify the specific cardiac device, as of 10/1/94. V53.3 is now V53.3x (or V53.30-V53.39) to identify the specific cardiac device, as of 10/1/94.

SOLUTION: AHRQ SOFTWARE INCLUDES BOTH OLD AND NEW CODES. NO CHANGE IS NECESSARY.

7. Paralysis - Paralysis due to late effects of cerebrovascular disease was reassigned from 342 or 344.3-344.4 to new codes under 438 (438.2x = hemiplegia/hemiparesis, 438.3x = monoplegia of upper limb, 438.4x = monoplegia of lower limb, 438.5x = other paralytic syndrome) on 10/1/97.

SOLUTION: 438.2X-438.5X WAS ADDED TO THE DEFINITION.

8. Other neurological disorders - 780.3 was split into 780.31 (febrile convulsions) and 780.39 (other convulsions) on 10/1/97.

SOLUTION: ONLY 780.39 IS RELEVANT (FEBRILE CONVULSIONS ARE A BENIGN CONDITION OF YOUNG CHILDREN), SO THIS CODE WAS ADDED TO THE DEFINITION.

9. Chronic pulmonary disease - 493.x2 (i.e., 493.92) was added 10/1/00 to denote "acute exacerbation" of asthma. 494 was split into 494.0 (without acute exacerbation) and 494.1 (with acute exacerbation) on 10/1/00.

SOLUTION: CURRENT AHRQ SOFTWARE INCLUDES 493.02, 493.12, AND 493.22, BUT NOT 493.92, WHICH WAS ADDED TO THE DEFINITION. NO CHANGE REQUIRED TO THE 494 CODES (NEW CODES ALREADY INCLUDED).

13. Renal failure - V56.1 (fitting and adjustment of extracorporeal dialysis catheter) was added 10/1/95. V56.2 (fitting and adjustment of peritoneal dialysis catheter) was added 10/1/98.

SOLUTION: V56.1 AND V56.2 WERE ADDED TO THE DEFINITION.

16. AIDS - 043 and 044 were deleted 10/1/94.

SOLUTION: AHRQ SOFTWARE INCLUDES BOTH OLD AND NEW CODES. NO CHANGE IS NECESSARY.

17. Lymphoma - 203.0 was split into 203.00 (without mention of remission) and 203.01 (in remission) on 10/1/91. 203.8 was split into 203.80 (without mention of remission) and 203.81 (in remission) on 10/1/91.

SOLUTION: 203.001-203.01 AND 203.80-203.81 WERE ADDED TO THE DEFINITION.

22. Obesity - 278.0 was split into 278.00 (obesity unspecified) and 278.01 (morbid obesity) on 10/1/95.

SOLUTION: AHRQ SOFTWARE INCLUDES BOTH OLD AND NEW CODES. NO CHANGE IS NECESSARY.

26. Deficiency anemia - A new set of codes for "anemia in chronic illness" (285.21 = end-stage renal disease, 285.22 = neoplastic disease, 285.29 = other chronic illness) was added on 10/1/00.

SOLUTION: AHRQ SOFTWARE INCLUDES BOTH OLD AND NEW CODES. NO CHANGE IS NECESSARY.

27. Alcohol abuse - 291.8 was split into 291.81 (alcohol withdrawal) and 291.89 (other specified alcoholic psychosis) on 10/1/96.

SOLUTION: AHRQ SOFTWARE INCLUDES BOTH OLD AND NEW CODES. NO CHANGE IS NECESSARY.

Section 4. Low Mortality DRGs Listed by Strata

DRG	DRG Label
	Medical (Adult)
015	TRANSIENT ISCHEMIC ATTACK & PRECEREBRAL OCCLUSIONS
021	VIRAL MENINGITIS
030	TRAUMATIC STUPOR & COMA, COMA <1 HR AGE 0-17
031	CONCUSSION AGE >17 W CC
032	CONCUSSION AGE >17 W/O CC
044	ACUTE MAJOR EYE INFECTIONS
045	NEUROLOGICAL EYE DISORDERS
065	DYSEQUILIBRIUM
068	OTITIS MEDIA & URI AGE >17 W CC
071	LARYNGOTRACHEITIS
096	BRONCHITIS & ASTHMA AGE >17 W CC
097	BRONCHITIS & ASTHMA AGE >17 W/O CC
125	CIRCULATORY DISORDERS EXCEPT AMI, W CARD CATH W/O COMPLEX DIAG
134	HYPERTENSION
140	ANGINA PECTORIS
141	SYNCOPE & COLLAPSE W CC
142	SYNCOPE & COLLAPSE W/O CC
143	CHEST PAIN
237	SPRAINS, STRAINS, & DISLOCATIONS OF HIP, PELVIS & THIGH
243	MEDICAL BACK PROBLEMS
246	NON-SPECIFIC ARTHROPATHIES
295	DIABETES AGE 0-35
317	ADMIT FOR RENAL DIALYSIS
323	URINARY STONES W CC, &/OR ESW LITHOTRIPSY
324	URINARY STONES W/O CC
351	STERILIZATION, MALE
369	MENSTRUAL & OTHER FEMALE REPRODUCTIVE SYSTEM DISORDERS
421	VIRAL ILLNESS AGE >17
	Medical (Pediatric)
026	SEIZURE & HEADACHE AGE 0-17
033	CONCUSSION AGE 0-17
070	OTITIS MEDIA & URI AGE 0-17
074	OTHER EAR, NOSE, MOUTH & THROAT DIAGNOSES AGE 0-17
091	SIMPLE PNEUMONIA & PLEURISY AGE 0-17
098	BRONCHITIS & ASTHMA AGE 0-17
184	ESOPHAGITIS, GASTROENT & MISC DIGEST DISORDERS AGE 0-17
190	OTHER DIGESTIVE SYSTEM DIAGNOSES AGE 0-17
252	FX, SPRN, STRN & DISL OF FOREARM, HAND, FOOT AGE 0-17
255	FX, SPRN, STRN & DISL OF UPARM,LOWLEG EX FOOT AGE 0-17
279	CELLULITIS AGE 0-17

282	TRAUMA TO THE SKIN, SUBCUT TISS & BREAST AGE 0-17
298	NUTRITIONAL & MISC METABOLIC DISORDERS AGE 0-17
322	KIDNEY & URINARY TRACT INFECTIONS AGE 0-17
333	OTHER KIDNEY & URINARY TRACT DIAGNOSES AGE 0-17
396	RED BLOOD CELL DISORDERS AGE 0-17
422	VIRAL ILLNESS & FEVER OF UNKNOWN ORIGIN AGE 0-17
446	TRAUMATIC INJURY AGE 0-17
448	ALLERGIC REACTIONS AGE 0-17
451	POISONING & TOXIC EFFECTS OF DRUGS AGE 0-17
	Surgical (Adult)
036	RETINAL PROCEDURES
037	ORBITAL PROCEDURES
042	INTRAOCULAR PROCEDURES EXCEPT RETINA, IRIS & LENS
050	SIALOADENECTOMY
052	CLEFT LIP & PALATE REPAIR
053	SINUS & MASTOID PROCEDURES AGE >17
055	MISCELLANEOUS EAR, NOSE, MOUTH & THROAT PROCEDURES
057	T&A PROC, EXCEPT TONSILLECTOMY &/OR ADENOIDECTOMY ONLY, AGE >17
063	OTHER EAR, NOSE, MOUTH & THROAT O.R. PROCEDURES
166	APPENDECTOMY W/O COMPLICATED PRINCIPAL DIAG W CC
167	APPENDECTOMY W/O COMPLICATED PRINCIPAL DIAG W/O CC
218	LOWER EXTREM & HUMER PROC EXCEPT HIP, FOOT, FEMUR AGE >17 W CC
219	LOWER EXTREM & HUMER PROC EXCEPT HIP, FOOT, FEMUR AGE >17 W/O CC
223	MAJOR SHOULDER/ELBOW PROC, OR OTHER UPPER EXTREMITY PROC W CC
224	SHOULDER,ELBOW OR FOREARM PROC,EXC MAJOR JOINT PROC, W/O CC
225	FOOT PROCEDURES
228	MAJOR THUMB OR JOINT PROC, OR OTH HAND OR WRIST PROC W CC
229	HAND OR WRIST PROC, EXCEPT MAJOR JOINT PROC, W/O CC
232	ARTHROSCOPY
257	TOTAL MASTECTOMY FOR MALIGNANCY W CC
258	TOTAL MASTECTOMY FOR MALIGNANCY W/O CC
261	BREAST PROC FOR NON-MALIGNANCY EXCEPT BIOPSY & LOCAL EXCISION
262	BREAST BIOPSY & LOCAL EXCISION FOR NON-MALIGNANCY
267	PERIANAL & PILONIDAL PROCEDURES
289	PARATHYROID PROCEDURES
290	THYROID PROCEDURES
293	OTHER ENDOCRINE, NUTRIT & METAB O.R. PROC W/O CC
334	MAJOR MALE PELVIC PROCEDURES W CC
335	MAJOR MALE PELVIC PROCEDURES W/O CC

336	TRANSURETHRAL PROSTATECTOMY W CC
337	TRANSURETHRAL PROSTATECTOMY W/O CC
356	FEMALE REPRODUCTIVE SYSTEM RECONSTRUCTIVE PROCEDURES
358	UTERINE & ADNEXA PROC FOR NON-MALIGNANCY W CC
359	UTERINE & ADNEXA PROC FOR NON-MALIGNANCY W/O CC
360	VAGINA, CERVIX & VULVA PROCEDURES
361	LAPAROSCOPY & INCISIONAL TUBAL INTERRUPTION
362	ENDOSCOPIC TUBAL INTERRUPTION
364	D&C, CONIZATION EXCEPT FOR MALIGNANCY
439	SKIN GRAFTS FOR INJURIES
441	HAND PROCEDURES FOR INJURIES
491	MAJOR JOINT & LIMB REATTACHMENT PROCEDURES OF UPPER EXTREMITY
499	BACK & NECK PROCEDURES EXCEPT SPINAL FUSION W CC
500	BACK & NECK PROCEDURES EXCEPT SPINAL FUSION W/O CC
	Surgical (Pediatric)
060	TONSILLECTOMY &/OR ADENOIDECTOMY ONLY, AGE 0-17
062	MYRINGOTOMY W TUBE INSERTION AGE 0-17
156	STOMACH, ESOPHAGEAL & DUODENAL PROCEDURES AGE 0-17
163	HERNIA PROCEDURES AGE 0-17
212	HIP & FEMUR PROCEDURES EXCEPT MAJOR JOINT AGE 0-17
220	LOWER EXTREM & HUMER PROC EXCEPT HIP,FOOT,FEMUR AGE 0-17
393	SPLENECTOMY AGE 0-17
	Neonatal
386	EXTREME IMMATURITY OR RESPIRATORY DISTRESS SYNDROME, NEONATE
387	PREMATURITY W MAJOR PROBLEMS
388	PREMATURITY W/O MAJOR PROBLEMS
390	NEONATE W OTHER SIGNIFICANT PROBLEMS
391	NORMAL NEWBORN
	Obstetric
370	CESAREAN SECTION W CC
371	CESAREAN SECTION W/O CC
372	VAGINAL DELIVERY W COMPLICATING DIAGNOSES
373	VAGINAL DELIVERY W/O COMPLICATING DIAGNOSES
374	VAGINAL DELIVERY W STERILIZATION &/OR D&C
375	VAGINAL DELIVERY W O.R. PROC EXCEPT STERIL &/OR D&C
377	POSTPARTUM & POST ABORTION DIAGNOSES W O.R. PROCEDURE
378	ECTOPIC PREGNANCY
379	THREATENED ABORTION
380	ABORTION W/O D&C
381	ABORTION W D&C, ASPIRATION CURETTAGE OR HYSTEROTOMY
382	FALSE LABOR

383	OTHER ANTEPARTUM DIAGNOSES W MEDICAL COMPLICATIONS
384	OTHER ANTEPARTUM DIAGNOSES W/O MEDICAL COMPLICATIONS
	Psychiatric
425	ACUTE ADJUSTMENT REACTION & PSYCHOSOCIAL DYSFUNCTION
426	DEPRESSIVE NEUROSES
427	NEUROSES EXCEPT DEPRESSIVE
428	DISORDERS OF PERSONALITY & IMPULSE CONTROL
431	CHILDHOOD MENTAL DISORDERS
432	OTHER MENTAL DISORDER DIAGNOSES
434	ALC/DRUG ABUSE OR DEPEND, DETOX OR OTH SYMPT TREAT W CC
435	ALC/DRUG ABUSE OR DEPEND, DETOX OR OTH SYMPT TREAT W/O CC
436	ALC/DRUG DEPENDENCE W REHABILITATION THERAPY

Appendix E

Details of Indicator Definitions

This appendix lists coding details for all indicators. It is divided into six sections (described below). For each indicator group (accepted, experimental, rejected) the definitions are provided in table form. In another section ICD-9-CM level details are presented for terms used in the tables (e.g. the codes used to define “hip fracture”). Terms are listed alphabetically and a table of contents is provided for ease of use.

ICD-9-CM codes are updated through 2001.

Section 1A contains the definition table for the Accepted hospital level indicators.

Section 1B contains the coding details for the Accepted hospital level indicators.

Section 2A contains the definition table for the Accepted area level indicators. Coding details are available in section 1B.

Section 3A contains the definition table for the Experimental indicators.

Section 3B contains the coding details for the Experimental indicators.

Section 4A contains the definition table for the Rejected indicators.

APPENDIX E. DETAILS OF INDICATOR DEFINITIONS

Section 1A. Accepted Hospital-Level Indicator Definitions

Items in bold and brackets are fully specified in the ICD-9-CM and DRG listings after this table.

Indicator	Definition and Numerator	Denominator
• Complications of anesthesia	Discharges with ICD-9-CM diagnosis codes for **[anesthesia complications]** in any secondary diagnosis field per 100 discharges.	All **[surgical]** discharges. Exclude patients with codes for poisoning due to anesthetics *[E855.1, 968.1-4, 968.7]* AND any diagnosis code for **[active drug dependence], [active nondependent abuse of drugs],** or **[self-inflicted injury]**.
• Death in low mortality DRGs Indicator is stratified in 7 subgroup indicators: 1. Adult surgical 2. Adult medical 3. Pediatric surgical 4. Pediatric medical 5. Psychiatric 6. Obstetric 7. Neonatal	All discharges with disposition of "deceased" per 100 population at risk.	All discharges in DRGs with less than 0.5% mortality rate, based on NIS 1997 **[low mortality DRG].** If a DRG is divided into "without/with complications" both DRGs must have mortality rates below 0.5% to qualify for inclusion. Exclude patients with any code for **[trauma], [immunocompromised]** state, or **[cancer]**.
• Decubitus ulcer	Discharges with ICD-9-CM code of 707.0 in any secondary diagnosis field per 100 discharges.	All **[medical]** and **[surgical]** discharges. Include only patients with a length of stay of more than 4 days. Exclude patients in MDC 9 or patients with any diagnosis of **[hemiplegia, paraplegia, or quadriplegia].** Exclude patients admitted from a **[long term care facility].**
• Failure to rescue	All discharges with disposition of "deceased" per 100 population at risk.	Discharges with potential complications of care listed in **[failure to rescue]** definition (e.g., pneumonia, DVT/PE, sepsis, acute renal failure, shock/cardiac arrest, or GI hemorrhage/acute ulcer). Exclusion criteria specific to each diagnosis.

Indicator	Definition and Numerator	Denominator
		Exclude patients **[transferred to acute care facility].** Exclude patients **[transferred from acute care facility]** Exclude patients admitted from a **[long-term care facility]**.
• Foreign body left in during procedure	Discharges with ICD-9-CM codes for **[foreign body left in during procedure]** in any secondary diagnosis field per 100 surgical discharges.	All **[medical]** and **[surgical]** discharges.
• Iatrogenic pneumothorax	Discharges with ICD-9-CM code of 512.1 in any secondary diagnosis field per 100 discharges.	All **[medical]** and **[surgical]** discharges. Exclude patients with any diagnosis of **[trauma].** Exclude patients with any code indicating **[thoracic surgery]** or **[lung or pleural biopsy]** or **[cardiac surgery].**
• Infection due to medical care	Discharges with ICD-9-CM code of 999.3 or 996.62 in any secondary diagnosis field per 100 discharges.	All **[medical]** and **[surgical]** discharges. Exclude patients with any diagnosis code for **[immunocompromised]** state or **[cancer]**.
• Postoperative hemorrhage or hematoma	Discharges with ICD-9-CM codes for **[postoperative hemorrhage]** or **[postoperative hematoma]** in any secondary diagnosis field AND code for postoperative **[control of hemorrhage]** or **[drainage of hematoma]** in any secondary procedure code field per 100 surgical discharges. Procedure code for postoperative control of hemorrhage or hematoma must occur on the same day or after the principal procedure.	All **[surgical]** discharges. Exclude all obstetric admissions (MDC 14 and 15).
• Postoperative hip fracture	Discharges with ICD-9-CM code for **[hip fracture]** in any secondary diagnosis field per 100 surgical discharges.	All **[surgical]** discharges. Exclude patients who have musculoskeletal and

Indicator	Definition and Numerator	Denominator
		connective tissue diseases (MDC 8). Exclude patients with principal diagnosis codes for **[seizure], [syncope], [stroke], [coma], [cardiac arrest], [poisoning], [trauma], [delirium and other psychoses],** or **[anoxic brain injury].** Exclude patients with any diagnosis of **[metastatic cancer], [lymphoid malignancy]** or **[bone malignancy]**, **[self-inflicted injury].** Exclude patients 17 years of age and younger.
• Postoperative physiologic and metabolic derangements	Discharges with ICD-9-CM codes for **[physiologic and metabolic derangements]** in any secondary diagnosis field per 100 surgical discharges. Discharges with acute renal failure (subgroup of physiologic and metabolic derangements) must be accompanied by a procedure code for dialysis (39.95, 54.98).	All **[elective] [surgical]** discharges. Exclude patients with both a diagnosis code of ketoacidosis, hyperosmolarity or other coma (subgroups of physiologic and metabolic derangements coding) AND a principal diagnosis of **[diabetes].** Exclude patients with both a secondary diagnosis code for acute renal failure (subgroup of physiologic and metabolic derangements coding) AND a principal diagnosis of **[acute myocardial infarction], [cardiac arrhythmia], [cardiac arrest], [shock], [hemorrhage]** or **[gastrointestinal hemorrhage].** Exclude all obstetric admissions (MDC 14 and 15).
• Postoperative pulmonary embolism or deep vein thrombosis	Discharges with ICD-9-CM codes for **[deep vein thrombosis]** or **[pulmonary embolism]** in any secondary diagnosis field per 100 surgical discharges.	All **[surgical]** discharges. Exclude patients with a principal diagnosis of **[deep vein thrombosis].** Exclude all obstetric admissions (MDC 14 and 15).

Indicator	Definition and Numerator	Denominator
		Exclude patients with secondary procedure code 38.7 when this procedure occurs on the day of or previous to the day of the principal procedure.
• Postoperative respiratory failure	Discharges with ICD-9-CM codes for acute respiratory failure (518.81) in any secondary diagnosis field per 100 surgical discharges. (After 1999, include 518.84).	All **[elective] [surgical]** discharges. Exclude patients with respiratory or circulatory diseases (MDC 4 and MDC 5). Exclude all obstetric admissions (MDC 14 and 15)
• Postoperative sepsis	Discharges with ICD-9-CM code for **[sepsis]** in any secondary diagnosis field per 100 discharges in the population at risk.	All **[elective] [surgical]** discharges. Exclude patients with a principal diagnosis of **[infection],** or any code for **[immunocompromised]** state, or **[cancer].** Include only patients with a length of stay of more than three days. Exclude all obstetric admissions (MDC 14 and 15).
• Technical difficulty with procedure	Discharges with ICD-9-CM code denoting **[technical difficulty]** (e.g., accidental cut, puncture, perforation or laceration during a procedure) in any secondary diagnosis field per 100 discharges.	All **[medical]** and **[surgical]** discharges. Exclude all obstetric admissions (MDC 14 and 15).
• Transfusion reaction	Discharges with ICD-9-CM codes for **[transfusion reaction]** in any secondary diagnosis field per 100 discharges.	All **[medical]** and **[surgical]** discharges.
• Postoperative wound dehiscence	Discharges with ICD-9-CM codes for reclosure of postoperative disruption of abdominal wall (54.61) in any secondary procedure field per 100 discharges.	All **[abdominopelvic]** surgical discharges. Exclude all obstetric admissions (MDC 14 and 15).
• Birth trauma- injury to neonate	Discharges with ICD-9-CM codes for **[birth trauma]** in any diagnosis field per 100 liveborn births.	All **[liveborn]** infants. Exclude infants with a subdural or cerebral hemorrhage (subgroup of birth trauma coding) AND any diagnosis code of **[preterm infant]** (denoting a birth weight of less than 2,500 g and

Indicator	Definition and Numerator	Denominator
		less than 37 weeks gestation). Exclude infants with injury to skeleton (767.3, 767.4) AND any diagnosis code of osteogenesis imperfecta (756.51).
• Obstetric trauma - vaginal with instrument	Discharges with ICD-9-CM codes for **[obstetric trauma]** in any diagnosis or procedure field per 100 instrument assisted vaginal deliveries.	All **[vaginal delivery] discharges** with any procedure code for **[instrument assisted delivery]**.
• Obstetric trauma - vaginal without instrument	Discharges with ICD-9-CM codes for **[obstetric trauma]** in any diagnosis or procedure field per 100 instrument assisted vaginal deliveries.	All **[vaginal delivery] discharges** patients. Exclude **[instrument assisted delivery].**
• Obstetric trauma - cesarean section	Discharges with ICD-9-CM codes for **[obstetric trauma]** in any diagnosis or procedure field per 100 cesarean deliveries.	All **[cesarean delivery]** discharges.

Section 1B. Coding Details for Accepted Hospital-Level Indicators

Abdominopelvic

ICD-9-CM procedure codes:

38.04	INCISION OF AORTA
38.06	INCISION OF ABDOMINAL ARTERIES
38.07	INCISION OF ABDOMINAL VEINS
38.14	ENDARTERECTOMY OF AORTA
38.16	ENDARTERECTOMY OF ABDOMINAL ARTERIES
38.34	RESECTION OF AORTA WITH ANASTOMOSIS
38.36	RESECTION OF ABDOMINAL ARTERIES WITH ANASTOMOSIS
38.37	RESECTION OF ABDOMINAL VEINS WITH ANASTOMOSIS
38.44	RESECTION OF AORTA, ABDOMINAL WITH REPLACEMENT
38.46	RESECTION OF ABDOMINAL ARTERIES WITH REPLACEMENT
38.47	RESECTION OF ABDOMINAL VEINS WITH REPLACEMENT
38.57	LIGATION AND STRIPPING OF VARICOSE VEINS, ABDOMINAL VEINS
38.64	OTHER EXCISION OF AORTA, ABDOMINAL
38.66	OTHER EXCISION OF ABDOMINAL ARTERIES
38.67	OTHER EXCISION OF ABDOMINAL VEINS
38.84	OTHER SURGICAL OCCLUSION OF AORTA, ABDOMINAL
38.86	OTHER SURGICAL OCCLUSION OF ABDOMINAL ARTERIES
38.87	OTHER SURGICAL OCCLUSION OF ABDOMINAL VEINS
39.1	INTRA-ABDOMINAL VENOUS SHUNT
39.24	AORTA-RENAL BYPASS
39.25	AORTA-ILIAC-FEMORAL BYPASS
39.26	OTHER INTRA-ABDOMINAL VASCULAR SHUNT OR BYPASS
40.52	RADICAL EXCISION OF PERIAORTIC LYMPH NODES
40.53	RADICAL EXCISION OF ILIAC LYMPH NODES
41.2	SPLENOTOMY
41.33	OPEN BIOPSY OF SPLEEN
41.41	MARSUPIALIZATION OF SPLENIC CYST
41.42	EXCISION OF LESION OR TISSUE OF SPLEEN
41.43	PARTIAL SPLENECTOMY
41.5	TOTAL SPLENECTOMY
41.93	EXCISION OF ACCESSORY SPLEEN
41.94	TRANSPLANTATION OF SPLEEN
41.95	REPAIR AND PLASTIC OPERATIONS ON SPLEEN
41.99	OTHER OPERATIONS ON SPLEEN
42.40	ESOPHAGECTOMY, NOS
42.41	PARTIAL ESOPHAGECTOMY
42.42	TOTAL ESOPHAGECTOMY
42.53	INTRATHORACIC ESOPHAGEAL ANASTOMOSIS WITH INTERPOSITION OF SMALL BOWEL
42.54	OTHER INTRATHORACIC ESOPHAGOENTEROSTOMY
42.55	INTRATHORACIC ESOPHAGEAL ANASTOMOSIS WITH INTERPOSITION OF COLON
42.56	OTHER INTRATHORACIC ESOPHAGOCOLOSTOMY
42.63	ANTESTERNAL ESOPHAGEAL ANASTOMOSIS WITH INTERPOSITION OF SMALL BOWEL
42.64	OTHER ANTESTERNAL ESOPHAGOENTEROSTOMY
42.65	ANTESTERNAL ESOPHAGEAL ANASTOMOSIS WITH INTERPOSITION OF COLON
42.66	OTHER ANTESTERNAL ESOPHAGOCOLOSTOMY
42.91	LIGATION OF ESOPHAGEAL VARICES
43.0	GASTROSTOMY
43.19	OTHER GASTROSTOMY
43.3	PYLOROMYOTOMY
43.42	LOCAL EXCISION OF OTHER LESION OR TISSUE OF STOMACH

43.49	OTHER DESTRUCTION OF LESION OR TISSUE OF STOMACH
43.5	PARTIAL GASTRECTOMY WITH ANASTOMOSIS TO ESOPHAGUS
43.6	PARTIAL GASTRECTOMY WITH ANASTOMOSIS TO DUODENUM
43.7	PARTIAL GASTRECTOMY WITH ANASTOMOSIS TO JEJUNUM
43.81	PARTIAL GASTRECTOMY WITH JEJUNA TRANSPOSITION
43.89	OTHER PARTIAL GASTRECTOMY
43.91	TOTAL GASTRECTOMY WITH INTESTINAL INTERPOSITION
43.99	OTHER TOTAL GASTRECTOMY
44.00	VAGOTOMY, NOS
44.01	TRUNCAL VAGOTOMY
44.02	HIGHLY SELECTIVE VAGOTOMY
44.03	OTHER SELECTIVE VAGOTOMY
44.11	TRANSABDOMINAL GASTROSCOPY
44.15	OPEN BIOPSY OF STOMACH
44.21	DILATION OF PYLORUS BY INCISION
44.29	OTHER PYLOROPLASTY
44.31	HIGH GASTRIC BYPASS
44.39	OTHER GASTROENTEROSTOMY
44.40	SUTURE OF PEPTIC ULCER, NOS
44.41	SUTURE OF GASTRIC ULCER SITE
44.42	SUTURE OF DUODENAL ULCER SITE
44.5	REVISION OF GASTRIC ANASTOMOSIS
44.61	SUTURE OF LACERATION OF STOMACH
44.63	CLOSURE OF OTHER GASTRIC FISTULA
44.64	GASTROPEXY
44.65	ESOPHAGOGASTROPLASTY
44.66	OTHER PROCEDURES FOR CREATION OF ESOPHAGOGASTRIC SPHINCTERIC COMPETENCE
44.69	OTHER REPAIR OF STOMACH
44.91	LIGATION OF GASTRIC VARICES
44.92	INTRAOPERATIVE MANIPULATION OF STOMACH
45.00	INCISION OF INTESTINE, NOS
45.01	INCISION OF DUODENUM
45.02	OTHER INCISION OF SMALL INTESTINE
45.03	INCISION OF LARGE INTESTINE
45.31	OTHER LOCAL EXCISION OF LESION OF DUODENUM
45.32	OTHER DESTRUCTION OF LESION OF DUODENUM
45.33	LOCAL EXCISION OF LESION OR TISSUE OF SMALL INTESTINE, EXCEPT DUODENUM
45.34	OTHER DESTRUCTION OF LESION OF SMALL INTESTINE, EXCEPT DUODENUM
45.41	EXCISION OF LESION OR TISSUE OF LARGE INTESTINE
45.49	OTHER DESTRUCTION OF LESION OF LARGE INTESTINE
45.50	ISOLATION OF INTESTINAL SEGMENT, NOS
45.51	ISOLATION OF SEGMENT OF SMALL INTESTINE
45.52	ISOLATION OF SEGMENT OF LARGE INTESTINE
45.61	MULTIPLE SEGMENTAL RESECTION OF SMALL INTESTINE
45.62	OTHER PARTIAL RESECTION OF SMALL INTESTINE
45.63	TOTAL REMOVAL OF SMALL INTESTINE
45.71	MULTIPLE SEGMENTAL RESECTION OF LARGE INTESTINE
45.72	CESECTOMY
45.73	RIGHT HEMICOLECTOMY
45.74	RESECTION OF TRANSVERSE COLON
45.75	LEFT HEMICOLECTOMY
45.76	SIGMOIDECTOMY
45.79	OTHER PARTIAL EXCISION OF LARGE INTESTINE
45.8	TOTAL INTRA-ABDOMINAL COLECTOMY
45.90	INTESTINAL ANASTOMOSIS, NOS
45.91	SMALL-TO-SMALL INTESTINAL ANASTOMOSIS
45.92	ANASTOMOSIS OF SMALL INTESTINE TO RECTAL STUMP
45.93	OTHER SMALL-TO-LARGE INTESTINAL ANASTOMOSIS
45.94	LARGE-TO-LARGE INTESTINAL ANASTOMOSIS
45.95	ANASTOMOSIS TO ANUS
46.01	EXTERIORIZATION OF SMALL INTESTINE
46.03	EXTERIORIZATION OF LARGE INTESTINE
46.10	COLOSTOMY, NOS
46.11	TEMPORARY COLOSTOMY
46.13	PERMANENT COLOSTOMY
46.20	ILEOSTOMY, NOS
46.21	TEMPORARY ILESOSTOMY
46.22	CONTINENT ILEOSTOMY
46.23	OTHER PERMANENT ILEOSTOMY
46.40	REVISION OF INTESTINA STOMA, NOS
46.41	REVISION OF STOMA OF SMALL INTESTINE
46.42	REPAIR OF PERICOLOSTOMY HERNIA
46.43	OTHER REVISION OF STOMA OF LARGE INTESTINE
46.50	CLOSURE OF INTESTINAL STOMA, NOS
46.51	CLOSURE OF STOMA OF SMALL INTESTINE
46.52	CLOSURE OF STOMA OF LARGE INTESTINE
46.60	FIXATION OF INTESTINE, NOS
46.61	FIXATION OF SMALL INTESTINE TO ABDOMINAL WALL
46.62	OTHER FIXATION OF SMALL INTESTINE
46.63	FIXATION OF LARGE INTESTINE TO ABDOMINAL WALL
46.64	OTHER FIXATION OF LARGE INTESTINE
46.72	CLOSURE OF FISTULA OF DUODENUM
46.74	CLOSURE OF FISTULA OF SMALL INTESTINE, EXCEPT DUODENUM
46.76	CLOSURE OF FISTULA OF LARGE INTESTINE
46.80	INTRA-ABDOMINAL MANIPULATION OF INTESTINE, NOS
46.81	INTRA-ABDOMINAL MANIPULATION OF SMALL INTESTINE
46.82	INTRA-ABDOMINAL MANIPULATION OF LARGE INTESTINE
46.91	MYOTOMY OF SIGMOID COLON
46.92	MYOTOMY OF OTHER PARTS OF COLON
46.93	REVISION OF ANASTOMOSIS OF SMALL INTESTINE
46.94	REVISION OF ANASTOMOSIS OF LARGE INTESTINE
46.99	OTHER OPERATIONS ON INTESTINES
47.09	OTHER APPENDECTOMY
47.19	OTHER INCIDENTAL APPENDECTOMY
47.2	DRAINAGE OF APPENDICEAL ABSCESS
47.91	APPENDECTOMY
47.92	CLOSURE OF APPENDICEAL FISTULA
47.99	OTHER OPERATION APPENDIX
48.41	SUBMUCOSAL RESECTION OF RECTUM
48.49	OTHER PULL-THROUGH RESECTION OF RECTUM
48.5	ABDOMINOPERINEAL RESECTION OF RECTUM
48.75	ABDOMINAL PROCTOPEXY
50.0	HEPATOTOMY
50.12	OPEN BIOPSY OF LIVER
50.21	MARSUPIALIZATION OF LESION OF LIVER
50.22	PARTIAL HEPATECTOMY

50.29 OTHER DESTRUCTION OF LESION OF LIVER
50.3 LOBECTOMY OF LIVER
50.4 TOTAL HEPATECTOMY
50.51 AUXILIARY LIVER TRANSPLANT
50.59 OTHER TRANSPLANT OF LIVER
50.69 OTHER REPAIR OF LIVER
51.03 OTHER CHOLECYSTOSTOMY
51.04 OTHER CHOLECYSTOTOMY
51.13 OPEN BIOPSY OF GALLBLADDER OR BILE DUCTS
51.21 OTHER PARTIAL CHOLECYSTECTOMY
51.22 CHOLECYSTECTOMY
51.31 ANASTOMOSIS OF GALLBLADDER TO HEPATIC DUCTS
51.32 ANASTOMOSIS OF GALLBLADDER TO INTESTINE
51.33 ANASTOMOSIS OF GALLBLADDER TO PANCREAS
51.34 ANASTOMOSIS OF GALLBLADDER TO STOMACH
51.35 OTHER GALLBLADDER ANASTOMOSIS
51.36 CHOLEDOCHOENTEROSTOMY
51.37 ANASTOMOSIS OF HEPATIC DUCT TO GASTROINTESTINAL TRACT
51.39 OTHER BILE DUCT ANASTOMOSIS
51.41 COMMON DUCT EXPLORATION FOR REMOVAL OF CALCULUS
51.42 COMMON DUCT EXPLORATION FOR RELIEF OF OTHER OBSTRUCTION
51.43 INSERTION OF CHOLEDOCHOHEPATIC TUBE FOR DECOMPRESSION
51.49 INCISION OF OTHER BILE DUCTS FOR RELIEF OF OBSTRUCTION
51.51 EXPLORATION OF COMMON DUCT
51.59 INCISION OF OTHER BILE DUCT
51.61 EXCISION OF CYSTIC DUCT REMNANT
51.62 EXCISION OF AMPULLA OF VATER WITH REIMPLANTATION OF COMMON DUCT
51.63 OTHER EXCISION OF COMMON DUCT
51.69 EXCISION OF OTHER BILE DUCT
51.71 SIMPLE SUTURE OF COMMON BILE DUCT
51.72 CHOLEDOCHOPLASTY
51.79 REPAIR OF OTHER BILE DUCTS
51.81 DILATION OF SPHINCTER OF ODDI
51.82 PANCREATIC SPHINCTEROTOMY
51.83 PANCREATIC SPHINCTEROPLASTY
51.89 OTHER OPERATIONS ON SPHINCTER OF ODDI
51.92 CLOSURE OF CHOLECYSTOSTOMY
51.93 CLOSURE OF OTHER BILIARY FISTULA
51.94 REVISION OF ANASTOMOSIS OF BILIARY TRACT
51.95 REMOVAL OF PROSTHETIC DEVICE FROM BILE DUCT
51.99 OTHER OPERATIONS ON BILIARY TRACT
52.01 DRAINAGE OF PANCREATIC CYST BY CATHETER
52.09 OTHER PANCREATOTOMY
52.12 OPEN BIOPSY OF PANCREAS
52.22 OTHER EXCISION OR DESTRUCTION OF LESION OR TISSUE OF PANCREAS OR PANCREATIC DUCT
52.3 MARSUPIALIZATION OF PANCREATIC CYST
52.4 INTERNAL DRAINAGE OF PANCREATIC CYST
52.51 PROXIMAL PANCREATECTOMY
52.52 DISTAL PANCREATECTOMY
52.53 RADIAL SUBTOTAL PANCREATECTOMY
52.59 OTHER PARTIAL PANCREATECTOMY
52.6 TOTAL PANCREATECTOMY
52.7 RADICAL PANCREATICODUODENECTOMY
52.80 PANCREATIC TRANSPLANT, NOS
52.81 REIMPLANTATION
52.82 HOMOTRANSPLANT OF PANCREAS
52.83 HETEROTRANSPLANT OF PANCREAS
52.92 CANNULATION OF PANCREATIC DUCT
52.95 OTHER REPAIR OF PANCREAS
52.96 ANASTOMOSIS OF PANCREAS
52.99 OTHER OPERATIONS ON PANCREAS
53.00 UNILATERAL REPAIR OF INGUINAL HERNIA, NOS
53.01 REPAIR OF DIRECT INGUINAL HERNIA
53.02 REPAIR OF INDIRECT INGUINAL HERNIA
53.03 AIR OF DIRECT INGUINAL HERNIA
53.04 REPAIR OF INDIRECT INGUINAL HERNIA WITH GRAFT OR PROSTHESIS
53.05 REPAIR OF INGUINAL HERNIA WITH GRAFT OR PROSTHESIS, NOS
53.10 BILATERAL REPAIR OF INGUINAL HERNIA, NOS
53.11 BILATERAL REPAIR OF DIRECT INGUINAL HERNIA
53.12 BILATERAL REPAIR OF INDIRECT INGUINAL HERNIA
53.13 BILATERAL REPAIR OF INGUINAL HERNIA, ONE DIRECT AND ONE INDIRECT
53.14 BILATERAL REPAIR OF DIRECT INGUINAL HERNIA WITH GRAFT OR PROSTHESIS
53.15 BILATERAL REPAIR OF INDIRECT INGUINAL HERNIA WITH GRAFT OR PROSTHESIS
53.16 BILATERAL REPAIR OF INGUINAL HERNIA, ONE DIRECT AND ONE INDIRECT, WITH GRAFT OR PROSTHESIS
53.17 BILATERAL INGUINAL HERNIA REPAIR WITH GRAFT OR PROSTHESIS, NOS
53.21 UNILATERAL REPAIR OF FEMORAL HERNIA
53.29 OTHER UNILATERAL FEMORAL HERNIORRHAPHY
53.31 BILATERAL REPAIR OF FEMORAL HERNIA WITH GRAFT OR PROSTHESIS
53.39 OTHER BILATERAL FEMORAL HERNIORRHAPHY
53.41 REPAIR OF UMBILICAL HERNIA WITH PROSTHESIS
53.49 OTHER UMBILICAL HERNIORRHAPHY
53.51 INCISIONAL HERNIA REPAIR
53.59 REPAIR OF OTHER HERNIA OF ANTERIOR ABDOMINAL WALL
53.61 INCISIONAL HERNIA REPAIR WITH PROSTHESIS
53.69 REPAIR OF OTHER HERNIA OF ANTERIOR ABDOMINAL WALL WITH PROSTHESIS
53.7 REPAIR OF DIAPHRAGMATIC HERNIA, ABDOMINAL APPROACH
54.0 INCISION OF ABDOMINAL WALL
54.11 EXPLORATORY LAPAROTOMY
54.19 OTHER LAPAROTOMY
54.22 BIOPSY OF ABDOMINAL WALL OR UMBILICUS
54.23 BIOPSY OF PERITONEUM
54.3 EXCISION OR DESTRUCTION OF LESION OR TISSUE OF ABDOMINAL WALL OR UMBILICUS
54.4 EXCISION OR DESTRUCTION OF PERITONEAL TISSUE
54.59 OTHER LYSIS OF PERITONEAL ADHESIONS
54.63 OTHER SUTURE OF ABDOMINAL WALL
54.64 SUTURE OF PERITONEUM

54.71	REPAIR OF GASTROSCHISIS
54.72	OTHER REPAIR OF ABDOMINAL WALLS
54.73	OTHER REPAIR OF PERITONEUM
54.74	OTHER REPAIR OF OMENTUM
54.75	OTHER REPAIR OF MESENTERY
54.92	REMOVAL OF FOREIGN BODY FROM PERITONEAL CAVITY
54.93	CREATION OF CUTANEOPERITONEAL FISTULA
54.94	CREATION OF PERITONEOVASCULAR SHUNT
54.95	INCISION OF PERITONEUM
55.51	NEPHROURETERECTOMY
55.52	NEPHRECTOMY OF REMAINING KIDNEY
55.53	REMOVAL OF TRANSPLANTED OR REJECTED KIDNEY
55.54	BILATERAL NEPHRECTOMY
55.61	RENAL AUTOTRANSPLANTATION
55.69	ULCERATIVE COLITIS, UNSPECIFIED
55.7	NEPHROPEXY
55.83	CLOSURE OF OTHER FISTULA OF KIDNEY
55.84	REDUCTION OF TORSION OF RENAL
55.85	SYMPHYSIOTOMY FOR HORESHOE KIDNEY
55.86	ANASTOMOSIS OF KIDNEY
55.87	CORRECTION OF URETEROPELVIC JUNCTION
55.91	DECAPSULATION OF KIDNEY
55.97	IMPLANTATION OR REPLACEMENT OF MECHANICAL KIDNEY
55.98	REMOVAL OF MECHANICAL KIDNEY
56.51	FORMATION OF CUTANEOUS URETERO-ILEOSTOMY
56.52	REVISION OF CUTANEOUS URETERO-ILEOSTOMY
56.61	FORMATION OF OTHER CUTANEOUS URETEROSTOMY
56.62	REVISION OF OTHER CUTANEOUS URETEROSTOMY
56.71	URINARY DIVERSION TO INTESTINE
56.72	REVISION OF URETEROINTESTINAL ANASTOMOSIS
56.73	NEPHROCYSTANASTOMOSIS, NOS
56.74	URETERONEOXYSTOSTOMY
56.75	TRANSURETEROURETEROSTOMY
56.83	CLOSURE OF URETEROSTOMY
56.84	CLOSURE OF OTHER FISTULA OF URETER
56.85	URETEROPEXY
56.86	REMOVAL OF LIGATURE FROM URETER
56.89	OTHER REPAIR OF URETER
56.95	LIGATION OF URETER
57.71	RADICAL CYSTECTOMY
57.79	OTHER TOTAL CYSTECTOMY
57.82	CLOSURE OF CYSTOSTOMY
57.87	RECONSTRUCTION OF URINARY BLADDER
59.00	RETROPERITONEAL DISSECTION, NOS
59.02	OTHER LYSIS OF PERIRENAL OR PERIURETERAL ADHESIONS
59.09	OTHER INCISION OF PERIRENAL OR PERIURETERAL TISSUE
60.12	OPEN BIOPSY OF PROSTATE
60.14	OPEN BIOPSY OF SEMINAL VESICLES
60.15	BIOPSY OF PERIPROSTATIC TISSUE
60.3	SUPRAPUBIC PROSTATECTOMY
60.4	RETROPUBIC PROSTATECTOMY
60.5	RADICAL PROSTATECTOMY
60.61	LOCAL EXCISION OF LESION OF PROSTATE
60.72	INCISION OF SEMINAL VESICLE
60.73	EXCISION OF SEMINAL VESICLE
60.79	OTHER OPERATIONS ON SEMINAL VESICLES
60.93	REPAIR OF PROSTATE
65.09	OTHER OOPHORECTOMY
65.12	OTHER BIOPSY OF OVARY
65.21	MARSUPIALIZATION OF OVARIAN CYST
65.22	WEDGE RESECTION OF OVARY
65.29	OTHER LOCAL EXCISION OR DESTRUCTION OF OVARY
65.39	OTHER UNLILATERAL OOPHORECTOMY
65.49	OTHER UNILATERAL SALPINGOOPHORECTOMY
65.51	OTHER REMOVAL OF BOTH OVARIES AT SAME OPERATIVE EPISODE
65.52	OTHER REMOVAL OF REMAINING OVARY
65.61	OTHER REMOVAL OF BOTH OVARIES AND TUBES AT SAME OPERATIVE EPISODE
65.62	OTHER REMOVAL OF REMAINING OVARY AND TUBE
65.71	OTHER SIMPLE SUTURE OF OVARY
65.72	OTHER REIMPLANTATION OF OVARY
65.73	OTHER SALPINGO OOPHOROPLASTY
65.79	OTHER REPAIR OF OVARY
65.89	OTHER LYSIS OF ADHESIONS OF OVARY AND FALLOPIAN TUBE
65.92	TRANSPLANTATION OF OVARY
65.93	MANUAL RUPTURE OF OVARIAN CYST
65.94	OVARIAN DENERVATION
65.95	RELEASE OF TORSION OF OVARY
65.99	OTHER OPERATIONS ON OVARY
66.01	SALPINGOTOMY
66.02	SALPINGOSTOMY
66.31	OTHER BILATERAL LIGATION AND CRUSHING OF FALLOPIAN TUBES
66.32	OTHER BILATERAL LIGATION AND DIVISION OF FALLOPIAN TUBES
66.39	OTHER BILATERAL DESTRUCTION OR OCCLUSION OF FALLOPIAN TUBES
66.4	TOTAL UNILATERAL SALPINGECTOMY
66.51	REMOVAL OF BOTH FALLOPIAN TUBES AT SAME OPERATIVE EPISODE
66.52	REMOVAL OF REMAINING FALLOPIAN TUBE
66.61	EXCISION OR DESTRUCTION OF LESION OF FALLOPIAN TUBE
66.62	SALPINGECTOMY WITH REMOVAL OF TUBAL PREGNANCY
66.63	BILATERAL PARTIAL SALPINGECTOMY, NOS
66.69	OTHER PARTIAL SALPINGECTOMY
66.71	SIMPLE SUTURE OF FALLOPIAN TUBE
66.72	SALPINGO-OOPHOROSTOMY
66.73	SALPINGO-SALPINGOSTOMY
66.74	SALPINGO-UTEROSTOMY
66.79	OTHER REPAIR OF FALLOPIAN TUBE
66.92	UNILATERAL DESTRUCTION OR OCCLUSION OF FALLOPIAN TUBE
66.97	BURYING OF FIMBRIAE IN UTERINE WALL
68.0	OTHER INCISION AND EXCISION OF UTERUS
68.13	OPEN BIOPSY OF UTERUS
68.14	OPEN BIOPSY OF UTERINE LIGAMENTS
68.3	SUBTOTAL ABDOMINAL HYSTERECTOMY
68.4	TOTAL ABDOMINAL HYSTERECTOMY
68.6	RADICAL ABDOMINAL HYSTERECTOMY
68.8	PELVIC EVISCERATION
69.22	OTHER UTERINE SUSPENSION
69.3	PARACERVICAL UTERINE DENERVATION
69.41	SUTURE OF LACERATION OF UTERUS
69.42	CLOSURE OF FISTULA OF UTERUS
69.49	OTHER REPAIR OF UTERUS

Active drug dependence

ICD-9-CM diagnosis codes:

304.00 OPIOID TYPE DEPENDENCE-UNSPECIFIED
304.01 OPIOID TYPE DEPENDENCE-CONTINUOUS
304.02 OPIOID TYPE DEPENDENCE-EPISODIC
304.10 BARBITURATE AND SIMILARLY ACTING SEDATIVE OR HYPNOTIC DEPENDENCE - UNSPECIFIED
304.11 BARBITURATE AND SIMILARLY ACTING SEDATIVE OR HYPNOTIC DEPENDENCE - CONTINUOUS
304.12 BARBITURATE AND SIMILARLY ACTING SEDATIVE OR HYPNOTIC DEPENDENCE, - EPISODIC
304.20 COCAINE DEPENDENCE-UNSPECIFIED
304.21 COCAINE DEPENDENCE-CONTINUOUS
304.22 COCAINE DEPENDENCE-EPISODIC
304.30 CANNABIS DEPENDENCE UNSPECIFIED
304.31 CANNABIS DEPENDENCE CONTINUOUS
304.32 CANNABIS DEPENDENCE EPISODIC
304.40 AMPHETAMINE AND OTHER PSYCHO STIMULANT DEPENDENCE-UNSPECIFIED
304.41 AMPHETAMINE AND OTHER PSYCHO STIMULANT DEPENDENCE-CONTINUOUS
304.42 AMPHETAMINE AND OTHER PSYCHO STIMULANT DEPENDENCE-EPISODIC
304.50 HALLUCINOGEN DEPENDENCE UNSPECIFIED
304.51 HALLUCINOGEN DEPENDENCE-CONTINUOUS
304.52 HALLUCINOGEN DEPENDENCE - EPISODIC
304.60 OTHER SPECIFIED DRUG DEPENDENCE - UNSPECIFIED
304.61 OTHER SPECIFIED DRUG DEPENDENCE - CONTINUOUS
304.62 OTHER SPECIFIED DRUG DEPENDENCE - EPISODIC
304.70 COMBINATIONS OF OPIOID TYPE DRUG WITH ANY OTHER - UNSPECIFIED
304.71 COMBINATIONS OF OPIOID TYPE DRUG WITH ANY OTHER - CONTINUOUS
304.72 COMBINATIONS OF OPIOID TYPE DRUG WITH ANY OTHER - EPISODIC
304.80 COMBINATIONS OF DRUG EXCLUDING OPIOID TYPE DRUG - UNSPECIFIED
304.81 COMBINATIONS OF DRUG EXCLUDING OPIOID TYPE DRUG - CONTINUOUS
304.82 COMBINATIONS OF DRUG EXCLUDING OPIOID TYPE DRUG - EPISODIC
304.90 UNSPECIFIED DRUG DEPENDENCE - UNSPECIFIED
304.91 UNSPECIFIED DRUG DEPENDENCE - CONTINUOUS
304.92 UNSPECIFIED DRUG DEPENDENCE - EPISODIC

Active nondependent abuse of drugs

ICD-9-CM diagnosis codes:

305.00 ALCOHOL ABUSE-UNSPECIFIED
305.01 ALCOHOL ABUSE-CONTINUOUS
305.02 ALCOHOL ABUSE-EPISODIC
305.10 TOBACCO USE DISORDER-UNSPECIFIED
305.11 TOBACCO USE DISORDER - CONTINUOUS
305.12 TOBACCO USE DISORDER -EPISODIC
305.20 CANNABIS ABUSE-UNSPECIFIED
305.21 CANNABIS ABUSE-CONTINUOUS
305.22 CANNABIS ABUSE-EPISODIC
305.30 HALLUCINOGEN ABUSE- UNSPECIFIED
305.31 HALLUCINOGEN ABUSE-CONTINUOUS
305.32 HALLUCINOGEN ABUSE- EPISODIC
305.40 BARBITURATE AND SIMILARLY ACTING SEDATIVE OR HYPNOTIC ABUSE-UNSPECIFIED
305.41 BARBITURATE AND SIMILARLY ACTING SEDATIVE OR HYPNOTIC ABUSE-CONTINUOUS
305.42 BARBITURATE AND SIMILARLY ACTING SEDATIVE OR HYPNOTIC ABUSE-EPISODIC
305.50 OPIOID ABUSE-UNSPECIFIED
305.51 OPIOD ABUSE-CONTINUOUS
305.52 OPIOID ABUSE-EPISODIC
305.60 COCAINE ABUSE-UNSPECIFIED
305.61 COCAINE ABUSE-CONTINUOUS
305.62 COCAINE ABUSE-EPISODIC
305.70 AMPHETAMINE OR RELATED ACTING SYMPATHOMIMETIC ABUSE-UNSPECIFIED
305.71 AMPHETAMINE OR RELATED ACTING SYMPATHOMIMETIC ABUSE-CONTINUOUS
305.72 AMPHETAMINE OR RELATED ACTING SYMPATHOMIMETIC ABUSE - EPISODIC
305.80 ANTIDEPRESSANT TYPE ABUSE-UNSPECIFIED
305.81 ANTIDEPRESSANT TYPE ABUSE-CONTINUOUS
305.82 ANTIDEPRESSANT TYPE ABUSE-EPISODIC
305.90 OTHER, MIXED, OR UNSPECIFIED DRUG ABUSE-UNSPECIFIED
305.91 OTHER, MIXED, OR UNSPECIFIED DRUG ABUSE- CONTINUOUS
305.92 OTHER, MIXED, OR UNSPECIFIED DRUG ABUSE- EPISODIC

Acute myocardial infarction

ICD-9-CM diagnosis codes:

410.00 AMI OF ANTEROLATERAL WALL – EPISODE OF CARE UNSPECIFIED
410.01 AMI OF ANTEROLATERAL WALL - INITIAL EPISODE OF CARE
410.10 AMI OF OTHER ANTERIOR WALL – EPISODE OF CARE UNSPECIFIED
410.11 AMI OF OTHER ANTERIOR WALL – INITIAL EPISODE OF CARE
410.20 AMI OF INFEROLATERAL WALL – EPISODE OF CARE UNSPECIFIED
410.21 AMI OF INFEROLATERAL WALL – INITIAL EPISODE OF CARE
410.30 AMI OF INFEROPOSTERIOR WALL – EPISODE OF CARE UNSPECIFIED
410.31 AMI OF INFEROPOSTERIOR WALL — INITIAL EPISODE OF CARE
410.40 AMI OF INFERIOR WALL - EPISODE OF CARE UNSPECIFIED
410.41 AMI OF INFERIOR WALL - INITIAL EPISODE OF CARE
410.50 AMI OF OTHER LATERAL WALL - EPISODE OF CARE UNSPECIFIED
410.51 AMI OF OTHER LATERAL WALL - INITIAL EPISODE OF CARE
410.60 AMI TRUE POSTERIOR WALL INFARCTION - EPISODE OF CARE UNSPECIFIED

410.61 AMI TRUE POSTERIOR WALL INFARCTION - INITIAL EPISODE OF CARE
410.70 AMI SUBENDOCARDIAL INFARCTION - EPISODE OF CARE UNSPECIFIED
410.71 AMI SUBENDOCARDIAL INFARCTION - INITIAL EPISODE OF CARE
410.80 AMI OF OTHER SPECIFIED SITES - EPISODE OF CARE UNSPECIFIED
410.81 AMI OF OTHER SPECIFIED SITES - INITIAL EPISODE OF CARE
410.90 AMI UNSPECIFIED SITE - EPISODE OF CARE UNSPECIFIED
410.91 AMI UNSPECIFIED SITE - INITIAL EPISODE OF CARE

Anesthesia complications

ICD-9-CM diagnosis codes:

E876.3 OTHER AND UNSPECIFIED MISADVENTURES DURING MEDICAL CARE, ENDOTRACHEAL TUBE WRONGLY PLACED DURING ANESTHETIC PROCEDURE
E855.1 OTHER NERVOUS SYSTEM DEPRESSANTS

OTHER CENTRAL NERVOUS SYSTEM DEPRESSANTS AND ANESTHETICS:
E938.1 HALOTHANE
E938.2 OTHER GASEOUS ANESTHETICS
E938.3 INTRAVENOUS ANESTHETICS
E938.4 OTHER AND UNSPECIFIED GENERAL \ANESTHETICS
E938.5 SURFACE AND INFILTRATION ANESTHETICS
E938.6 PERIPHERAL NERVE AND PLEXUS BLOCKING ANESTHETICS
E938.7 SPINAL ANESTHETICS
E938.9 OTHER AND UNSPECIFIED LOCAL ANESTHETICS

POISONING BY OTHER CENTRAL NERVOUS SYSTEM DEPRESSANTS AND ANESTHETICS:
968.1 HALOTHANE
968.2 OTHER GASEOUS ANESTHETICS
968.3 INTRAVENEOUS ANESTHETICS
968.4 OTHER AND UNSPECIFIED GENERAL ANESTHETICS
968.7 SPINAL ANESTHETICS

Anoxic brain injury

ICD-9-CM diagnosis codes:

348.1 ANOXIC BRAIN DAMAGE

Birth trauma

ICD-9-CM diagnosis codes:

767.0 SUBDURAL AND CEREBRAL HEMORRHAGE (DUE TO TRAUMA OR TO INTRAPARTUM ANOXIA OR HYPOXIA)
767.3 INJURIES TO SKELETON (EXCLUDES CLAVICLE)
767.4 INJURY TO SPINE AND SPINAL CORD
767.7 OTHER CRANIAL AND PERIPHERAL NERVE INJURIES
767.8 OTHER SPECIFIED BIRTH TRAUMA
767.9 BIRTH TRAUMA, UNSPECIFIED

Bone malignancy

ICD-9-CM diagnosis codes (all 4th and 5th digits) *:*

170 MALIGNANT NEOPLASM OF BONE AND ARTICULAR CARTILAGE

Cancer

ICD-9-CM diagnosis codes(all 4th and 5th digits) :

140 MALIGNANT NEOPLASM OF LIP
141 MALIGNANT NEOPLASM OF TONGUE
142 MALIGNANT NEOPLASM OF MAJORITY SALIVARY GLANDS
143 MALIGNANT NEOPLASM OF GUM
144 MALIGNANT NEOPLASM OF FLOOR OF MOUTH
145 MALIGNANT NEOPLASM OF OTHER AND UNSPECIFIED PARTS OF MOUTH
146 MALIGNANT NEOPLASM OF OROPHARYNX
147 MALIGNANT NEOPLASM OF NASOPHARYNX
148 MALIGNANT NEOPLASM OF HYPOPHARYNX
149 MALIGNANT NEOPLASM OF OTHER AND ILL-DEFINED SITES WITHIN THE LIP, ORAL CAVITY, AND PHARYNX
150 MALIGNANT NEOPLASM OF ESOPHAGUS
151 MALIGNANT NEOPLASM OF STOMACH
152 MALIGNANT NEOPLASM OF SMALL INTESTINE, INCLUDING DUODENUM
153 MALIGNANT NEOPLASM OF COLON
154 MALIGNANT NEOPLASM OF RECTUM, RECTOSIGMOID JUNCTION, AND ANUS
155 MALIGNANT NEOPLASM OF LIVER AND INTRAHEPATIC BILE DUCTS
156 MALIGNANT NEOPLASM OF GALLBLADDER AND EXTRAHEPATIC BILE DUCTS
157 MALIGNANT NEOPLASM OF PANCREAS
158 MALIGNANT NEOPLASM OF RETROPERITONEUM AND PERITONEUM
159 MALIGNANT NEOPLASM OF OTHER AND ILL-DEFINED SITES WITHIN THE DIGESTIVE ORGANS AND PERITONEUM
160 MALIGNANT NEOPLASM OF NASAL CAVITIES, MIDDLE EAR, AND ACCESSORY SINUSES
161 MALIGNANT NEOPLASM OF LARYNX
162 MALIGNANT NEOPLASM OF TRACHEA, BRONCHUS, AND LUNG
163 MALIGNANT NEOPLASM OF PLEURA
164 MALIGNANT NEOPLASM OF THYMUS, HEART, AND MEDIASTINUM
165 MALIGNANT NEOPLASM OF OTHER AND ILL-DEFINED SITES WITHIN THE RESPIRATORY SYSTEM AND INTRATHORACIC ORGANS
170 MALIGNANT NEOPLASM OF BONE AND ARTICULAR CARTILAGE
171 MALIGNANT NEOPLASM OF CONNECTIVE AND OTHER SOFT TISSUE
172 MALIGNANT MELANOMA OF SKIN
174 MALIGNANT NEOPLASM OF FEMALE BREAST
175 MALIGNANT NEOPLASM OF MALE BREAST
176 KARPOSI'S SARCOMA
179 MALIGNANT NEOPLASM OF UTERUS, PART UNSPECIFIED

180 MALIGNANT NEOPLASM OF CERVIX UTERI
181 MALIGNANT NEOPLASM OF EYE
182 MALIGNANT NEOPLASM OF BODY OF UTERUS
183 MALIGNANT NEOPLASM OF OVARY AND OTHER UTERINE ADNEXA
184 MALIGNANT NEOPLASM OF OTHER AND UNSPECIFIED FEMALE GENITAL ORGANS
185 MALIGNANT NEOPLASM OF OTHER AND UNSPECIFIED FEMALE GENITAL ORGANS
186 MALIGNANT NEOPLASM OF TESTIS
187 MALIGNANT NEOPLASM OF PENIS AND OTHER MALE GENITAL ORGANS
188 MALIGNANT NEOPLASM OF BLADDER
189 MALIGNANT NEOPLASM OF KIDNEY AND OTHER AND UNSPECIFIED URINARY ORGANS
190 MALIGNANT NEOPLASM OF EYE
191 MALIGNANT NEOPLASM OF BRAIN
192 MALIGNANT NEOPLASM OF OTHER AND UNSPECIFIED PARTS OF NERVOUS SYSTEM
193 MALIGNANT NEOPLASM OF THYROID GLAND
194 MALIGNANT NEOPLASM OF OTHER ENDOCRINE GLANDS AND RELATED STRUCTURES
195 MALIGNANT NEOPLASM OF OTHER, AND ILL-DEFINED SITES
196 SECONDARY AND UNSPECIFIED MALIGNANT NEOPLASM OF LYMPH NODES
197 SECONDARY MALIGNANT NEOPLASM OF RESPIRATORY AND DIGESTIVE SYSTEMS
198 SECONDARY MALIGNANT NEOPLASM OF OTHER SPECIFIED SITES
199 MALIGNANT NEOPLASM WITHOUT SPECIFICATION OF SITE
200 LYMPHOSARCOMA AND RETICULOSARCOMA
201 HODGKIN'S DISEASE
202 OTHER MALIGNANT NEOPLASMS OF LYMPHOID AND HISTIOCYTIC TISSUES
203 MULTIPLE MYELOMA AND IMMUNOPROLIFERATIVE NEOPLASMS
204 LYMPHOID LEUKEMIA
205 MYELOID LEUKEMIA
206 MONOCYTIC LEUKEMIA
207 OTHER SPECIFIED LEUKEMIA
208 LEUKEMIA OF UNSPECIFIED CELL TYPE
238.6 NEOPLASM OF UNCERTAIN BEHAVIOR OF OTHER AND UNSPECIFIED SITES AND TISSUES, PLASMA CELLS
273.3 DISORDERS OF PLASMA PROTEIN METABOLISM-MACROGLOBULINEMIA

PERSONAL HISTORY OF MALIGNANT NEOPLASM:
V10.00 GASTROINTESTINAL TRACT, UNSPECIFIED
V10.01 TONGUE
V10.02 OTHER AND UNSPECIFIED ORAL CAVITY AND PHARYNX
V10.03 ESOPHAGUS
V10.04 STOMACH
V10.05 LARGE INTESTINE
V10.06 RECTUM, RECTOSIGMOID JUNCTION, AND ANUS
V10.07 LIVER
V10.09 OTHER GASTROINTESTINAL TRACT
V10.11 BRONCHUS AND LUNG
V10.12 TRACHEA
V10.20 RESPIRATORY ORGAN, UNSPECIFIED
V10.21 LARYNX
V10.22 NASAL CAVITIES, MIDDLE EAR, AND ACCESSORY SINUSES
V10.29 OTHER RESPIRATORYAND INTRATHORACIC ORGANS
V10.3 BREAST
V10.40 FEMALE GENITAL ORGAN, UNSPECIFIED
V10.41 CERVIX UTERI
V10.42 OTHER PARTS OF UTERUS
V10.43 OVARY
V10.44 OTHER FEMALE GENITAL ORGANS
V10.45 MALE GENITAL ORGAN, UNSPECIFIED
V10.46 PROSTATE
V10.47 TESTIS
V10.48 EPIDIDYMIS
V10.49 OTHER MALE GENITAL ORGANS
V10.50 URINARY ORGAN, UNSPECIFIED
V10.51 BLADDER
V10.52 KIDNEY
V10.59 OTHER URINARY ORGAN
V10.60 LYMPHOSARCOMA AND RETICULOSARCOMA
V10.61 HODGKINS DISEASE
V10.62 MYELOID LEUKEMIA
V10.63 MONOCYTIC LEUKEMIA
V10.69 OTHER LEUKEMIA
V10.71 LYMPHOSARCOMA AND RETICULOSARCOMA
V10.72 HODGKINS DISEASE
V10.79 OTHER LYMPHATIC AND HEMATOPOIETIC NEOPLASM
V10.81 BONE
V10.82 MALIGNANT MELANOMA OF SKIN
V10.83 OTHER MALIGNANT NEOPLASM OF SKIN
V10.84 EYE
V10.85 BRAIN
V10.86 OTHER PARTS OF NERVOUS SYSTEM
V10.87 THYROID
V10.88 OTHER ENDOCRINE GLANDS AND RELATED STRUCTURES
V10.89 OTHER NEOPLASM
V10.9 UNSPECIFIED PERSONAL HISTORY OF MALIGNANT NEOPLASM

Diagnostic Related Groups (DRGS)

010 NERVOUS SYSTEM NEOPLASMS WITH CC
011 NERVOUS SYSTEM NEOPLASMS WITHOUT CC
064 EAR, NOSE, MOUTH AND THROAT MALIGNANCY
082 RESPIRATORY NEOPLASMS
172 DIGESTIVE MALIGNANCY WITH CC
173 DIGESTIVE MALIGNANCY WITHOUT CC
199 HEPATOBILIARY DIAGNOSTIC PROCEDURE FOR MALIGNANCY
203 MALIGNANCY OF HEPATOBILIARY SYSTEM OR PANCREAS
239 PATHOLOGICAL FRACTURES AND MUSCULOSKELETAL AND CONNECTIVE TISSUE MALIGNANCY
257 TOTAL MASTECTOMY FOR MALIGNANCY WITH CC
258 TOTAL MASTECTOMY FOR MALIGNANCY WITHOUT CC
259 SUBTOTAL MASTECTOMY FOR MALIGNANCY WITH CC
260 SUBTOTAL MASTECTOMY FOR MALIGNANCY WITHOUT CC
274 MALIGNANT BREAST DISORDERS WITH CC
275 MALIGNANT BREAST DISORDERS WITHOUT CC

303 KIDNEY, URETER AND MAJOR BLADDER PROCEDURES FOR NEOPLASM
318 KIDNEY AND URINARY TRACT NEOPLSMS WITH CC
319 KIDNEY AND URINARY TRACT NEOPLASMS WITHOUT CC
338 TESTES PROCEDURES FOR MALIGNANCY
344 OTHER MALE REPRODUCTIVE SYSTEM OR PROCEDURES FOR MALIGNANCY
346 MALIGNANCY OF MALE REPRODUCTIVE SYSTEM WITH CC
347 MALIGNANCY OF MALE REPRODUCTIVE SYSTEM WITHOUT CC
354 UTERINE AND ADNEXA PROCEDURES FOR NONOVARIAN/ADNEXAL MALIGNANCY WITH CC
355 UTERINE AND ADNEXA PROCEDURES FOR NONOVARIAN/ADNEXAL MALIGNANCY WITHOUT CC
357 UTERINE AND ADNEXA PROCEDURES FOR OVARIAN OR ADNEXAL MALIGNANCY
363 D AND C, CONIZATION AND RADIOIMPLANT FOR MALIGNANCY
367 MALIGNANCY OF FEMALE REPRODUCTIVE SYSTEM WITHOUT CC
400 LYMPHOMA AND LEUKEMIA WITH MAJOR OR PROCEDURES
401 LYMPHOMA AND NONACUTE LEUKEMIA WITH OTHER OR PROCEDURE WITH CC
402 LYMPHOMA AND NONACUTE LEUKEMIA WITH OTHER OR PROCEDURE WITHOUT CC
403 LYMPHOMA AND NONACUTE LEUKEMIA WITH CC
404 LYMPHOMA AND NONACUTE LEUKEMIA WITHOUT CC
405 ACUTE LEUKEMIAWITHOUT MAJOR OR PROCEDURE, AGE 0-17
406 MYELOPROLIFERATIVE DISORDERS OR POORLY DIFFERENTIATED NEOPLASMS WITH MAJOR OR PROCEDURES WITH CC
407 MYELOPROLIFERATIVE DISORDERS OR POORLY DIFFERENTIATED NEOPLASMS WITH MAJOR OR PROCEDURE WITHOUT CC
408 MYELOPROLIFERATIVE DISORDERS OR POORLY DIFFERENTIATED NEOPLASMS WITH OTHER OR PROCEDURES
409 RADIOTHERAPY
410 CHEMOTHERAPY WITHOUT ACUTE LEUKEMIA AS SECONDARY DIAGNOSIS
411 HISTORY OF MALIGNANCY WITHOUT ENDOSCOPY
412 HISTORY OF MALIGNANCY WITH ENDOSCOPY
413 OTHER MYELOPROLIFERATIVE DISORDERS OR POORLY DIFFERENTIATED NEOPLASM DIAGNOSES WITH CC
414 OTHER MYELOPROLIFERATIVE DISORDERS OR POORLY DIFFERENTIATED NEOPLASM DIAGNOSES WITHOUT CC
473 ACUTE LEUKEMIA WITHOUT MAJOR OR PROCEDURE, AGE GREATER THAN 17
492 CHEMOTHERAPY WITH ACUTE LEUKEMIA AS SECONDARY DIAGNOSIS

Cardiac arrest

ICD-9-CM codes:

427.5 CARDIAC ARREST

Cardiac arrhythmia

ICD-9-CM diagnosis codes:

426.0 ATRIOVENTRICULAR BLOCK, COMPLETE
427.0 PAROXYSMAL SUPRAVENTRICULAR TACHYCARDIA
427.1 PAROXYSMAL VENTRICULAR TACHYCARDIA
427.2 PAROXYSMAL TACHYCARDIA, UNSPECIFIED
427.31 ATRIAL FIBRILLATION
427.32 ATRIAL FLUTTER
427.41 VENTRICULAR FIBRILLATION
427.42 VENTRICULAR FLUTTER
427.9 CARDIAC DYSRHYTHMIA

Diagnostic Related Groups (DRGs):

138 CARDIAC ARRHYTHMIA AND CONDUCTION DISORDERS WITH CC
139 CARDIAC ARRHYTHMIA AND CONDUCTION DISORDERS WITHOUT CC

Cardiac surgery

Diagnostic Related Groups (DRGs):

103 HEART TRANSPLANT
104 CARDIAC VALVE AND OTHER MAJOR CARDIOTHORACIC PROCEDURES WITH CARDIAC CATHETERIZATION
105 CARDIAC VALVE AND OTHER MAJOR CARDIOTHORACIC PROCEDURES WITHOUT CARDIAC CATHETERIZATION
106 CORONARY BYPASS WITH PTCA
107 CORONARY BYPASS WITH CARDIAC CATHETERIZATION
108 OTHER CARDIOTHORACIC PROCEDURES
109 CORONARY BYPASS WITHOUT CARDIAC CATHETERIZATION
110 MAJOR CARDIOVASCULAR PROCEDURES WITH CC
111 MAJOR CARDIOVASCULAR PROCEDURES WITHOUT CC

Cesarean delivery

Diagnostic related groups (DRGs):

370 CESAREAN SECTION WITH CC
371 CESAREAN SECTION WITHOUT CC

Coma

ICD-9-CM diagnosis codes:

251.0 OTHER DISORDERS OF PANCREATIC INTERNAL SECRETION, HYPOGLYCEMIC COMA
572.2 LIVER ABSCESS AND SEQUELAE OF CHRONIC LIVER DISEASE, HEPATIC COMA
780.01 GENERAL SYMPTOMS, ALTERATION OF CONSCIOUSNESS, COMA
250.20 DIABETES WITH HYPEROSMOLARITY, TYPE 2 [NONINSULIN DEPENDENT TYPE][NIDDM TYPE][ADULT-ONSET] OR

	UNSPECIFIED TYPE, NOT STATED AS UNCONTROLLED
250.21	DIABETES WITH HYPEROSMOLARITY, TYPE 1 [INSULIN DEPENDENT TYPE][NIDDM-TYPE] [JUVENILE TYPE], NOT STATED AS UNCONTROLLED
250.22	DIABETES WITH HYPEROSMOLARITY, TYPE 2
250.23	DIABETES MELLITUS, DIABETES WITH HYPEROSMOLARITY , TYPE 1 [INSULIN DEPENDENT TYPE][NIDMM-TYPE][JUVENILE TYPE] UNCONTROLLED
250.30	DIABETES WITH OTHER COMA, TYPE 2 NOT STATED AS UNCONTROLLED
250.31	DIABETES WITH OTHER COMA, TYPE 1 NOT STATED AS UNCONTROLLED
250.32	DIABETES MELLITUS, DIABETES WITH OTHER COMA, TYPE 2 UNCONTROLLED
250.33	DIABETES MELLITUS, DIABETES WITH OTHER COMA, TYPE 1 UNCONTROLLED
780.03	GENERAL SYMPTOMS, ALTERATION OF CONSCIOUSNESS PERSISTENT VEGETATIVE STATE

Control of postoperative hemorrhage

ICD-9-CM procedure codes:

28.7	CONTROL OF HEMORRHAGE AFTER TONSILLECTOMY AND ADENOIDECTOMY
38.80	OTHER SURGICAL OCCLUSION OF UNSPECIFIED SITE
38.81	OTHER SURGICAL OCCLUSION OF INTRACRANIAL VESSELS
38.82	OTHER SURGICAL OCCLUSION OF OTHER VESSELS OF HEAD AND NECK
38.83	OTHER SURGICAL OCCLUSION OF UPPER LIMB VESSELS
38.84	OTHER SURGICAL OCCLUSION OF AORTA, ABDOMINAL
38.85	OTHER SURGICAL OCCLUSION OF THORACIC VESSEL
38.86	OTHER SURGICAL OCCLUSION OF ABDOMINAL ARTERIES
38.87	OTHER SURGICAL OCCLUSION OF VESSELS ABDOMINAL VEINS
38.88	OTHER SURGICAL OCCLUSION OF LOWER LIMB ARTERIES
38.89	OTHER SURGICAL OCCLUSION OF LOWER LIMB VEINS
39.41	CONTROL OF HEMORRHAGE AFTER TONSILLECTOMY AND ADENOIDECTOMY
39.98	CONTROL OF HEMORRHAGE NOS
49.95	CONTROL OF (POSTOPERATIVE) HEMORRHAGE OF ANUS
57.93	CONTROL OF (POSTOPERATIVE) HEMORRHAGE OF BLADDER
60.94	CONTROL OF (POSTOPERATIVE) HEMORRHAGE OF PROSTATE

Deep vein thrombosis

ICD-9-CM diagnosis codes:

451.11	PHLEBITIS AND THROMBOSIS OF FEMORAL VEIN (DEEP) (SUPERFICIAL)
451.19	PHLEBITIS AND THROMBOPHLEBITIS - OF DEEP VESSEL OF LOWER EXTREMITIES - OTHER
451.2	PHLEBITIS AND THROMBOPHLEBITIS OF LOWER EXTREMITIES UNSPECIFIED
451.81	PHLEBITIS AND THROMBOPHLEBITIS OF ILIAC VEIN
451.9	PHLEBITIS AND THROMBOPHLEBITIS OF OTHER SITES - OF UNSPECIFIED SITE
453.8	OTHER VENOUS EMBOLISM AND THROMBOSIS OF OTHER SPECIFIED VEINS
453.9	OTHER VENOUS EMBOLISM AND THROMBOSIS OF UNSPECIFIED SITE

Delirium and other psychoses

ICD-9-CM diagnosis codes (includes all 4th and 5th digits)

290	SENILE AND PRESENILE ORGANIC PSYCHOTIC CONDITIONS
291	ALCOHOLIC PSYCHOSES
292	DRUG PSYCHOSES
293	TRANSIENT ORGANIC PSYCHOTIC CONDITIONS
294	OTHER ORGANIC PSYCHOTIC CONDITIONS
295	SCHIZOPHRENIC DISORDERS
296	AFFECTIVE PSYCHOSES
297	PARANOID STATES
298	OTHER NONORGANIC PSYCHOSES
299	PSYCHOSES WITH ORIGIN SPECIFIC TO CHILDHOOD

Diabetes

ICD-9-CM diagnosis codes:

250.0	DIABETES MELLITUS WITHOUT MENTION OF COMPLICATION
250.1	DIABETES WITH KETOACIDOSIS
250.2	DIABETES WITH HYPEROSMOLARITY
250.3	DIABETES WITH OTHER COMA
250.4	DIABETES WITH RENAL MANIFESTATIONS
250.5	DIABETES WITH OPHTHALMIC MANIFESTATIONS
250.6	DIABETES WITH NEUROLOGICAL MANIFESTATIONS
250.7	DIABETES WITH PERIPHERAL CIRCULATORY DISORDERS
250.8	DIABETES WITH OTHER SPECIFIED MANIFESTATIONS
250.9	DIABETES WITH OTHER UNSPECIFIED COMPLICATIONS

Drainage of hematoma

ICD-9-CM procedure codes:

18.09	OTHER INCISION OF EXTERNAL EAR
54.0	INCISION OF ABDOMINAL WALL
54.12	REOPENING OF RECENT LAPAROTOMY SITE
59.19	OTHER INCISION OF PERIVESICLE TISSUE
61.0	INCISION AND DRAINAGE OF SCROTUM AND TUNICA VAGINALIS
69.98	OTHER OPERATIONS ON SUPPORTING STRUCTURES OF UTERUS
70.14	OTHER VAGINOTOMY
71.09	OTHER INCISION OF VULVA AND PERINEUM
75.91	EVACUATION OF OBSTETRICAL INCISIONAL HEMATOMA OF PERINEUM
75.92	EVACUATION OF OTHER HEMATOMA OF VULVA OR VAGINA
86.04	OTHER INCISION WITH DRAINAGE OF SKIN AND SUBCUTANEOUS TISSUE

Elective

ADMISSION TYPE IS RECORDED AS ELECTIVE (ATYPE = 3)

Foreign body left in during procedure

ICD-9-CM diagnosis codes:

998.4 FOREIGN BODY ACCIDENTALLY LEFT DURING A PROCEDURE
998.7 ACUTE REACTION TO FOREIGN SUBSTANCE ACCIDENTALLY LEFT DURING A PROCEDURE

FOREIGN BODY LEFT IN DURING:
E871.0 SURGICAL OPERATION
E871.1 INFUSION OR TRANSFUSION
E871.2 KIDNEY DIALYSIS OR OTHER PERFUSION
E871.3 INJECTION OR VACCINATION
E871.4 ENDOSCOPIC EXAMINATION
E871.5 ASPIRATION OF FLUID OR TISSUE, PUNCTURE, AND CATHETERIZATION
E871.6 HEART CATHETERIZATION
E871.7 REMOVAL OF CATHETER OR PACKING
E871.8 OTHER SPECIFIED PROCEDURES
E871.9 UNSPECIFIED PROCEDURE

Gastrointestinal (GI) hemorrhage

ICD-9-CM diagnosis codes:

456.0 ESOPHAGEAL VARICES WITH BLEEDING
456.20 ESOPHAGEAL VARICES IN DISEASES CLASSIFIED ELSEWHERE WITH BLEEDING
530.7 GASTROESOPHAGEAL LACERATION-HEMORRHAGE SYNDROME
530.82 ESOPHAGEAL HEMORRHAGE
531.00 GASTRIC ULCER ACUTE WITH HEMORRHAGE - WITHOUT MENTION OF OBSTRUCTION
531.01 GASTRIC ULCER ACUTE WITH HEMORRHAGE - WITH OBSTRUCTION
531.20 GASTRIC ULCER ACUTE WITH HEMORRHAGE AND PERFORATION - WITHOUT MENTION OF OBSTRUCTION
531.21 GASTRIC ULCER, ACUTE WITH HEMORRHAGE AND PERFORATION - WITH OBSTRUCTION
531.40 GASTRIC ULCER CHRONIC OR UNSPECIFIED WITH HEMORRHAGE - WITHOUT MENTION OF OBSTRUCTION
531.41 GASTRIC ULCER CHRONIC OR UNSPECIFIED WITH HEMORRHAGE - WITH OBSTRUCTION
531.60 GASTRIC ULCER CHRONIC OR UNSPECIFIED WITH HEMORRHAGE AND PERFORATION - WITHOUT MENTION OF OBSTRUCTION
531.61 GASTRIC ULCER CHRONIC OR UNSPECIFIED WITH HEMORRHAGE AND PERFORATION - WITH OBSTRUCTION
532.00 DUODENAL ULCER ACUTE WITH HEMORRHAGE - WITHOUT MENTION OF OBSTRUCTION
532.01 DUODENAL ULCER ACUTE WITH HEMORRHAGE - WITH OBSTRUCTION
532.20 DUODENAL ULCER ACUTE WITH HEMORRHAGE AND PERFORATION - WITHOUT MENTION OF OBSTRUCTION
532.21 DUODENAL ULCER ACUTE WITH HEMORRHAGE AND PERFORATION - WITH OBSTRUCTION
532.40 DUODENAL ULCER CHRONIC OR UNSPECIFIED WITH HEMORRHAGE - WITHOUT MENTION OF OBSTRUCTION
532.41 DUODENAL ULCER CHRONIC OR UNSPECIFIED WITH HEMORRHAGE - WITH OBSTRUCTION
532.60 DUODENAL ULCER CHRONIC OR UNSPECIFIED WITH HEMORRHAGE AND PERFORATION – WITHOUT MENTION OF OBSTRUCTION
532.61 DUODENAL ULCER CHRONIC OR UNSPECIFIED WITH HEMORRHAGE AND PERFORATION - WITH OBSTRUCTION
533.00 PEPTIC ULCER, SITE UNSPECIFIED ACUTE WITH HEMORRHAGE - WITHOUT MENTION OF OBSTRUCTION
533.01 PEPTIC ULCER, SITE UNSPECIFIED, ACUTE WITH HEMORRHAGE - WITH OBSTRUCTION
533.20 PEPTIC ULCER, SITE UNSPECIFIED, ACUTE WITH HEMORRHAGE AND PERFORATION - WITHOUT MENTION OF OBSTRUCTION
533.21 PEPTIC ULCER, SITE UNSPECIFIED, ACUTE WITH HEMORRHAGE AND PERFORATION - WITH OBSTRUCTION
533.40 PEPTIC ULCER, SITE UNSPECIFIED CHRONIC OR UNSPECIFIED WITH HEMORRHAGE - WITHOUT MENTION OF OBSTRUCTION
533.41 PEPTIC ULCER, SITE UNSPECIFIED, CHRONIC OR UNSPECIFIED WITH HEMORRHAGE - WITH OBSTRUCTION
533.60 PEPTIC ULCER, SITE UNSPECIFIED, CHRONIC OR UNSPECIFIED WITH HEMORRHAGE AND PERFORATION - WITHOUT MENTION OF OBSTRUCTION
533.61 PEPTIC ULCER, SITE UNSPECIFIED, CHRONIC OR UNSPECIFIED WITH HEMORRHAGE AND PERFORATION - WITH OBSTRUCTION
534.00 GASTROJEJUNAL ULCER, ACUTE WITH HEMORRHAGE - WITHOUT MENTION OF OBSTRUCTION
534.01 GASTROJEJUNAL ULCER, ACUTE WITH HEMORRHAGE - WITH OBSTRUCTION
534.20 GASTROJEJUNAL ULCER, ACUTE WITH HEMORRHAGE AND PERFORATION - WITHOUT MENTION OF OBSTRUCTION
534.21 GASTROJEJUNAL ULCER, ACUTE WITH HEMORRHAGE AND PERFORATION - WITH OBSTRUCTION
534.40 GASTROJEJUNAL ULCER, CHRONIC OR UNSPECIFIED WITH HEMORRHAGE - WITHOUT MENTION OF OBSTRUCTION
534.41 GASTROJEJUNAL ULCER, CHRONIC OR UNSPECIFIED WITH HEMORRHAGE - WITH OBSTRUCTION
534.60 GASTROJEJUNAL ULCER, CHRONIC OR UNSPECIFIED WITH HEMORRHAGE AND PERFORATION - WITHOUT MENTION OF OBSTRUCTION
534.61 GASTROJEJUNAL ULCER, CHRONIC OR UNSPECIFIED WITH HEMORRHAGE AND PERFORATION - WITH OBSTRUCTION
535.01 GASTRITIS AND DUODENITIS, ACUTE GASTRITIS WITH HEMORRHAGE
535.11 GASTRITIS AND DUODENITIS, ATROPHIC GASTRITIS WITH HEMORRHAGE
535.21 GASTRITIS AND DUODENITIS, GASTRIC MUCOSAL HYPERTROPHY, WITH HEMORRHAGE

535.31	GASTRITIS AND DUODENITIS, ALCOHOLIC GASTRITIS, WITH HEMORRHAGE
535.41	GASTRITIS AND DUODENITIS, OTHER SPECIFIED GASTRITIS - WITH HEMORRHAGE
535.51	GASTRITIS AND DUODENITIS, UNSPECIFIED GASTRITIS AND GASTRODUODENITIS - WITH HEMORRHAGE
535.61	GASTRITIS AND DUODENITIS, DUODENITIS - WITH HEMORRHAGE
537.83	OTHER SPECIFIED DISORDERS OF STOMACH AND DUODENUM, ANGIODYSPLASIA OF STOMACH AND DUODENUM - WITH HEMORRHAGE
562.02	DIVERTICULOSIS OF SMALL INTESTINE - WITH HEMORRHAGE
562.03	DIVERTICULITIS OF SMALL INTESTINE - WITH HEMORRHAGE
562.12	DIVERTICULOSIS OF COLON - WITH HEMORRHAGE
562.13	DIVERTICULITIS OF COLON - WITH HEMORRHAGE
569.3	HEMORRHAGE OF RECTUM AND ANUS
569.85	ANGIODYSPLASIA OF INTESTINE - WITH HEMORRHAGE
578.0	GASTROINTESTINAL HEMORRHAGE, HEMATEMESIS
578.1	GASTROINTESTINAL HEMORRHAGE, BLOOD IN STOOL
578.9	GASTROINTESTINAL HEMORRHAGE, HEMORRHAGE OF GASTROINTESTINAL TRACT, UNSPECIFIED

Hemiplegia, paraplegia, or quadriplegia

ICD-9-CM diagnosis codes (includes all 4th and 5th digits):

342.0	FLACCID HEMIPLEGIA
342.1	SPASTIC HEMIPLEGIA
342.8	OTHER SPECIFIED HEMIPLEGIA
342.9	HEMIPLEGIA, UNSPECIFIED
343.0	INFANTILE CEREBRAL PALSY, DIPLEGIC
343.1	INFANTILE CEREBRAL PALSY, HEMIPLEGIC
343.2	INFANTILE CEREBRAL PALSY, QUADRIPLEGIC
343.3	INFANTILE CEREBRAL PALSY, MONOPLEGIC
343.4	INFANTILE CEREBRAL PALSY INFANTILE HEMIPLEGIA
343.8	INFANTILE CEREBRAL PALSY OTHER SPECIFIED INFANTILE CEREBRAL PALSY
343.9	INFANTILE CEREBRAL PALSY, INFANTILE CEREBRAL PALSY, UNSPECIFIED
344.0	QUADRIPLEGIA AND QUADRIPARESIS
344.1	PARAPLEGIA
344.2	DIPLEGIA OF UPPER LIMBS
344.3	MONOPLEGIA OF LOWER LIMB
344.4	MONOPLEGIA OF UPPER LIMB
344.5	UNSPECIFIED MONOPLEGIA
344.6	CAUDA EQUINA SYNDROME
344.8	OTHER SPECIFIED PARALYTIC SYNDROMES
344.9	PARALYSIS, UNSPECIFIED
438.2	HEMIPLEGIA/HEMIPARESIS
438.3	MONOPLEGIA OF UPPER LIMB
438.4	MONOPLEGIA OF LOWER LIMB
438.5	OTHER PARALYTIC SYNDROME

Hemorrhage

ICD-9-CM diagnosis codes:

285.1	ACUTE POSTHEMORRHAGIC ANEMIA
459.0	OTHER DISORDERS OF CIRCULATORY SYSTEM, HEMORRHAGE, UNSPECIFIED
958.2	CERTAIN EARLY COMPLICATIONS OF TRAUMA, SECONDARY AND RECURRENT HEMORRHAGE
998.11	HEMORRHAGE COMPLICATING A PROCEDURE

Hip fracture

ICD-9-CM diagnosis codes: (includes all 5th digits)

820.0	FRACTURE OF NECK OF FEMUR-TRANSCERVICAL FRACTURE, CLOSED
820.1	FRACTURE OF NECK OF FEMUR-TRANSCERVICAL FRACTURE, OPEN
820.2	FRACTURE OF NECK OF FEMUR-PERTROCHANTERIC FRACTURE, CLOSED
820.3	FRACTURE OF NECK OF FEMUR-PERTROCHANTERIC FRACTURE, OPEN
820.8	UNSPECIFIED PART OF NECK OF FEMUR, CLOSED
820.9	UNSPECIFIED PART OF NECK OF FEMUR, OPEN

Immunocompromised

ICD-9-CM diagnosis codes (includes all 4th and 5th digits)

042	HUMAN IMMUNODEFICIENCY VIRUS DISEASE
136.3	PNEUMOCYSTOSIS
279.0	DEFFICIENCY OF HUMORAL IMMUNITY
279.1	DEFFICIENCY OF CELL-MEDIATED IMMUNITY
279.2	COMBINED IMMUNITY DEFFICIENCY
279.3	UNSPECIFIED IMMUNITY DEFFICIENCY
279.4	AUTOIMMUNE DISEASE, NOT ELSEWHERE CLASSIFIED
279.8	OTHER SPECIFIED DISORDERS INVOLVING THE IMMUNE MECHANISM
279.9	UNSPECIFIED DISORDER OF IMMUNE MECHANISM
996.8	COMPLICATIONS OF TRANSPLANTED ORGAN
V42.0	KIDNEY REPLACED BY TRANSPLANT
V42.1	HEART REPLACED BY TRANSPLANT
V42.6	LUNG REPLACED BY TRANSPLANT
V42.7	LIVER REPLACED BY TRANSPLANT
V42.81	BONE MARROW SPECIFIED BY TRANSPLANT
V42.82	PERIPHERAL STEM CELLS REPLACED BY TRANSPLANT
V42.83	PANCREAS REPLACED BY TRANSPLANT
V42.84	INTESTINES REPLACED BY TRANSPLANT
V42.89	OTHER REPLACED BY TRANSPLANT

ICD-9-CM procedure codes (includes 4th and 5th digits:)

33.5	LUNG TRANSPLANT
33.6	COMBINED HEART-LUNG TRANSPLANTATION
37.5	HEART TRANSPLANTATION
41.0	OPERATIONS ON BONE MAROW AND SPLEEN
50.5	LIVER TRANSPLANT
55.69	OTHER KIDNEY TRANSPLANTATION

52.80 PANCREATIC TRANSPLANT, NOS
52.81 REIMPLANTATION OF PANCREATIC TISSUE
52.83 HETEROTRANSPLANT OF PANCREAS
52.85 ALLOTRANSPLANTATION OF CELLS OF ISLETS OF LANGERHANS
52.86 TRANSPLANTATION OF CELLS OF ISLETS OF LANGERHANS, NOS

Diagnostic Related Groups (DRGs):

488 HIV WITH EXTENSIVE OR PROCEDURE
489 HIV WITH MAJOR RELATED CONDITION
490 HIV WITH OR WITHOUT OTHER RELATED CONDITION

Indications of current drug abuse

ICD-9-CM diagnosis codes

TOXIC EFFECT OF ALCOHOL:
980.0 ETHYL ALCOHOL
980.1 METHYL ALCOHOL
980.2 ISOPROPYL ALCOHOL
980.3 FUSEL OIL

981 TOXIC EFFECT OF PETROLEUM PRODUCTS

SOLVENTS OTHER THAN PETROLEUM-BASED:
982.0 BENZENE AND HOMOLOGUES
982.1 CARBON TETRACHLORIDE
982.2 CARBON DISULFIDE
982.3 OTHER CHLORINATED HYDROCARBON SOLVENTS
982.4 NITROGLYCOL
982.8 OTHER NONPETROLEUM-BASED SOLVENTS

983.0 TOXIC EFFECT OF CORROSIVE AROMATICS
983.1 TOXIC EFFECT OF ACIDS
983.2 TOXIC EFFECT OF CAUSTIC ALKALIDES
983.9 TOXIC EFFECT OF CAUSTIC, UNSPECIFIED

TOXIC EFFECT OF LEAD AND ITS COMPOUNDS (INCLUDING FUMES):
984.0 INORGANIC LEAD COMPOUNDS
984.1 ORGANIC LEAD COMPOUNDS
984.8 OTHER LEAD COMPOUNDS
984.9 UNSPECIFIED LEAD COMPOUND

TOXIC EFFECT OF OTHER METALS :
985.0 MERCURY AND ITS COMPOUNDS
985.1 ARSENIC AND ITS COMPOUNDS
985.2 MANGANESE AND ITS COMPOUNDS
985.3 BERYLLIUM AND ITS COMPOUNDS
985.4 ANTIMONY AND ITS COMPOUNDS
985.5 CADMIUM AND ITS COMPOUNDS
985.6 CHROMIUM
985.8 OTHER SPECIFIED METALS
985.9 UNSPECIFIED METAL

986 TOXIC EFFECT OF CARBON MONOXIDE

TOXIC EFFECT OF OTHER GASES, FUMES, OR VAPORS:
987.0 LIQUEFIED PETROLEUM GASES
987.1 OTHER HYDROCARBON GAS
987.2 NITROGEN OXIDES
987.3 SULFUR DIOXIDE
987.4 FREON
987.5 LACRIMOGENIC GAS
987.6 CHLORINE GAS
987.7 HYDROCYANIC ACID GAS
987.8 OTHER SPECIFIED GASES, FUMES, OR VAPORS
987.9 UNSPECIFIED GAS, FUME, OR VAPOR

NOXIOUS SUBSTANCES EATEN AS FOOD:
988.0 FISH AND SHELLFISH
988.1 MUSHROOMS
988.2 BERRIES AND OTHER PLANTS
988.8 OTHER SPECIFIED NOXIOUS SUBSTANCES EATEN AS FOOD

TOXIC EFFECT OF OTHER SUBSTANCES, CHIEFLY NONMEDICINAL AS TO SOURCE:
989.0 HYDROCYANIC ACID AND CYANIDES
989.1 STRYCHNINE AND SALTS
989.2 CHLORINATED HYDROCARBONS
989.3 ORGANOPHOSPHATE AND CARBAMATE
989.4 OTHER PESTICIDES, NEC
989.5 VENOM
989.6 SOAPS AND DETERGENTS
989.7 AFLATOXIN AND OTHER MYCOTOXIN [FOOD CONTAMINANTS]
989.8 OTHER SUBSTANCES, CHIEFLY NONMEDICIAN AS TO SOURCE
989.9 UNSPECIFIED SUBSTANCE, CHIEFLY NONMEDICINAL AS TO SOURCE

291.0 ALCOHOL WITHDRAWAL DELIRIUM
291.1 ALCOHOL AMNESTIC SYNDROME
291.2 OTHER ALCOHOLIC DEMENTIA
291.3 ALCOHOL WITHDRAWL HALLUCINOSIS
291.4 IDIOSYNCRATIC ALCOHOL INTOXICATION
291.5 ALCOHOL JEALOUSY
291.8 OTHER SPECIFIED ALCOHOLIC PSYCHOSIS
291.81 ALCOHOL WITHDRAWAL
291.9 ALCOHOLIC PSYCHOSES

DRUG PSYCHOSES:
292.0 DRUG WITHDRAWL SYNDROME
292.11 DRUG-INDUCED ORGANIC DELUSIONAL SYNDROME
292.12 DRUG- INDUCED HALLUCINOSIS
292.2 PATHOLOGICAL DRUG INTOXICATION
292.81 DRUG-INDUCED DELIRIUM
292.82 DRUG-INDUCED DEMENTIA
292.83 DRUG-INDUCED AMNESTIC SYNDROME
292.84 DRUG-INDUCED ORGANIC AFFECTIVE SYNDROME
292.89 OTHER SPECIFIED DRUG-INDUCED MENTAL DISORDERS
292.9 UNSPECIFIED DRUG-INDUCED MENTAL DISORDER

(includes all 4th and 5th digits)
303.0 ACUTE ALCOHOLIC INTOXICATION
303.9 OTHER AND UNSPECIFIED ALCOHOL .\DEPENDENCE
304.0 OPIOID TYPE DEPENDENCE
304.1 BARBITURATE AND SIMILARLY ACTING SEDATIVE OR HYPNOTIC DEPENDENCE
304.2 COCAINE DEPENDENCE
304.3 CANNABIS DEPENDENCE
304.4 AMPHETAMINE AND OTHER PSYCHOSTIMULANT DEPENDENCE
304.5 HALLUCINOGEN DEPENDENCE
304.6 OTHER SPECIFIED DRUG DEPENDENCE
304.7 COMBINATIONS OF OPIOID TYPE DRUG WITH ANY OTHER
304.8 COMBINATIONS OF DRUG DEPENDENCE EXCLUDING OPIOID TYPE DRUG

304.9	UNSPECIFIED DRUG DEPENDENCE
305.0	ALCOHOL ABUSE
305.2	CANNABIS ABUSE
305.3	HALLUCINOGEN ABUSE
305.4	BARBITURATE AND SIMILARLY ACTING SEDATIVE OR HYPNOTIC ABUSE
305.5	OPIOID ABUSE
305.6	COCAINE ABUSE
305.7	AMPHETAMINE OR RELATED ACTING SYMPATHOMIMETIC ABUSE
305.8	ANTIDEPRESSANT TYPE ABUSE
305.9	OTHER MIXED OR UNSPECIFIED DRUG ABUSE

Infection

ICD-9-CM diagnosis codes:

540.0	ACUTE APPENDICITIS WITH GENERALIZED PERITONITIS
540.1	ACUTE APPENDICITIS WITH PERITONEAL ABSCESS
540.9	ACUTE APPENDICITIS WITHOUT MENTION OF PERITONITIS
541	APPENDICITIS, UNQUALIFIED
542	OTHER APPENDICITIS
562.01	DIVERTICULITIS OF SMALL INTESTINE (WITHOUT MENTION OF HEMORRHAGE)
562.03	DIVERTICULITIS OF SMALL INTESTINE WITH HEMORRHAGE
562.11	DIVERTICULITIS OF COLON (WITHOUT MENTION OF HEMORRHAGE)
562.13	DIVERTICULITIS OF COLON WITH HEMORRHAGE
566	ABSCESS OF ANAL AND RECTAL REGIONS
567.0	PERITONITIS IN INFECTIOUS DISEASES CLASSIFIED ELSEWHERE
567.1	PNEUMOCOCCAL PERITONITIS
567.2	OTHER SUPPURATIVE PERITONITIS
567.8	OTHER SPECIFIED PERITONITIS
567.9	UNSPECIFIED PERITONITIS
569.5	ABSCESS OF INTESTINE
569.61	INFECTION OF COLOSTOMY OR ENTEROSTOMY
572.0	ABSCESS OF LIVER
572.1	PORTAL PYEMIA
574.00	CALCULUS OF GALLBLADDER WITH ACUTE CHOLECYSTITIS - WITHOUT MENTION OF OBSTRUCTION
574.01	CALCULUS OF GALLBLADDER WITH ACUTE CHOLECYSTITS - WITH OBSTRUCTION
574.30	CALCULUS OF BILE DUCT WITH ACUTE CHOLECYSTITIS - WITHOUT MENTION OF OBSTRUCTION
574.31	CALCULUS OF BILE DUCT WITH ACUTE CHOLECYSTITIS - WITH OBSTRUCTION
574.60	CALCULUS OF GALLBLADDER AND BILE DUCT WITH ACUTE CHOLECYSTITIS - WITHOUT MENTION OF OBSTRUCTION
574.61	CALCULUS OF GALLBLADDER AND BILE DUCT WITH ACUTE CHOLECYSTITIS - WITH OBSTRUCTION
574.80	CALCULUS OF GALLBLADDER AND BILE DUCT WITH ACUTE AND CHRONIC CHOLECYSTITIS - WITHOUT MENTION OF OBSTRUCTION
574.81	CALCULUS OF GALLBLADDER AND BILE DUCT WITH ACUTE AND CHRONIC CHOLECYSTITIS - WITH OBSTRUCTION
575.0	ACUTE CHOLECYSTITIS
575.4	PERFORATION OF GALLBLADDER
576.1	CHOLANGITIS
576.3	PERFORATION OF BILE DUCT

Diagnostic Related Groups (DRGs)

020	NERVOUS SYSTEM INFECTION EXCEPT VIRAL MENINGITIS
068	OTITIS MEDIA AND URI, AGE GREATER THAN 17 WITH CC
069	OTITIS MEDIA AND URI, AGE GREATER THAN 17 WITHOUT CC
079	RESPIRATORY INFECTIONS AND INFLAMMATIONS, AGE GREATER THAN 17 WITH CC
080	RESPIRATORY INF ECTIONS AND INFLAMMATIONS, AGE GREATER THAN 17 WITHOUT CC
089	SIMPLE PNEUMONIA AND PLEURISY, AGE GREATER THAN 17 WITH CC
090	SIMPLE PNEUMONIA AND PLEURISY, AGE GREATER THAN 17 WITHOUT CC
126	ACUTE AND SUBACUTE ENDOCARDITIS
238	OSTEOMYELITIS
242	SEPTIC ARTHRITIS
277	CELLULITIS, AGE GREATER THAN 17 WITH CC
278	CELLULITIS, AGE GREATER THAN 17 WITHOUT CC
320	KIDNEY AND URINARY TRACT INFECTIONS, AGE GREATER THAN 17 WITH CC
321	KIDNEY AND URINARY TRACT INFECTIONS, AGE GREATER THAN 17 WITHOUT CC
368	INFECTIONS OF FEMALE REPRODUCTIVE SYSTEM
416	SEPTICEMIA, AGE GREATER THAN 17

Instrument assisted delivery

ICD-9-CM procedure codes

72.0	LOW FORCEPS OPERATION
72.1	LOW FORCEPS OPERATION WITH EPISIOTOMY
72.21	MID FORCEPS OPERATION WITH EPISIOTOMY
72.29	OTHER MID FORCEPS OPERATION
72.31	HIGH FORCEPS OPERATION WITH EPISIOTOMY
72.39	OTHER HIGH FORCEPS OPERATION
72.4	FORCEPS ROTATION OF FETAL HEAD
72.51	PARTIAL BREECH EXTRACTION WITH FORCEPS TO AFTERCOMING HEAD
72.53	TOTAL BREECH EXTRACTION WITH FORCEPS TO AFTERCOMING HEAD
72.6	FORCEPS APPLICATION TO AFTERCOMING HEAD
72.71	VACUUM EXTRACTION WITH EPISIOTOMY
72.8	OTHER SPECIFIED INSTRUMENTAL DELIVERY
72.9	UNSPECIFIED INSTRUMENTAL DELIVERY

Liveborn

Diagnostic Related Groups (DRG):

385	NEONATES, DIED OR TRANSFERRED TO ANOTHER ACUTE CARE FACILITY

386 EXTREME IMMATURITY OR RESPIRATORY DISTRESS SYNDROME OF NEONATE
387 PREMATURITY WITH MAJOR PROBLEMS
388 PREMATURITY WITHOUT MAJOR PROBLEMS
389 FULL TERM NEONATE WITH MAJOR PROBLEMS
390 NEONATE WITH OTHER SIGNIFICANT PROBLEMS
391 NORMAL NEWBORN

AND

ICD-9-CM diagnosis codes (includes 4th and 5th digits)

Admission type recorded as (4):

764 SLOW FETAL GROWTH AND FETAL MALNUTRITION
765 DISORDERS RELATING TO SHORT GESTATION AND UNSPECIFIED LOW BIRTH WEIGHT
766 DISORDERS RELATING TO LONG GESTATION AND HIGH BIRTH WEIGHT
767 BIRTH TRAUMA
768 INTRAUTERINE HYPOXIA AND BIRTH ASPHYXIA
769 RESPIRATORY DISTRESS SYNDROME
770 OTHER RESPIRATORY CONDITIONS OF FETUS AND NEWBORN
V30 SINGLE LIVEBORN
V31 TWIN, MATE LIVEBORN
V32 TWIN, MATE STILLBORN
V33 TWIN, UNSPECIFIED
V34 OTHER MULTIPLE, MATES ALL LIVEBORN
V35 OTHER MULTIPLE, MATE ALL STILLBORN
V36 OTHER MULTIPLE, MATES LIVE- AND STILLBORN
V37 OTHER MULTIPLE, UNSPECIFIED
V39 UNSPECIFIED

Long term care facility

ADMISSION SOURCE IS RECORDED AS LONGTERM CARE FACILITY (ASOURCE=3)

Low mortality

Diagnostic Related Groups DRGs

MEDICAL:
015 TRANSIENT ISCHEMIC ATTACK AND PRECEREBRAL OCCLUSIONS
021 VIRAL MENINGITIS
030 TRAUMATIC STUPOR AND COMA, COMA LESS THAN ONE HOUR, AGE 0-17
031 CONCUSSION, AGE GREATER THAN 17 WITH CC
032 CONCUSSION, AGE GREATER THAN 17 WITHOUT CC
044 ACUTE MAJOR EYE INFECTIONS
045 NEUROLOGICAL EYE DISORDERS
065 DYSEQUILIBRIUM
068 OTITIS MEDIA AND URI, AGE GREATER THAN 17 WITH CC
071 LARYNGOTRACHEITIS
096 BRONCHITIS AND ASTHMA, AGE GREATER THAN 17 WITH CC
097 BRONCHITIS AND ASTHMA, AGE GREATER THAN 17 WITHOUT CC
125 CIRCULATORY DISORDERS EXCEPT ACUTE MYOCARDIAL INFARCTION WITH CARDIAC CATHETERIZATION WITHOUT COMPLEX DIAGNOSIS
134 HYPERTENSION
140 ANGINA PECTORIS
141 SYNCOPE AND COLLAPSE WITH CC
142 SYNCOPE AND COLLAPSE WITHOUT CC
143 CHEST PAIN
237 SPRAINS, STRAINS AND DISLOCATIONS OF HIP, PELVIS AND THIGH
243 MEDICAL BACK PROBLEMS
246 NONSPECIFIC ARTHROPATHIES

295 DIABETES, AGE 0-35
317 ADMISSION FOR RENAL DIALYSIS
323 URINARY STONES WITH CC AND/OR ESW LITHOTRIPSY
324 URINARY STONES WITHOUT CC
351 STERILIZATION, MALE
369 MENSTRUAL AND OTHER FEMALE REPRODUCTIVE SYSTEM DISORDERS
421 VIRAL ILLNESS, AGE GREATER THAN 17

PEDIATRIC MEDICAL:
026 SEIZURE AND HEADACHE, AGE 0-17
033 CONCUSSION, AGE 0-17
070 OTITIS MEDIA AND URI, AGE 0-17
074 OTHER EAR, NOSE, MOUTH AND THROAT DIAGNOSES, AGE 0-17
091 SIMPLE PNEUMONIA AND PLEURISY, AGE 0-17
098 BRONCHITIS AND ASTHMA, AGE 0-17
184 ESOPHAGITIS, GASTROENTERITIS AND MISCELLANEOUS DIGESTIVE DISORDERS, AGE 0-17
190 OTHER DIGESTIVE SYSTEM DIAGNOSES, AGE 0-17
252 FRACTURES, SPRAINS, STRAINS AND DISLOCATIONS OF FOREARM, HAND AND FOOT, AGE 0-17
255 FRACTURES, SPRAINS, STRAINS AND DISLOCATIONS OF UPPER ARM AND LOWER LEG EXCEPT FOOT, AGE 0-17
279 CELLULITIS, AGE 0-17
282 TRAUMA TO SKIN, SUBCUTANEOUS TISSUE AND BREAST, AGE 0-17
298 NUTRITIONAL AND MISCELLANEOUS METABOLIC DISORDERS, AGE GREATER THAN 17 WITHOUT CC
322 KIDNEY AND URINARY TRACT INFECTION, AGE 0-17
333 OTHER KIDNEY AND URINARY TRACT DIAGNOSES, AGE 0-17
396 RED BLOOD CELL DISORDERS, AGE 0-17
422 VIRAL ILLNESS AND FEVER OF UNKNOWN ORIGIN, AGE 0-17
446 TRAUMATIC INJURY, AGE 0-17
448 ALLERGIC REACTIONS, AGE 0-17
451 POISONING AND TOXIC EFFECTS OF DRUGS, AGE 0-17

SURGICAL:
036 RETINAL PROCEDURES
037 ORBITAL PROCEDURES
042 INTRAOCULAR PROCEDURES
050 SIALOADENECTOMY
052 CLEFT LIP AND PALATE REPAIR
053 SINUS AND MASTOID PROCEDURES, AGE GREATER THAN 17
055 MISCELLANEOUS EAR, NOSE, MOUTH AND THROAT PROCEDURES
057 TONSILLECTOMY AND ADENOIDECTOMY PROCEDURES EXCEPT TONSILLECTOMY AND/OR

ADENOIDECTOMY ONLY, AGE GREATER THAN 17
063 OTHER EAR, NOSE, MOUTH AND THROAT OR PROCEDURES
166 APPENDECTOMY WITHOUT COMPLICATED PRINCIPAL DIAGNOSIS WITH CC
167 APPENDECTOMY WITHOUT COMPLICATED PRINCIPAL DIAGNOSIS WITHOUT CC
218 LOWER EXTREMITY AND HUMERUS PROCEDURES EXCEPT HIP, FOOT AND FEMUR, AGE GREATER THAN 17 WITH CC
219 LOWER EXTREMITY AND HUMERUS PROCEDURES EXCEPT HIP, FOOT AND FEMUR, AGE GREATER THAN 17 WITHOUT CC
223 MAJOR SHOULDER, ELBOW PROCEDURES OR OTHER UPPER EXTREMITY PROCEDURES WITH CC
224 SHOULDER, ELBOW OR FOREARM PROCEDURES EXCEPT MAJOR JOINT PROCEDURES WITHOUT CC
225 FOOT PROCEDURES
228 MAJOR THUMB OR JOINT PROCEDURES OR OTHER HAND OR WRIST PROCEDURES WITH CC
229 HAND OR WRIST PROCEDURES EXCEPT MAJOR JOINT PROCEDURES WITHOUT CC
232 ARTHROSCOPY
257 TOTAL MASTECTOMY FOR MALIGNANCY WITH CC
258 TOTAL MASTECTOMY FOR MALIGNANCY WITHOUT CC
261 BREAST PROCEDURE FOR NONMALIGNANCY EXCEPT BIOPSY AND LOCAL EXCISION
262 BREAST BIOPSY AND LOCAL EXCISION OF NONMALIGNANCY
267 PERIANAL AND PILONICAL PROCEDURES
289 PARATHYROID PROCEDURES
290 THYROID PROCEDURES
293 OTHER ENDOCRINE, NUTRITIONAL AND METABOLIC OR PROCEDURES WITHOUT CC
334 MAJOR MALE PELVIC PROCEDURES WITH CC
335 MAJOR MALE PELVIC PROCEDURES WITHOUT CC
336 TRANSURETHRAL PROSTATECTOMY WITH CC
337 TRANSURETHRAL PROSTATECTOMY WITHOUT CC
356 FEMALE REPRODUCTION SYSTEM RECONCSTRUCTIVE PROCEDURES
358 UTERINE AND ADNEXA PROCEDURES FOR NONMALIGNANCY WITH CC
359 UTERINE AND ADNEXA PROCEDURES FOR NONMALIGNANCY WITHOUT CC
360 VAGINA, CERVIX AND VULVA PROCEDURES
361 LAPAROSCOPY AND INCISIONAL TUBAL INTERRUPTION
362 ENDOSCOPIC TUBAL INTERRUPTION
364 D AND C, CONIZATION EXCEPT FOR MALIGNANCY
439 SKIN GRAFTS FOR INJURIES
441 HAND PROCEDURES FOR INJURIES
491 MAJOR JOINT AND LIMB REATTACHMENT PROCEUDRES OF UPPER EXTREMITY
499 BACK AND NECK PROCEDURES EXCEPT SPINAL FUSION WITH CC
500 BACK AND NECK PROCEDURES EXCEPT SPINAL FUSION WITHOUT CC

PEDIATRIC SURGICAL:
060 TONSILLECTOMY AND/OR ADENOIDECTOMY ONLY, AGE 0-17
062 MYRINGOTOMY WITH TUBE INSERTION, AGE 0-17
156 STOMACH, ESOPHAGEAL AND DUODENAL PROCEDURES, AGE 0-17
163 HERNIA PROCEDURES, AGE 0-17
212 HIP AND FEMUR PROCEDURES EXCEPT MAJOR JOINT PROCEDURES, AGE 0-17
220 LOWER EXTREMITY AND HUMEROUS PROCEDURES EXCEPT HIP, FOOT AND FEMUR, AGE 0-17
393 SPLENECTOMY, AGE 0-17

OBSTETRIC:
370 CESAREAN SCTION WITH CC
371 CESAREAN SECTION WITHOUT CC
372 VAGINAL DELIVERY WITH COMPLICATING DIAGNOSES
373 VAGINAL DELIVERY WITHOUT COMPLICATING DIAGNOSES
374 VAGINAL DELIVERY WITH STERILIZATION AND/OR D AND C
375 VAGINAL DELIVERY WITH OR PROCEDURE EXCEPT STERILIZATION AND/OR D AND C
377 POSTPARTUM AND POSTABORTION DIAGNOSES WITH OR PROCEDURE
378 ECTOPIC PREGNANCY
379 THREATENED ABORTION
380 ABORTION WITHOUT D AND C
381 ABORTION WITH D AND C, ASPIRATION CURETTAGE OR HYTEROTOMY
382 FALSE LABOR
383 OTHER ANTEPARTUM DIAGNOSES WITH MEDICAL COMPLICATIONS
384 OTHER ANTEPARTUM DIAGNOSES WITHOUT MEDICAL COMPLICATIONS

NEONATAL:
386 EXTREME IMMATURITY OR RESPIRATORY DISTRESS SYNDROME OF NEONATE
387 PREMATURITY WITH MAJOR PROBLEMS
388 PREMATURITY WITHOUT MAJOR PROBLEMS
390 NEONATE WITH OTHER SIGNIFICANT PROBLEMS
391 NORMAL NEWBORN

PSYCHIATRIC:
425 ACUTE ADJUSTMENT REACTIONS AND DISTURBANCES OF PSYCHOSOCIAL DYSFUNCTION
426 DEPRESSIVE NEUROSES
427 NEUROSIES EXCEPT DEPRESSIVE
428 DISORDERS OF PERSONALITY AND IMPULSE CONTROL
431 CHILDHOOD MENTAL DISORDERS
432 OTHER MENTAL DISORDER DIAGNOSES
434 ALCOHOL/DRUG ABUSE OR DEPENDENCE, DETOXIFICATION OR OTHER SYMPTOMATIC TREATMENT WITH CC
435 ALCOHOL/DRUG ABUSE OR DEPENDENCE, DETOXIFICATION OR OTHER SYMPTOMATIC TREATMENT WITHOUT CC

436 ALCOHOL/DRUG DEPENDENCE WITH REHABILITATION THERAPY

Lung or pleural biopsy

ICD-9-CM Procedure codes:

332.6 CLOSED [PERCUTANEOUS] [NEEDLE] BIOPSY OF LUNG
332.8 OPEN BIOPSY OF LUNG
342.4 PLEURAL BIOPSY

Lymphoid malignancy

ICD-9-CM diagnosis codes(includes 4th and 5th digits):

200 LYMPHOSARCOMA AND RETICULOSARCOMA
201 HODGKINS DISEASE
202 OTHER MALIGNANT NEOPLASMS OF LYMPHOID AND HISTIOCYTIC TISSUE
203 MULTIPLE MYELOMA AND IMMUNOPROLIFERATIVE NEOPLASMS
204 LYMPHOID LEUKEMIA
205 MYELOID LEUKEMIA
206 MONOCYTIC LEUKEMIA
207 OTHER SPECIFIED LEUKEMIA
208 LEUKEMIA OF UNSPECIFIED CELL TYPE

Medical

Diagnostic Related Groups (DRGs):

009 SPINAL DISORDERS AND INJURIES
010 NERVOUS SYSTEM NEOPLASMS WITH CC
011 NERVOUS SYSTEM NEOPLASMS WITH CC
012 DEGENERATIVE NERVOUS SYSTEM DISORDERS
013 MULTIPLE SCLEROSIS AND CEREBELLAR ATAXIA
014 SPECIFIC CEREBROVASCULAR DISORDERS EXCEPT TRANSIENT ISCHEMIC ATTACK
015 TRANSIENT ISCHEMIC ATTACK AND PRECEREBRAL OCCLUSIONS
016 NONSPECIFIC CEREBROVASCULAR DISORDERS WITH CC
017 NONSPECIFIC CEREBROVASCULAR DISORDERS WITHOUT CC
018 CRANIAL AND PERIPHERAL NERVE DISORDERS WITH CC
019 CRANIAL AND PERIPHERAL NERVE DISORDERS WITHOUT CC
020 NERVOUS SYSTEM INFECTION EXCEPT VIRAL MENINGITIS
021 VIRAL MENINGITIS
022 HYPERTENSIVE ENCEPHALOPATHY
023 NONTRAUMATIC STUPOR AND COMA
024 SEIZURE AND HEADACHE, AGE GREATER THAN 17 WITH CC
025 SEIZURE AND HEADACHE, AGE GREATER THAN 17 WITHOUT CC
026 SEIZURE AND HEADACHE, AGE 0-17
027 TRAUMATIC STUPOR AND COMA, COMA GREATER THAN ONE HOUR
028 TRAUMATIC STUPOR AND COMA, COMA LESS THAN ONE HOUR, AGE GREATER THAN 19 WITH CC
029 TRAUMATIC STUPOR AND COMA, COMA LESS THAN ONE HOUR, AGE GREATER THAN 17 WITHOUT CC
030 TRAUMATIC STUPOR AND COMA, COMA LESS THAN ONE HOUR, AGE 0-17
031 CONCUSSION, AGE GREATER THAN 17 WITH CC
032 CONCUSSION, AGE GREATER THAN 17 WITHOUT CC
033 CONCUSSION, AGE 0-17
034 OTHER DISORDERS OF NERVOUS SYSTEM WITH CC
035 OTHER DISORDERS OF NERVOUS SYSTEM WITHOUT CC
043 HYPHEMA
044 ACUTE MAJOR EYE INFECTIONS
045 NEUROLOGICAL EYE DISORDERS
046 OTHER DISORDERS OF THE EYE, AGE GREATER THAN 17 WITH CC
047 OTHER DISORDER OF THE EYE, AGE GREATER THAN 17 WITHOUT CC
048 OTHER DISORDERS OF THE EYE, AGE 0-17
064 EAR, NOSE, MOUTH AND THROAT MALIGNANCY
065 DISEQUILIBRIA
066 EPISTAXIS
067 EPIGLOTITIS
068 OTITIS MEDIA AND URI, AGE GREATER THAN 17 WITH CC
069 OTITIS MEDIA AND URI, AGE GREATER THAN 17 WITHOUT CC
070 OTITIS MEDIA AND URI, AGE 0-17
071 LARYNGOTRACHEITIS
072 NASAL TRAUMA AND DEFORMITY
073 OTHER EAR, NOSE, MOUTH AND THROAT DIAGNOSES, AGE GREATER THAN 17
074 OTHER EAR, NOSE, MOUTH AND THROAT DIAGNOSES, AGE 0-17
078 PULMONARY EMBOLISM
079 RESPIRATORY INFECTIONS AND INFLAMMATIONS, AGE GREATER THAN 17 WITH CC
080 RESPIRATORY INFECTIONS AND INFLAMMATIONS, AGE GREATER THAN 17 WITHOUT CC
081 SIMPLE PNEUMONIA AND PLEURISY, AGE GREATER THAN 17 WITH CC
082 RESPIRATORY NEOPLASMS
083 MAJOR CHEST TRAUMA WITH CC
084 MAJOR CHEST TRAUMA WITHOUT CC
085 PLEURAL EFFUSION WITH CC
086 PLEURAL EFFUSION WITHOUT CC
087 PULMONARY EDEMA AND RESPIRATORY FAILURE
088 CHRONIC OBSTRUCTIVE PULMONARY DISEASE
089 SIMPLE PNEUMONIA AND PLEURISY, AGE GREATER THAN 17 WITH CC
090 SIMPLE PNEUMONIA AND PLEURISY, AGE GREATER THAN 17 WITHOUT CC
091 SIMPLE PNEUMONIA AND PLEURISY, AGE 0-17
092 INTERSTITIAL LUNG DISEASE WITH CC
093 INTERSTITIAL LUNG DISEASE WITHOUT CC
094 PNEUMOTHORAX WITH CC
095 PNEUMOTHORAX WITHOUT CC
096 BRONCHITIS AND ASTHMA, AGE GREATER THAN 17 WITH CC
097 BRONCHITIS AND ASTHMA, AGE GREATER THAN 17 WITHOUT CC
098 BRONCHITIS AND ASTHMA, AGE 0-17
099 RESPIRATORY SIGNS AND SYMPTOMS WITH CC

100 RESPIRATORY SIGNS AND SYMPTOMS WITHOUT CC
101 OTHER RESPIRATORY SYSTEM DIAGNOSES WITH CC
102 OTHER RESPIRATORY SYSTEM DIAGNOSES WITHOUT CC
121 CIRCULATORY DISORDERS WITH ACUTE MYOCARDIAL INFARCTION AND MAJOR COMPLICATION, DISCHARGED ALIVE
122 CIRCULATORY DISORDERS WITH ACUTE MYOCARDIAL INFARCTION WITHOUT MAJOR COMPLICATION, DISCHARGED ALIVE
123 CIRCULATORY DISORDERS WITH ACUTE MYOCARDIAL INFARCTION, EXPIRED
124 CIRCULATORY DISORDERS EXCEPT ACUTE MYOCARDIAL INFARCTION WITH CARDIAC CATHETERIZATION AND COMPLEX DIAGNOSIS
125 CIRCULATORY DISORDERS EXCEPT ACUTE MYOCARDIAL INFARCTION WITH CARDIAC CATHETERIZATION WITHOUT COMPLEX DIAGNOSIS
126 ACUTE AND SUB ACUTE ENDOCARDITIS
127 HEART FAILURE AND SHOCK
128 DEEP VEIN THROMBOPHLEBITIS
129 CARDIAC ARREST, UNEXPLAINED
130 PERIPHERAL VASCULAR DISORDERS WITH CC
131 PERIPHERAL VASCULAR DISORDERS WITHOUT CC
132 ATHEROSCLEROSIS WITH CC
133 ATHEROSCLEROSIS WITHOUT CC
134 HYPERTENSION
135 CARDIAC CONGENITAL AND VALVULAR DISORDERS, AGE GREATER THAN 17 WITH CC
136 CARDIAC CONGENITAL AND VALVULAR DISORDERS, AGE GREATER THAN 17 WITHOUT CC
137 CARDIAC CONGENITAL AND VALVULAR DISORDERS, AGE GREATER THAN 17 WITHOUT CC
138 CARDIAC ARRHYTHMIA AND CONDUCTION DISORDERS WITH CC
139 CARDIAC ARRHYTHMIA AND CONDUCTION DISORDERS WITHOUT CC
140 ANGINA PECTORIS
141 SYNCOPE AND COLLAPSE WITH CC
142 SYNCOPE AND COLLAPSE WITHOUT CC
143 CHEST PAIN
144 OTHER CIRCULATORY SYSTEM DIAGNOSES WITH CC
145 OTHER CIRCULATORY SYSTEM DIAGNOSES WITHOUT CC
172 DIGESTIVE MALIGNANCY WITH CC
173 DIGESTIVE MALIGNANCY WITHOUT CC
174 GI HEMORRHAGE WITH CC
175 GI HEMORRHAGE WITHOUT CC
176 COMPLICATED PEPTIC ULCER
177 UNCOMPLICATED PEPTIC ULCER WITH CC
178 UNCOMPLICATED PEPTIC ULCER WITHOUT CC
179 INFLAMMATORY BOWEL DISEASE
180 GI OBSTRUCTION WITH CC
181 GI OBSTRUCTION WITHOUT CC
182 ESOPHAGITIS, GASTROENTERITIS AND MISCELLANEOUS DIGESTIVE DISORDERS, AGE GREATER THAN 17 WITH CC
183 ESOPHAGITIS, GASTROENTERITIS AND MISCELLANEOUS DIGESTIVE DISORDERS, AGE GREATER THAN 17 WITHOUT CC
184 ESOPHAGITIS, GASTROENTERITIS AND MISCELLANEOUS DIGESTIVE DISORDERS, AGE 0-17
185 DENTAL AND ORAL DISEASES EXCEPT EXTRACTIONS AND RESTORATIONS, AGE GREATER THAN 17
186 DENTAL AND ORAL DISEASES EXCEPT EXTRACTIONS AND RESTORATIONS, AGE 0-17
187 DENTAL EXTRACTIONS AND RESTORATIONS
188 OTHER DIGESTIVE SYSTEM DIAGNOSES, AGE GREATER THAN 17 WITH CC
189 OTHER DIGESTIVE SYSTEM DIAGNOSES, AGE GREATER THAN 17 WITHOUT CC
190 OTHER DIGESTIVE SYSTEM DIAGNOSES, AGE 0-17
202 CIRRHOSIS AND ALCOHOLIC HEPATITIS
203 MALIGNANCY OF HEPATOBILIARY SYSTEM OR PANCREAS
204 DISORDERS OF PANCREAS EXCEPT MALIGNANCY
205 DISORDERS OF LIVER EXCEPT MALIGNANCY, CIRRHOSIS AND ALCOHOLIC HEPATITIS WITH CC
206 DISORDERS OF LIVER EXCEPT MALIGNANCY, CIRRHOSIS AND ALCOHOLIC HEPATITIS WITHOUT CC
207 DISORDERS OF THE BILIARY TRACT WITH CC
208 DISORDERS OF THE BILIARY TRACT WITHOUT CC
235 FRACTURES OF FEMUR
236 FRACTURES OF HIP AND PELVIS
237 SPRAINS, STRAINS AND DISLOCATIONS OF HIP, PELVIS AND THIGH
238 OSTEOMYELITIS
239 PATHOLOGICAL FRACTURES AND MUSCULOSKELETAL AND CONNECTIVE TISSUE MALIGNANCY
240 CONNECTIVE TISSUE DISORDERS WITH CC
241 CONNECTIVE TISSUE DISORDERS WITHOUT CC
242 SEPTIC ARTHRITIS
243 MEDICAL BACK PROBLEMS
244 BONE DISEASES AND SPECIFIC ARTHROPATHIES WITH CC
245 BONE DISEASES AND SPECIFIC ARTHROPATHIES WITHOUT CC
246 NONSPECIFIC ARTHROPATHIES
247 SIGNS AND SYMPTOMS OF MUSCULOSKELETAL SYSTEM AND CONNECTIVE TISSUE
248 TENDONITIS, MYOSITIS AND BURSITIS
249 AFTERCARE, MUSCULOSKELETAL SYSTEM AND CONNECTIVE TISSUE
250 FRACTURES, SPRAINS, STRAINS AND DISLOCATIONS OF FOREARM, HAND AND FOOT, AGE GREATER THAN 17 WITH CC
251 FRACTURES, SPRAINS, STRAINS AND DISLOCATIONS OF FOREARM, HAND AND FOOT, AGE GREATER THAN 17 WITHOUT CC
252 FRACTURES, SPRAINS, STRAINS AND DISLOCATIONS OF FOREARM, HAND AND FOOT, AGE 0-17
253 FRACTURES, SPRAINS, STRAINS AND DISLOCATIONS OF UPPER ARM AND LOWER LEG EXCEPT FOOT, AGE GREATER THAN 17 WITH CC
254 FRACTURES, SPRAINS, STRAINS AND DISLOCATIONS OF UPPER ARM AND

LOWER LEG EXCEPT FOOT, AGE GREATER THAN 17 WITHOUT CC
255 FRACTURES, SPRAINS, STRAINS AND DISLOCATIONS OF UPPER ARM AND LOWER LEG EXCEPT FOOT, AGE 0-17
256 OTHER MUSCULOSKELETAL SYSTEM AND CONNECTIVE TISSUE DIAGNOSES
271 SKIN ULCERS
272 MAJOR SKIN DISORDERS WITH CC
273 MAJOR SKIN DISORDERS WITHOUT CC
274 MALIGNANT BREAST DISORDERS WITH CC
275 MALIGNANT BREAST DISORDERS WITHOUT CC
276 NONMALIGNANT BREAST DISORDERS
277 CELLULITIS, AGE GREATER THAN 17 WITH CC
278 CELLULITIS, AGE GREATER THAN 17 WITHOUT CC
279 CELLULITIS, AGE 0-17
280 TRAUMA TO SKIN, SUBCUTANEOUS TISSUE AND BREAST, AGE GREATER THAN 17 WITH CC
281 TRAUMA TO SKIN, SUBCUTANEOUS TISSUE AND BREAST, AGE GREATER THAN 17 WITHOUT CC
282 TRAUMA TO SKIN, SUBCUTANEOUS TISSUE AND BREAST, AGE 0-17
283 MINOR SKIN DISORDERS WITH CC
284 MINOR SKIN DISORDERS WITHOUT CC
294 DIABETES, AGE GREATER THAN 35
295 DIABETES, AGE 0-35
296 NUTRITIONAL AND MISCELLANEOUS METABOLIC DISORDERS, AGE GREATER THAN 17 WITH CC
297 NUTRITIONAL AND MISCELLANEOUS METABOLIC DISORDERS, AGE GREATER THAN 17 WITHOUT CC
298 NUTRITIONAL AND MISCELLANEOUS METABOLIC DISORDERS, AGE 0-17
299 INBORN ERRORS OF METABOLISM
300 ENDOCRINE DISORDERS WITH CC
301 ENDOCRINE DISORDERS WITHOUT CC
316 RENAL FAILURE
317 ADMISSION FOR RENAL DIALYSIS
318 KIDNEY AND URINARY TRACT NEOPLASMS WITH CC
319 KIDNEY AND URINARY TRACT NEOPLASMS WITHOUT CC
320 KIDNEY AND URINARY TRACT INFECTIONS, AGE GREATER THAN 17 WITH CC
321 KIDNEY AND URINARY TRACT INFECTIONS, AGE GREATER THAN 17 WITHOUT CC
322 KIDNEY AND URINARY TRACT INFECTION, AGE 0-17
323 URINARY STONES WITH CC AND/ OR ESW LITHOTRIPSY
324 URINARY STONES WITHOUT CC
325 KIDNEY AND URINARY TRACT SIGNS AND SYMPTOMS, AGE GREATER THAN 17 WITH CC
326 KIDNEY AND URINARY TRACT SIGNS AND SYMPTOMS, AGE GREATER THAN 17 WITHOUT CC
327 KIDNEY AND URINARY TRACT SIGNS AND SYMPTOMS, AGE 0-17
328 URETHRAL STRICTURE, AGE GREATER THAN 17 WITH CC
329 URETHRAL STRICTURE, AGE GREATER THAN 17 WITHOUT CC
330 URETHRAL STRICTURE, AGE 0-17
331 OTHER KIDNEY AND URINARY TRACT DIAGNOSES, AGE GREATER THAN 17 WITH CC
332 OTHER KIDNEY AND URINARY TRACT DIAGNOSES, AGE GREATER THAN 17 WITHOUT CC
333 OTHER KIDNEY AND URINARY TRACT DIAGNOSES, AGE 0-17
346 MALIGNANCY OF MALE REPRODUCTIVE SYSTEM WITH CC
347 MALIGNANCY OF MALE REPRODUCTIVE SYSTEM WITHOUT CC
348 BENIGN PROSTATIC HYPERTROPHY WITH CC
349 BENIGN PROSTATIC HYPERTROPHY WITHOUT CC
350 INFLAMMATION OF THE MALE REPRODUCTIVE SYSTEM
351 STERILIZATION, MALE
352 OTHER MALE REPRODUCTIVE SYSTEM DIAGNOSES
366 MALIGNANCY OF FEMALE REPRODUCTIVE SYSTEM WITH CC
367 MALIGNANCY OF FEMALE REPRODUCTIVE SYSTEM WITHOUT CC
368 INFECTIONS OF FEMALE REPRODUCTIVE SYSTEM
369 MENSTRUAL AND OTHER FEMALE REPRODUCTIVE SYSTEM DISORDERS
372 VAGINAL DELIVERY WITH COMPLICATING DIAGNOSES
373 VAGINAL DELIVERY WITHOUT COMPLICATING DIAGNOSES
376 POSTPARTUM AND POSTABORTION DIAGNOSES WITHOUT OR PROCEDURE
378 ECTOPIC PREGNANCY
379 THREATENED ABORTION
380 ABORTION WITHOUT D AND C
382 FALSE LABOR
383 OTHER ANTEPARTUM DIAGNOSES WITH MEDICAL COMPLICATIONS
384 OTHER ANTEPARTUM DIAGNOSES WITHOUT MEDICAL COMPLICATIONS
395 RED BLOOD CELL DISORDERS, AGE GREATER THAN 17
396 RED BLOOD CELL DISORDERS, AGE 0-17
397 COAGULATION DISORDERS
398 RETICULOENDOTHELIAL AND IMMUNITY DISORDERS WITH CC
399 RETICULOENDOTHELIAL AND IMMUNITY DISORDERS WITHOUT CC
403 LYMPHOMA AND NONACUTE LEUKEMIA WITH CC
404 LYMPHOMA AND NONACUTE LEUKEMIA WITHOUT CC
405 ACUTE LEUKEMIA WITHOUT MAJOR OR PROCEDURE, AGE 0-17
409 RADIOTHERAPY
410 CHEMOTHERAPY WITHOUT ACUTE LEUKEMIA AS SECONDARY DIAGNOSIS
411 HISTORY OF MALIGNANCY WITHOUT ENDOSCOPY
412 HISTORY OF MALIGNANCY WITH ENDOSCOPY
413 OTHER MYELOPROLIFERATIVE DISORDERS OR POORLY DIFFERENTIATED NEOPLASM DIAGNOSES WITH CC
414 OTHER MYELOPROLIFERATIVE DISORDERS OR POORLY DIFFERENTIATED NEOPLASM DIAGNOSES WITHOUT CC
416 SEPTICEMIA, AGE GREATER THAN 17
417 SEPTICEMIA, AGE 0-17

418 POSTOPERATIVE AND POSTTRAUMATIC INFECTIONS
419 FEVER OF UNKNOWN ORIGIN, AGE GREATER THAN 17 WITH CC
420 FEVER OF UNKNOWN ORIGIN, AGE GREATER THAN 17 WITHOUT CC
421 VIRAL ILLNESS, AGE GREATER THAN 17
422 VIRAL ILLNESS AND FEVER OF UNKNOWN ORIGIN, AGE 0-17
423 OTHER INFECTIOUS AND PARASITIC DISEASES DIAGNOSES
425 ACUTE ADJUSTMENT REACTIONS AND DISTURBANCES OF PSYCHOSOCIAL DYSFUNCTION
426 DEPRESSIVE NEUROSES
427 NEUROSES EXCEPT DEPRESSIVE
428 DISORDERS OF PERSONALITY AND IMPULSE CONTROL
429 ORGANIC DISTURBANCES AND MENTAL RETARDATION
430 PSYCHOSES
431 CHILDHOOD MENTAL DISORDERS
432 OTHER MENTAL DISORDER DIAGNOSES
433 ALCOHOL/DRUG ABUSE OR DEPENDENCE, LEFT AGAINST MEDICAL ADVICE
434 ALCOHOL/DRUG ABUSE OR DEPENDENCE, DETOXIFICATION OR OTHER SYMPTOMATIC TREATMENT WITH CC
435 ALCOHOL/DRUG ABUSE OR DEPENDENCE, DETOXIFICATION OR OTHER SYMPTOMATIC TREATMENT WITHOUT CC
436 ALCOHOL/DRUG DEPENDENCE WITH REHABILITATION THERAPY
437 ALCOHOL DRUG DEPENDENCE WITH COMBINED REHABILITATION AND DETOXIFICATION THERAPY
444 TRAUMATIC INJURY, AGE GREATER THAN 17 WITH CC
445 TRAUMATIC INJURY, AGE GREATER THAN 17 WITHOUT CC
446 TRAUMATIC INJURY, AGE 0-17
447 ALLERGIC REACTIONS, AGE GREATER THAN 17
448 ALLERGIC REACTIONS, AGE 0-17
449 POISONING AND TOXIC EFFECTS OF DRUGS, AGE GREATER THAN 17 WITH CC
450 POISONING AND TOXIC EFFECTS OF DRUGS, AGE GREATER THAN 17 WITHOUT CC
451 POISONING AND TOXIC EFFECTS OF DRUGS, AGE 0-17
452 COMPLICATIONS OF TREATMENT WITH CC
453 COMPLICATIONS OF TREATMENT WITHOUT CC
454 OTHER INJURY, POISONING AND TOXIC EFFECT DIAGNOSES WITH CC
455 OTHER INJURY, POISONING AND TOXIC EFFECT DIAGNOSES WITHOUT CC
456 NO LONGER VALID
457 NO LONGER VALID
460 NO LONGER VALID
462 REHABILITATION
463 SIGNS AND SYMPTOMS WITH CC
464 SIGNS AND SYMPTOMS WITHOUT CC
465 AFTERCARE WITH HISTORY OF MALIGNANCY AS SECONDARY DIAGNOSIS
466 AFTERCARE WITHOUT HISTORY OF MALIGNANCY AS SECONDARY DIAGNOSIS
467 OTHER FACTORS INFLUENCING HEALTH STATUS
473 ACUTE LEUKEMIA WITHOUT MAJOR OR PROCEDURE, AGE GREATER THAN 17
474 NO LONGER VALID
475 RESPIRATORY SYSTEM DIAGNOSIS WITH VENTILATOR SUPPORT
487 OTHER MULTIPLE SIGNIFICANT TRAUMA
489 HIV WITH MAJOR RELATED CONDITION
490 HIV WITH OR WITHOUT OTHER RELATED CONDITION
492 CHEMOTHERAPY WITH ACUTE LEUKEMIA AS SECONDARY DIAGNOSIS

Metastatic cancer

ICD-9-CM diagnosis codes (includes all 4th and 5th digits):

196 SECONDARY AND UNSPECIFIED MALIGNANT NEOPLASM OF LYMPH NODES
197 SECONDARY MALIGNANT NEOPLASM OF RESPIRATORY AND DIGESTIVE SYSTEMS
198 SECONDARY MALIGNANT NEOPLASM OF OTHER SPECIFIED SITES
1990 MALIGNANT NEOPLASM WITHOUT SPECIFICATION OF SITE, DISSEMINATED

Obstetric trauma

ICD-9-CM diagnosis codes:

664.30,1,4 TRAUMA TO PERINEUM AND VULVA DURING DELIVERY, FOURTH-DEGREE PERINEAL LACERATION
665.30, 1, 4 OTHER OBSTETRICAL TRAUMA, LACERATION OF CERVIX
665.40, 1, 4 OTHER OBSTETRICAL TRAUMA, HIGH VAGINAL LACERATIONS
665.50, 1, 4 OTHER OBSTETRICAL TRAUMA, OTHER INJURY TO PELVIC ORGANS

ICD-9-CM procedure codes:

75.50 REPAIR OF CURRENT OBSTETRIC LACERATIONS UTERUS
75.51 REPAIR OF CURRENT OBSTETRIC LACERATIONS OF CERVIX
75.52 REPAIR OF CURRENT OBSTETRIC LACERATIONS OF CORPUS UTERI
75.61 REPAIR OF CURRENT OBSTETRIC LACERATION OF BLADDER AND URETHRA
75.62 REPAIR OF CURRENT OBSTETRIC LACERATION OF RECTUM AND SPHINCTER ANI

Physiologic and metabolic derangements

ICD-9-CM diagnosis codes:

DIABETES WITH KETOACIDOSIS:
250.10 TYPE 2, OR UNSPECIFIED TYPE, NOT STATED AS UNCONTROLLED
250.11 TYPE 1 NOT STATED AS UNCONTROLLED
250.12 TYPE 2 OR UNSPECIFIED TYPE, UNCONTROLLED

250.13 TYPE 1 UNCONTROLLED

DIABETES WITH HYPEROSMOLARITY:
250.20 TYPE 2, OR UNSPECIFIED TYPE, NOT STATED AS UNCONTROLLED
250.21 TYPE 1 NOT STATED AS UNCONTROLLED
250.22 TYPE 2 OR UNSPECIFIED TYPE, UNCONTROLLED
250.23 TYPE 1 UNCONTROLLED

DIABETES WITH OTHER COMA:
250.30 TYPE 2, OR UNSPECIFIED TYPE, NOT STATED AS UNCONTROLLED
250.31 TYPE 1 NOT STATED AS UNCONTROLLED
250.32 TYPE 2 OR UNSPECIFIED TYPE, UNCONTROLLED
250.33 TYPE 1 UNCONTROLLED

ACUTE RENAL FAILURE:
584.5 WITH LESION OF TUBULAR NECROSIS
584.6 WITH LESION OF RENAL CORTICAL NECROSIS
584.7 WITH LESION OF RENAL MEDULLARY [PAPILLARY] NECROSIS
584.8 WITH OTHER SPECIFIED PATHOLOGICAL LESION IN KIDNEY
584.9 ACUTE RENAL FAILURE, UNSPECIFIED

Poisoning

ICD-9-CM diagnosis codes (includes 4th and 5th digits):

960 POISONING BY ANTIBIOTICS
961 POISONING BY OTHER ANTI-INFECTIVES
962 POISONING BY HORMONES AND SYNTHETIC SUBSTITUTES
963 POISONING BY PRIMARILY SYSTEMIC AGENTS
964 POISONING BY AGENTS PRIMARILY AFFECTING BLOOD CONSTITUENTS
965 POISONING BY ANALGESICS, ANTIPYRETICS, AND ANTIRHEUMATICS
966 POISONING BY ANTICONVULSANTS AND ANTI-PARKINSONISM DRUGS
967 POISONING BY SEDATIVES AND HYPNOTICS
968 POISONING BY OTHER CENTRAL NERVOUS SYSTEM DEPRESSANTS AND ANESTHETICS
969 POISONING BY PSYCHOTROPIC AGENTS
970 POISONING BY CENTRAL NERVOUS SYSTEM STIMULANTS
971 POISONING BY DRUGS PRIMARILY AFFECTING THE AUTONOMIC NERVOUS SYSTEM
972 POISONING BY AGENTS PRIMARILY AFFECTING THE CARDIOVASCULAR SYSTEM
973 POISONING BY AGENTS PRIMARILY AFFECTING THE GASTROINTESTINAL SYSTEM
974 POISONING BY WATER, MINERAL, AND URIC ACID METABOLISM DRUGS
975 POISONING BY AGENTS PRIMARILY ACTING ON THE SMOOTH AND SKELETAL MUSCLES AND RESPIRATORY SYSTEM
976 POISONING BY AGENTS PRIMARILY AFFECTING SKIN AND MUCOUS MEMBRANE, OPTHAMOLOGICAL, OTORHINOLARYNCOLOGICAL AND DENTAL DRUGS
977 POISONING BY OTHER AND UNSPECIFIED DRUGS AND MEDICINAL SUBSTANCES
978 POISONING BY BACTERIAL VACCINES
979 POISONING BY OTHER VACCINES AND BIOLOGICAL SUBSTANCES
E850 ACCIDENTAL POISONING BY ANALGESICS, ANTIPYRETICS, AND ANTIRHEUMATICS
E851 ACCIDENTAL POISONING BY BARBITURATES
E852 ACCIDENTAL POISONING BY OTHER SEDATIVES AND HYPNOTICS
E853 ACCIDENTAL POISONING BY TRANQUILIZERS
E854 ACCIDENTAL POISONING BY OTHER PSYCHOTROPIC AGENTS
E855 ACCIDENTAL POISONING BY OTHER DRUGS ACTING ON CENTRAL AND AUTONOMIC NERVOUS SYSTEM
E856 ACCIDENTAL POISONING BY ANTIBIOTICS
E857 ACCIDENTAL POISONING BY OTHER ANTI-INFECTIVES
E858 ACCIDENTAL POISONING BY OTHER DRUGS
E860 ACCIDENTAL POISONING BY ALCOHOL, NEC
E861 ACCIDENTAL POISONING BY CLEANING AND POLISHING AGENTS, DISINFECTANTS, PAINTS, AND VARNISHES
E862 ACCIDENTAL POISONING BY PETROLEUM PRODUCTS, OTHER SOLVENTS AND THEIR VAPORS, NEC
E863 ACCIDENTAL POISONONING BY AGRICULTURAL AND HORTICULTURAL CHEMICAL AND PHARMACEUTICAL PREPARATIONS OTHER THAN PLANT FOODS AND FERTILIZERS
E864 ACCIDENTAL POISONING BY CORROSIVES AND CAUSTICS, NEC
E865 ACCIDENTAL POISONING FROM POISONOUS FOODSTUFFS AND POISONOUS PLANTS
E866 ACCIDENTAL POISONG BY OTHER AND UNSPECIFIED SOLID AND LIQUID SUBSTANCES
E867 ACCIDENTAL POISONOING BY GAS DISTRIBUTED BY PIPELINE
E868 ACCIDENTAL POISONING BY OTHER UTILITY GAS AND OTHER CARBON MONOXIDE
E869 ACCIDENTAL POISONING BY OTHER GASES AND VAPORS
E951 SUICIDE AND SELF-INFLICTED POISONING BY GASES IN DOMESTIC USE
E952 SUICIDE AND SELF-INFLICTED POISONING BY OTHER GASES AND VAPORS
E962 ASSAULT BY POISONING
E980 POISONING BY SOLID OR LIQUID SUBSTANCES, UNDETERMINED WHETHER ACCIDENTALLY OR PURPOSELY INFLICTED
E981 POISONING BY GASES IN DOMESTIC USE, UNDETERMINED WHETHER ACCIDENTALLY OR PURPOSELY INFLICTED
E982 POISONING BY OTHER GASES, UNDETERMINED WHETHER ACCIDENTALLY OR PURPOSELY INFLICTED

Postoperative hematoma

ICD-9-CM diagnosis codes:

998.12 HEMATOMA COMPLICATING A PROCEDURE

Postoperative hemorrhage or hematoma

ICD-9-CM diagnosis codes:

998.11 HEMORRHAGE COMPLICATING A PROCEDURE

Preterm infant

ICD-9-CM diagnosis codes:

765.01-765.08 EXTREME IMMATURITY
765.11-765.18 OTHER PRETERM INFANTS

Pulmonary embolism

ICD-9-CM diagnosis codes:

415.11 IAGTROGENIC PULMONARY EMBOLISM AND INFARCTION
415.19 OTHER PULMONARY EMBOLISM

Seizure

ICD-9-CM diagnosis codes:

345.00 GENERALIZED NONCONVULSIVE EPILEPSY - WITHOUT MENTION OF INTRACTABLE EPILEPSY
345.01 GENERALIZED NONCONVULSIVE EPILEPSY - WITH INTRACTABLE EPILEPSY
345.10 GENERALIZED CONVULSIVE EPILEPSY - WITHOUT MENTION OF INTRACTABLE EPILEPSY
345.11 GENERALIZED CONVULSIVE EPILEPSY - WITH INTRACTABLE EPILEPSY
345.2 EPILEPSY-PETIT MAL STATUS
345.3 EPILEPSY-GRAND MAL STATUS
345.40 PARTIAL EPILEPSY, WITH IMPAIRMENT OF CONSCIOUSNESS - WITH INTRACTABLE EPILEPSY
345.41 PARTIAL EPILEPSY, WITH IMPAIRMENT OF CONSCIOUSNESS - WITHOUT MENTION OF INTRACTABLE EPILEPSY
345.50 PARTIAL EPILEPSY, WITHOUT MENTION OF IMPAIRMENT OF CONSCIOUSNESS, - WITHOUT MENTION OF INTRACTABLE EPILEPSY
345.51 PARTIAL EPILEPSY, WITHOUT MENTION OF IMPAIRMENT OF CONSCIOUSNESS - WITH INTRACTABLE EPILEPSY
345.60 INFANTILE SPASMS - WITHOUT MENTION OF INTRACTABLE EPILEPSY
345.61 INFANTILE SPASMS - WITH INTRACTABLE EPILEPSY
345.70 EPILEPSIA PARTIALIS CONTINUA - WITHOUT MENTION OF INTRACTABLE EPILEPSY
345.71 EPILEPSIA PARTIALIS CONTINUA - WITH INTRACTABLE EPILEPSY
345.80 OTHER FORMS OF EPILEPSY - WITHOUT MENTION OF INTRACTABLE EPILEPSY
345.81 OTHER FORMS OF EPILEPSY - WITH INTRACTABLE EPILEPSY
345.90 EPILEPSY, UNSPECIFIED - WITHOUT MENTION OF INTRACTABLE EPILEPSY
345.91 EPILEPSY, UNSPECIFIED - WITH INTRACTABLE EPILEPSY
780.31 FEBRILE CONVULSIONS
780.39 OTHER CONVULSIONS
780.3 CONVULSIONS (OLD CODE NO LONGER VALID)

Self inflicted injury

ICD-9-CM diagnosis codes:

SUICIDE AND SELF-INFLICTED POISONING BY SOLID OR LIQUID SUBSTANCE:
E950.0 ANALGESICS, ANTIPYRETICS, AND ANTIRHEUMATICS
E950.1 BARBITURATES
E950.2 OTHER SEDATIVE AND HYPNOTICS
E950.3 TRANQUILIZIERS AND OTHER PSYCHOTROPIC AGENTS
E950.4 OTHER SPECIFIED DRUGS AND MEDICINAL SUBSTANCES
E950.5 UNSPECIFIED DRUG OR MEDICINAL SUBSTANCE
E950.6 AGRICULTURAL AND HORTICULTURAL CHEMICAL AND PHARMACEUTICAL PREPARATIONS OTHER THAN PLANT FOODS AND FERTILIZERS
E950.7 CORROSIVE AND CAUSTIC SUBSTANCES
E950.8 ARSENIC AND ITS COMPOUNDS
E950.9 OTHER AND UNSPECIFIED SOLID AND LIQUID SUBSTANCES

SUICIDE AND SELF-INFLICED POISONING BY GASES IN DOMESTIC USE:
E951.0 GAS DISTRIBUTED BY PIPELINE
E951.1 LIQUEFIED PETROLEUM GAS DISTRIBUTED IN MOBILE CONTAINERS
E951.8 OTHERS UTILITY GASES
E952.0 MOTOR VEHICLE EXHAUST GAS
E952.1 OTHER CARBON MONOXIDE
E952.8 OTHER SPECIFIED GASES AND VAPORS
E952.9 UNSPECIFIED GASES AND VAPORS

SUICIDE AND SELF-INFLICTED INJURY BY HANGING, STRANGULATION, AND SUFFOCATION:
E953.0 HANGING
E953.1 SUFFOCATION BY PLASTIC BAG
E953.8 OTHER SPECIFIED MEANS
E954 SUICIDE AND SELF-INFLICTED INJURY BY SUBMERSION [DROWNING]

SUICIDE AND SELF-INFLICTED INJURY BY FIREARMS AND EXPLOSIVES:
E955.0 HANDGUN
E955.1 SHOTGUN
E955.2 HUNTING RIFLE
E955.3 MILITARY FIREARMS
E955.4 OTHER AND UNSPECIFIED FIREARMS
E955.5 EXPLOSIVES
E955.9 UNSPECIFIED
E956 SUICIDE AND SELF INFLICTED INJURY BY CUTTING AND PIERCING INSTRUMENT

SUICIDE AND SELF-INFLICTED INJURY BY JUMPING FROM A HIGH PLACE:
E957.0 RESIDENTIAL PREMISES
E957.1 OTHER MAN-MADE STRUCTURES
E957.2 NATURAL SITES
E957.3 UNSPECIFIED

SUICIDE AND SELF-INFLICTED INJURY BY OTHER AND UNSPECIFIED MEANS:

E958.0	JUMPING OR LYING BEFORE MOVING OBJECT
E958.1	BURNS, FIRE
E958.2	SCALD
E958.3	EXTREMES OF COLD
E958.4	ELECTROCUTION
E958.5	CRASHING OF MOTOR VEHICLE
E958.6	CRASHING OF AIRCRAFT
E958.7	CAUSTIC SUBSTANCES EXCEPT POISONING
E958.8	OTHER SPECIFIED MEANS
E958.9	UNSPECIFIED MEANS

Sepsis

ICD-9-CM diagnosis codes:

038.0	STREPTOCOCCAL SEPTICEMIA
038.10	STAPHYLOCOCCAL SEPTICEMIA, UNSPECIFIED
038.11	STAPHYLOCOCCUS AUREUS SEPTICEMIA
038.19	OTHER STAPHYLOCOCCAL SEPTICEMIA
038.2	PNEUMOCOCCAL SEPTICEMIA (STREPTOCOCCUS PNEUMONIAE SEPTICEMIA)
038.3	SEPTICEMIA DUE TO ANAEROBES

SEPTICEMIA DUE TO

038.40	GRAM-NEGATIVE ORGANISM, UNSPECIFIED
038.41	HEMOPHILUS INFLUENZAE
038.42	ESCHERICHIA COLI
038.43	PSEUDOMONAS
038.44	SERRATIA
038.49	SEPTICEMIA DUE TO OTHER GRAM-NEGATIVE ORGANISMS
038.8	OTHER SPECIFIED SEPTICEMIAS
038.9	UNSPECIFIED SEPTICEMIA

Shock

ICD-9-CM diagnosis codes:

SHOCK WITHOUT MENTION OF TRAUMA:

785.50	SHOCK, UNSPECIFIED
785.51	CARDIOGENIC SHOCK
785.59	OTHER

Stroke

ICD-9-CM diagnosis codes:

430	SUBARACHNOID HEMORRHAGE
431	INTRACEREBRAL HEMORRHAGE
432.0	NONTRAUMATIC EXTRADURAL HEMORRHAGE
432.1	SUBDURAL HEMORRHAGE
432.9	UNSPECIFIED INTRACRANIAL HEMORRHAGE
436	ACUTE, BUT ILL-DEFINED CEREBROVASCULAR DISEASE

OCCLUSION AND STENOSIS OF PRECEREBRAL ARTERIES:

433.01	BASILAR ARTERY, WITH CEREBRAL INFARCTION
433.11	CAROTID ARTERY, WITH CEREBRAL INFARCTION
433.21	VERTEBRAL ARTERY, WITH CEREBRAL INFARCTION
433.31	MULTIPLE AND BILATERAL WITH CEREBRAL INFARCTION
433.81	OTHER SPECIFIED PRECEREBRAL ARTERY WITH CEREBRAL INFARCTION
433.91	OCCLUSION AND STENOSIS OF PRECEREBRAL ARTERIES, UNSPECIFIED PRECEREBRAL ARTERY WITH CEREBRAL INFARCTION

OCCLUSION OF CEREBRAL ARTERIES:

434.01	CEREBRAL THROMBOSIS - WITH CEREBRAL INFARCTION
434.11	CEREBRAL EMBOLISM - WITH CEREBRAL INFARCTION
434.91	CEREBRAL ARTERY OCCLUSION, UNSPECIFIED - WITH CEREBRAL INFARCTION

Surgical

Diagnostic Related Groups (DRGs):

001	CRANIOTOMY, AGE GREATER THAN 17 EXCEPT FOR TRAUMA
002	CRANIOTOMY FOR TRAUMA, AGE GREATER THAN 17
003	CRANIOTOMY, AGE 0-17
004	SPINAL PROCEDURES
005	EXTRACRANIAL VASCULAR PROCEDURES
006	CARPAL TUNNEL RELEASE
007	PERIPHERAL AND CRANIAL NERVE AND OTHER NERVOUS SYSTEM PROCEDURES WITH CC
008	PERIPHERAL AND CRANIAL NERVE AND OTHER NERVOUS SYSTEM PROCEDURES WITHOUT CC
036	RETINAL PROCEDURES
037	ORBITAL PROCEDURES
038	PRIMARY IRIS PROCEDURES
039	LENS PROCEDURES WITH OR WITHOUT VITRECTOMY
040	EXTRAOCULAR PROCEDURES EXCEPT ORBIT, AGE GREATER THAN 17
041	EXTRAOCULAR PROCEDURES EXCEPT ORBIT, AGE 0-17
042	INTRAOCULAR PROCEDURES EXCEPT RETINA, IRIS AND LENS
049	MAJOR HEAD AND NECK PROCEDURES
050	SIALOADENECTOMY
051	SALIVARY GLAND PROCEDURES EXCEPT SIALOADENECTOMY
052	CLEFT LIP AND PALATE REPAIR
053	SINUS AND MASTOID PROCEDURES, AGE GREATER THAN 17
054	SINUS AND MASTOID PROCEDURES, AGE 0-17
055	MISCELLANEOUS EAR, NOSE, MOUTH AND THROAT PROCEDURES
056	RHINOPLASTY
057	TONSILLECTOMY AND ADENOIDECTOMY PROCEDURES EXCEPT TONSILLECTOMY AND/OR ADENOIDECTOMY ONLY, AGE GREATER THAN 17
058	TONSILLECTOMY AND ADENOIDECTOMY PROCEDURES EXCEPT TONSILLECTOMY AND/OR ADENOIDECTOMY ONLY, AGE 0-17
059	TONSILLECTOMY AND/OR ADENOIDECTOMY ONLY, AGE GREATER THAN 17

060 TONSILLECTOMY AND/OR ADENOIDECTOMY ONLY, AGE 0-17
061 MYRINGOTOMY WITH TUBE INSERTION, AGE GREATER THAN 17
062 MYRINGOTOMY WITH TUBE INSERTION, AGE 0-17
063 OTHER EAR, NOSE, MOUTH AND THROAT OR PROCEDURES
075 MAJOR CHEST PROCEDURES
076 OTHER RESPIRATORY SYSTEM OR PROCEDURES WITH CC
077 OTHER RESPIRATORY SYSTEM OR PROCEDURES WITHOUT CC
103 HEART TRANSPLANT
104 CARDIAC VALVE AND OTHER MAJOR CARDIOTHORACIC PROCEDURES WITH CARDIAC CATHETERIZATION
105 CARDIAC VALVE AND OTHER MAJOR CARDIOTHORACIC PROCEDURES WITHOUT CARDIAC CATHETERIZATION
106 CORONARY BYPASS WITH PTCA
107 CORONARY BYPASS WITH CARDIAC CATHETERIZATION
108 OTHER CARDIOTHORACIC PROCEDURES
109 CORONARY BYPASS WITHOUT CARDIAC CATHETERIZATION
110 MAJOR CARDIOVASCULAR PROCEDURES WITH CC
111 MAJOR CARDIOVASCULAR PROCEDURES WITHOUT CC
112 PERCUTANEOUS CARDIOVASCULAR PROCEDURES
113 AMPUTATION FOR CIRCULATORY SYSTEM DISORDERS EXCEPT UPPER LIMB AND TOE
114 UPPER LIMB AND TOES AMPUTATION FOR CIRCULATORY SITE
115 PERMANENT CARDIAC PACEMAKER IMPLANT WITH ACUTE MYOCARDIAL INFARCTION, HEART FAILURE OR SHOCK OR ACID LEAD OR GENERATOR PROCEDURE
116 OTHER PERMANENT CARDIAC PACEMAKER IMPLANT OR PTCA WITH CORONARY ARTERIAL STENT
117 CARDIAC PACEMAKER REVISION EXCEPT DEVICE REPLACEMENT
118 CARDIAC PACEMAKER DEVICE REPLACEMENT
119 VEIN LIGATION AND STRIPPING
120 OTHER CIRCULATORY SYSTEM OR PROCEDURES
146 RECTAL RESECTION WITH CC
147 RECTAL RESECTION WITHOUT CC
148 MAJOR SMALL AND LARGE BOWEL PROCEDURES WITH CC
149 MAJOR SMALL AND LARGE BOWEL PROCEDURES WITHOUT CC
150 PERITONEAL ADHESIOLYSIS WITH CC
151 PERITONEAL ADHESIOLYSIS WITHOUT CC
152 MINOR SMALL AND LARGE BOWEL PROCEDURES WITH CC
153 MINOR SMALL AND LARGE BOWEL PROCEDURES WITHOUT CC
154 STOMACH, ESOPHAGEAL AND DUODENAL PROCEDURES, AGE GREATER THAN 17 WITH CC
155 STOMACH, ESOPHAGEAL AND DUODENAL PROCEDURES, AGE GREATER THAN 17 WIHOUT CC
156 STOMACH, ESOPHAGEAL AND DUODENAL PROCEDURES, AGE 0-17
157 ANAL AND STOMAL PROCEDURES WITH CC
158 ANAL AND STOMAL PROCEDURES WITHOUT CC
159 HERNIA PROCEDURES EXCEPT INGUINAL AND FEMORAL, AGE GREATER THAN 17 WITH CC
160 HERNIA PROCEDURES EXCEPT INGUINAL AND FEMORAL, AGE GREATER THAN 17 WITHOUT CC
161 INGUINAL AND FEMORAL HERNIA PROCEDURES, AGE GREATER THAN 17 WITH CC
162 INGUINAL AND FEMORAL HERNIA PROCEDURES, AGE GREATER THAN 17 WITHOUT CC
163 HERNIA PROCEDURES, AGE 0-17
164 APPENDECTOMY WITH COMPLICATED PRINCIPAL DIAGNOSIS WITH CC
165 APPENDECTOMY WITH COMPLICATED PRINCIPAL DIAGNOSIS WITHOUT CC
166 APPENDECTOMY WITHOUT COMPLICATED PRINCIPAL DIAGNOSIS WITH CC
167 APPENDECTOMY WITHOUT COMPLICATED PRINCIPAL DIAGNOSIS WITHOUT CC
168 MOUTH PROCEDURES WITH CC
169 MOUTH PROCEDURES WITHOUT CC
170 OTHER DIGESTIVE SYSTEM OR PROCEDURES WITH CC
171 OTHER DIGESTIVE SYSTEM OR PROCEDURES WITHOUT CC
191 PANCREAS, LIVER AND SHUNT PROCEDURES WITH CC
192 PANCREAS, LIVER AND SHUNT PROCEDURES WITHOUT CC
193 BILIARY TRACT PROCEDURES EXCEPT ONLY CHOLECYSTECTOMY WITH OR WITHOUT COMMON DUCT EXPLORATION WITH CC
194 BILIARY TRACT PROCEDURES EXCEPT ONLY CHOLECYSTECTOMY WITH OR WITHOUT COMMON DUCT EXPLORATION WITHOUT CC
195 CHOLECYSTECTOMY WITH COMMON DUCT EXPLORATION WITH CC
196 CHOLECYSTECTOMY WITH COMMON DUCT EXPLORATION WITHOUT CC
197 CHOLECYSTECTOMY EXCEPT BY LAPAROSCOPE WITHOUT COMMON DUCT EXPLORATION WITH CC
198 CHOLECYSTECTOMY EXCEPT BY LAPAROSCOPE WITHOUT COMMON DUCT EXPLORATION WITHOUT CC
199 HEPATOBILIARY DIAGNOSTIC PROCEDURE FOR MALIGNANCY
200 HEPATOBILIARY DIAGNOSTIC PROCEDURE FOR NONMALIGNANCY
201 OTHER HEPATOBILIARY OR PANCREAS OR PROCEDURES
209 MAJOR JOINT AND LIMB REATTACHMENT PROCEDURES OF LOWER EXTREMITY
210 HIP AND FEMUR PROCEDURES EXCEPT MAJOR JOINT PROCEDURES, AGE GREATER THAN 17 WITH CC
211 HIP AND FEMUR PROCEDURES EXCEPT MAJOR JOINT PROCEDURES, AGE GREATER THAN 17 WITHOUT CC
212 HIP AND FEMUR PROCEDURES EXCEPT MAJOR JOINT PROCEDURE, AGE 0-17
213 AMPUTATION FOR MUSCULOSKELETAL SYSTEM AND CONNECTIVE TISSUE DISORDERS
214 NO LONGER VALID
215 NO LONGER VALID

216	BIOPSIES OF MUSCULOSKELETAL SYSTEM AND CONNECTIVE TISSUE
217	WOUND DEBRIDEMENT AND SKIN GRAFT EXCEPT HAND FOR MUSCULOSKELETAL AND CONNECTIVE TISSUE DISORDERS
218	LOWER EXTREMITY AND HUMERUS PROCEURES EXCEPT HIP, FOOT AND FEMUR, AGE GREATER THAN 17 WITH CC
219	LOWER EXTREMITY AND HUMERUS PROCEDURES EXCEPT HIP, FOOT AND FEMUR, AGE GREATER THAN 17 WITHOUT CC
220	LOWER EXTREMITY AND HUMERUS PROCEDURES EXCEPT HIP, FOOT AND FEMUR, AGE 0-17
221	NO LONGER VALID
222	NO LONGER VALID
223	MAJOR SHOULDER/ELBOW PROCEDURES OR OTHER UPPER EXTREMITY PROCEDURES WITH CC
224	SHOULDER, ELBOW OR FOREARM PROCEDURES EXCEPT MAJOR JOINT PROCEDURES WITHOUT CC
225	FOOT PROCEDURES
226	SOFT TISSUE PROCEDURES WITH CC
227	SOFT TISSUE PROCEDURES WITHOUT CC
228	MAJOR THUMB OR JOINT PROCEDURES OR OTHER HAND OR WRIST PROCEDURES WITH CC
229	HAND OR WRIST PROCEDURES EXCEPT MAJOR JOINT PROCEDURES WITHOUT CC
230	LOCAL EXCISION AND REMOVAL OF INTERNAL FIXATION DEVICES OF HIP AND FEMUR
231	LOCAL EXCISION AND REMOVAL OF INTERNAL FIXATION DEVICES EXCEPT HIP AND FEMUR
232	ARTHROSCOPY
233	OTHER MUSCULOSKELETAL SYSTEM AND CONNECTIVE TISSUE OR PROCEDURES WITH CC
234	OTHER MUSCULOSKELETAL SYSTEM AND CONNECTIVE TISSUE OR PROCEDURES WITHOUT CC
257	TOTAL MASTECTOMY FOR MALIGNANCY WITH CC
258	TOTAL MASTECTOMY FOR MALIGNANCY WITHOUT CC
259	SUBTOTAL MASTECTOMY FOR MALIGNANCY WITH CC
260	SUBTOTAL MASTECTOMY FOR MALIGNANCY WITHOUT CC
261	BREAST PROCEDURE FOR NONMALIGNANCY EXCEPT BIOPSY AND LOCAL EXCISION
262	BREAST BIOPSY AND LOCAL EXCISION FOR NONMALIGNANCY
263	SKIN GRAFT AND/OR DEBRIDEMENT FOR SKIN ULCER OR CELLULITIS WITH CC
264	SKIN GRAFT AND OR DEBRIDEMENT FOR SKIN ULCER OR CELLULITIS WITHOUT CC
265	SKIN GRAFT AND OR DEBRIDEMENT EXCEPT FOR SKIN ULCER OR CELLULITIS WITH CC
266	SKIN GRAFT AND/OR DEBRIDEMENT EXCEPT FOR SKIN ULCER OR CELLULITIS WITHOUT CC
267	PERIANAL AND PILONIDAL PROCEDURES
268	SKIN, SUBCUTANEOUS TISSUE AND BREAST PLASTIC PROCEDURES
269	OTHER SKIN, SUBCUTANEOUS TISSUE AND BREAST PROCEDURES WITH CC
270	OTHER SKIN, SUBCUTANEOUS TISSUE AND BREAST PROCEDURS WITHOUT CC
285	AMPUTATION OF LOWER LIMB FOR ENDOCRINE, NUTRITIONAL AND METABOLIC DISORDERS
286	ADRENAL AND PITUITARY PROCEDURES
287	SKIN GRAFTS AND WOUND DEBRIDEMENTS FOR ENDOCRINE, NUTRITIONAL AND METABOLIC DISORDERS
288	OR PROCEDURES FOR OBESITY
289	PARATHYROID PROCEDURES
290	THYROID PROCEDURES
291	THYROGLOSSAL PROCEDURES
292	OTHER ENDOCRINE, NUTRITIONAL AND METABOLIC OR PROCEDURES WITH CC
293	OTHER ENDOCRINE, NUTRITIONAL AND METABOLIC OR PROCEDURES WITHOUT CC
302	KIDNEY TRANSPLANT
303	KIDNEY, URETER AND MAJOR BLADDER PROCEDURES FOR NEOPLASM
304	KIDNEY, URETER AND MAJOR BLADDER PROCEDURES FOR NONNEOPLASMS WITH CC
305	KIDNEY, URETER AND MAJOR BLADDER PROCEDURES FOR NONNEOPLASMS WITHOUT CC
306	PROSTATECTOMY WITH CC
307	PROSTATECTOMY WITHOUT CC
308	MINOR BLADDER PROCEDURES WITH CC
309	MINOR BLADDER PROCEDURES WITHOUT CC
310	TRANSURETHRAL PROCEDURES WITH CC
311	TRANSURETHRAL PROCEDURES WITHOUT CC
312	URETHRAL PROCEDURES, AGE GREATER THAN 17 WITH CC
313	URETHRAL PROCEDURES, AGE GREATER THAN 17 WITHOUT CC
314	URETHRAL PROCEDURES, AGE 0-17
315	OTHER KIDNEY AND URINARY TRACT OR PROCEDURES
334	MAJOR MALE PELVIC PROCEDURES WITH CC
335	MAJOR MALE PELVIC PROCEDURES WITHOUT CC
336	TRANSURETHRAL PROSTATECTOMY WITH CC
337	TRANSURETHRAL PROSTATECTOMY WITHOUT CC
338	TESTES PROCEDURES FOR MALIGNANCY
339	TESTES PROCEDURES FOR NONMALIGNANCY, AGE GREATER THAN 17
340	TESTES PROCEDURES FOR NONMALIGNANCY, AGE 0-17
341	PENIS PROCEDURES
342	CIRCUMCISION, AGE GREATER THAN 17
343	CIRCUMCISION, AGE 0-17
344	OTHER MALE REPRODUCTIVE SYSTEM OR PROCEDURES FOR MALIGNANCY
345	OTHER MALE REPRODUCTIVE SYSTEM OR PROCEDURES EXCEPT FOR MALIGNANCY

353 PELVIC EVISCERATION, RADICAL HYSTERECTOMY AND RADICAL VULVECTOMY
354 UTERINE AND ADNEXA PROCEDURES FOR NONOVARIAN/ADNEXAL MALIGNANCY WITH CC
355 UTERINE AND ADNEXA PROCEDURES FOR NONOVARIAN/ADNEXA PROCEDURES FOR NONOVARIAN/ADNEXAL MALIGNANCY WITHOUT CC
356 FEMALE REPRODUCTIVE SYSTEM RECONSTRUCTIVE PROCEDURES
357 UTERINE AND ADNEXA PROCEDURES FOR OVARIAN OR ADNEXAL MALIGNANCY
358 UTERINE AND ADNEXA PROCEDURES FOR NONMALIGNANCY WITH CC
359 UTERINE AND ADNEXA PROCEDURES FOR NONMALIGNANCY WITHOUT CC
360 VAGINA, CERVIX AND VULVA PROCEDURES
361 LAPAROSCOPY AND INCISIONAL TUBAL INTERRUPTION
362 ENDOSCOPIC TUBAL INTERRUPTION
363 D AND C, CONIZATION AND RADIOIMPLANT FOR MALIGNANCY
364 D AND C, CONIZATION EXCEPT FOR MALIGNANCY
365 OTHER FEMALE REPRODUCTIVE SYSTEM OR PROCEDURES
370 CESAREAN SECTION WITH CC
371 CESAREAN SECTION WITHOUT CC
374 VAGINAL DELIVERY WITH STERILIZATION AND/OR D AND C
375 VAGINAL DELIVERY WITH OR PROCEDURE EXCEPT STERILIZATION AND/OR D AND C
377 POSTPARTUM AND POSTABORTION DIAGNOSES WITH OR PROCEDURE
381 ABORTION WITH D AND C ASPIRATION CURETTAGE OR HYSTERECTOMY
392 SPLENECTOMY, AGE GREATER THAN 17
393 SPLENECTOMY, AGE 0-17
394 OTHER OR PROCEDURES OF THE BLOOD AND BLOOD-FORMING ORGANS
400 LYMPHOMA AND LEUKEMIA WITH MAJOR OR PROCEDURES
401 LYMPHOMA AND NONACUTE LEUKEMIA WITH OTHER OR PROCEDURE WITH CC
402 LYMPHOMA AND NONACUTE LEUKEMIA WITH OTHER OR PROCEDURE WITHOUT CC
406 MYELOPROLIFERATIVE DISORDERS OR POORLY DIFFERENTIATED NEOPLASMS WITH MAJOR OR PROCEDURES WITH CC
407 MYELOPROLIFERATIVE DISORDERS OR POORLY DIFFERENTIATED NEOPLASMS WITH MAJOR OR PROCEDURES WITHOUT CC
408 MYELOPROLIFERATIVE DISORDERS OR POORLY DIFFERENTIATED NEOPLASMS WITH OTHER OR PROCEDURES
415 OR PROCEDURE FOR INFECTIOUS AND PARASITIC DISEASES
424 OR PROCEDURES WITH PRINCIPAL DIAGNOSIS OF MENTAL ILLNESS
439 SKIN GRAFTS FOR INJURIES
440 WOUND DEBRIDEMENTS FOR INJURIES
441 WOUND HAND PROCEDURES FOR INJURIES
442 OTHER OR PROCEDURES FOR INJURIES WITH CC
443 OTHER OR PROCEDURES FOR INJURIES
458 NO LONGER VALID
459 NO LONGER VALID
461 OR PROCEDURES WITH DIAGNOSES OF OTHER CONTACT WITH HEALTH SERVICES
468 EXTENSIVE OR PROCEDURE UNRELATED TO PRINCIPAL DIAGNOSIS
471 BILATERAL OR MULTIPLE MAJOR JOINT PROCEDURES OF LOWER EXTREMITY
472 NO LONGER VALID
476 PROSTATIC OR PROCEDURE UNRELATED TO PRINCIPAL DIAGNOSIS
477 NONEXTENSIVE OR PROCEDURE UNRELATED TO PRINCIPAL DIAGNOSIS
478 OTHER VASCULAR PROCEDURES WITH CC
479 OTHER VASCULAR PROCEDURES WITHOUT CC
480 LIVER TRANSPLANT
481 BONE MARROW TRANSPLANT
482 TRACHEOSTOMY FOR FACE, MOUTH AND NECK DIAGNOSES
483 TRACHEOSTOMY EXCEPT FOR FACE, MOUTH AND NECK DIAGNOSES
484 CRANIOTOMY FOR MULTIPLE SIGNIFICANT TRAUMA
485 LIMB REATTACHMENT, HIP AND FEMUR PROCEDURES FOR MULTIPLE SIGNIFICANT TRAUMA
486 OTHER OR PROCEDURES FOR MULTIPLE SIGNIFICANT TRAUMA
488 HIV WITH EXTENSIVE OR PROCEDURE
491 MAJOR JOINT AND LIMB REATTACHMENT PROCEDURES OF UPPER EXTREMITY
493 LAPAROSCOPIC CHOLECYSTECTOMY WITHOUT COMMON DUCT EXPLORATION WITH CC
494 LAPAROSCOPIC CHOLECYSTECTOMY WITHOUT COMMON DUCT EXPLORATION WITHOUT CC
495 LUNG TRANSPLANT
496 COMBINED ANTERIOR/POSTERIOR SPINAL FUSION
497 SPINAL FUSION WITH CC
498 SPINAL FUSION WITHOUT CC
499 BACK AND NECK PROCEDURES EXCEPT SPINAL FUSION WITH CC
500 BACK AND NECK PROCEDURES EXCEPT SPINAL FUSION WITHOUT CC
501 KNEE PROCEDURES WITH PRINCIPAL DIAGNOSIS OF INFECTION, WITH CC
502 KNEE PROCEDURES WITH PRINCIPAL DIAGNOSIS OF INFECTION, WITHOUT CC
503 KNEE PROCEDURES WITHOUT PRINCIPAL DIAGNOSIS OF INFECTION

Syncope

ICD-9-CM diagnosis codes:

780.2 SYNCOPE AND COLLAPSE

Technical difficulty

ICD-9-CM diagnosis codes:

ACCIDENTAL CUT, PUNCTURE, PERFORATION, OR HEMORRHAGE DURING:
E870.0 SURGICAL OPERATION
E870.1 INFUSION OR TRANSFUSION
E870.2 KIDNEY DIALYSIS OR OTHER PERFUSION
E870.3 INJECTION OR VACCINATION

E870.4	ENDOSCOPIC EXAMINATION
E870.5	ASPIRATION OF FLUID OR TISSUE, PUNCTURE, AND CATHETERIZATION
E870.6	HEART CATHETERIZATION
E870.7	ADMINISTRATION OF ENEMA
E870.8	OTHER SPECIFIED MEDICAL CARE
E870.9	UNSPECIFIED MEDICAL CARE
998.2	ACCIDENTAL PUNCTURE OR LACERATION DURING A PROCEDURE

Thoracic surgery

ICD-9-CM procedure codes:

31.21	MEDIASTINAL TRACHEOSTOMY
31.45	OPEN BIOPSY OF LARYNX OR TRACHEA
31.73	CLOSURE OF OTHER FISTULA OF TRACHEA
31.79	OTHER REPAIR AND PLASTIC OPERATIONS ON TRACHEA
31.99	OTHER OPERATIONS ON TRACHEA
32.09	OTHER LOCAL EXCISION OR DESTRUCTION OF LESION OR TISSUE OF BRONCHUS
32.1	OTHER EXCISION OF BRONCHUS
32.21	PLICATION OF EMPHYSEMATIOUS BLEB
32.22	LUNG VOLUME REDUCTION SURGERY
32.28	ENDOSCOPIC EXCISION OR DESTRUCTION OF LESION OR TISSUE OF LUNG
32.29	OTHER LOCAL EXCISION OR DESTRUCTION OF LESION OR TISSUE OF LUNG
32.3	SEGMENTAL RESECTION OF LUNG
32.4	LOBECTOMY OF LUNG
32.5	COMPLETE PNEUMONECTOMY
32.6	RADICAL DISSECTION OF THORACIC STRUCTURES
32.9	OTHER EXCISION OF LUNG
33.0	INCISION OF BRONCHUS
33.1	INCISION OF LUNG
33.25	OPEN BIOPSY OF BRONCHUS
33.26	CLOSED [PERCUTANEOUS][NEEDLE] BIOPSY OF LUNG
33.27	CLOSED ENDOSCOPIC BIOPSY OF LUNG
33.28	OPEN BIOPSY OF LUNG
33.31	DESTRUCTION OF PHRENIC NERVE FOR COLLAPSE OF LUNG (NO LONGER PERFORMED)
33.32	ARTIFICAL PNEUMOTHORAX FOR COLLAPSE OF LUNG
33.34	THORACOPLASTY
33.39	OTHER SURGICAL COLLAPSE OF LUNG
33.41	SUTURE OF LACERATION OF BRONCHUS
33.42	CLOSURE OF BRONCHIAL FISTULA
33.43	CLOSURE OF LACERATION OF LUNG
33.48	OTHER REPAIR AND PLASTIC OPERATIONS ON BRONCHUS
33.49	OTHER REPAIR AND PLASTIC OPERATIONS ON LUNG
33.50	LUNG TRANSPLANTATION, NOS
33.51	UNILATERAL LUNG TRANSPLANTATION
33.52	BILATERAL LUNG TRANSPLANTATION
33.6	COMBINED HEART-LUNG TRANSPLANTATION
33.92	LIGATION OF BRONCHUS
33.93	PUNCTURE OF LUNG
33.98	OTHER OPERATIONS ON BRONCHUS
33.99	OTHER OPERATIONS ON LUNG
33.29	OTHER DIAGNOSTIC PROCEDURE ON LUNG AND BRONCHUS
33.33	PNEUMOPERITONEUM FOR COLLAPSE OF LUNG
34.01	INCISION OF CHEST WALL
34.02	EXPLORATORY THORACOTOMY
34.03	REOPENING OF RECENT THORACOTOMY SITE
34.05	CREATION OF PLEUROPERITONEAL SHUNT
34.09	OTHER INCISION OF PLEURA
34.1	INCISION OF MEDIASTINUM
34.21	TRANSPLEURAL THORACOSOCOPY
34.22	MEDIASTINOSCOPY
34.23	BIOPSY OF CHEST WALL
34.24	PLEURAL BIOPSY
34.25	CLOSED [PERCUTANEOUS][NEEDLE] BIOPSY OF MEDIASTINUM
34.26	OPEN BIOPSY OF MEDIASTINUM
34.27	BIOPSY OF DIAPHRAGM
34.28	OTHER DIAGNOSTIC PROCEDURES ON CHEST WALL, PLEURA, AND DIAPHRAGM
34.29	OTHER DIAGNOSTIC PROCEDURES ON MEDIASTINUM
34.3	EXCISION OR DESTRUCTION OF LESION OR TISSUE OF MEDIASTINUM
34.4	EXCISION OR DESTRUCTION OF LESION OF CHEST WALL
34.51	DECORTICATION OF LUNG
34.59	OTHER EXCISION OF PLEURA
34.71	SUTURE OF LACERATION OF CHEST WALL
34.72	CLOSURE OF THORACOSTOMY
34.73	CLOSURE OF OTHER FISTULA OF THORAX
34.74	REPAIR OF PECTUS DEFORMITY
34.79	OTHER REPAIR OF CHEST WALL
34.81	EXCISION OF LESION OR TISSUE OF DIAPHRAGM
34.82	SUTURE OF LACERATION OF DIAPHRAGM
34.83	CLOSURE OF FISTULA OF DIAPHRAGM
34.84	OTHER REPAIR OF DIAPHRAGM
34.85	IMPLANTATION OF DIAPHRAGMATIC PACEMAKER
34.89	OTHER OPERATIONS ON DIAPHRAGM
34.93	REPAIR OF PLEURA
34.99	OTHER
40.61	CANNULATION OF THORACIC DUCT
40.62	FISTULIZATION OF THORACIC DUCT
40.63	CLOSURE OF FISTULA OF THORACIC DUCT
40.64	LIGATION OF THORACIC DUCT
40.69	OTHER OPERATIONS ON THORACIC DUCT
42.01	INCISION OF ESOPHAGEAL WEB
42.09	OTHER INCISION OF ESOPHAGUS
42.10	ESOPHAGOSTOMY, NOS
42.11	CERVICAL ESOPHAGOSTOMY
42.12	EXTERIORIZATION OF ESOPHAGEAL POUCH
42.19	OTHER EXTERNAL FISTULIZATION OF ESOPHAGUS
42.21	OPERATIVE ESOPHAGOSCOPY BY INCISION
42.25	OPEN BIOPSY OF ESOPHAGUS
42.31	LOCAL EXCISION OF ESOPHAGEAL DIVERTICULUM
42.32	LOCAL EXCISION OF OTHER LESION OR TISSUE OF ESOPHAGUS
42.39	OTHER DESTRUCTION OF LESION OR TISSUE OF ESOPHAGUS
42.40	ESOPHAGECTOMY, NOS
42.41	PARTIAL ESOPHAGECTOMY
42.42	TOTAL ESOPHAGECTOMY
42.51	INTRATHORACIC ESOPHAGOESOPHAGOSTOMY

42.52	INTRATHORACIC ESOPHAGOGASTROSTOMY
42.53	INTRATHORACIC ESOPHAGEAL ANASTOMOSIS WITH INTERPOSITION OF SMALL BOWEL
42.54	OTHER INTRATHORACIC ESOPHAGOENTEROSTOMY
42.55	INTRATHORACIC ESOPHAGEAL ANASTOMOSIS WITH INTERPOSITION OF COLON
42.56	OTHER INTRATHORACIC ESOPHAGOCOLOSTOMY
42.58	INTRATHORACIC ESOPHAGEAL ANASTOMOSIS WITH OTHER INTERPOSITION
42.59	OTHER INTRATHORACIC ANASTOMOSIS OF ESOPHAGUS
42.61	ANTESTERNAL ESOPHAGOESOPHAGOSTOMY
42.62	ANTESTERNAL ESOPHAGOGASTROSTOMY
42.63	ANTESTERNAL ESOPHAGEAL ANASTOMOSIS WITH INTERPOSITION OF SMALL BOWEL
42.64	OTHER ANTESTERNAL ESOPHAGOENTEROSTOMY
42.65	ANTESTERNAL ESOPHAGEAL ANASTOMOSIS WITH INTERPOSITION OF COLON
42.66	OTHER ANTESTERNAL ESOPHAGOCOLOSTOMY
42.68	OTHER ANTESTERNAL ESOPHAGEAL ANASTOMOSIS WITH INTERPOSITION
42.69	OTHER ANTESTERNAL ANASTOMOSIS OF ESOPHAGUS
42.7	ESOPHAGOMYOTOMY
42.81	INSERTION OF PERMANENT TUBE INTO ESOPHAGUS
42.82	SUTURE OF LACERATION OF ESOPHAGUS
42.83	CLOSURE OF ESOPHAGOSTOMY
42.84	REPAIR OF ESOPHAGEAL FISTULA, NEC
42.85	REPAIR OF ESOPHAGEAL STRICTURE
42.86	PRODUCTION OF SUBCUTANEOUS TUNNEL WITHOUT ESOPHAGEAL ANASTOMOSIS
42.87	OTHER GRAFT OF ESOPHAGUS
42.89	OTHER REPAIR OF ESOPHAGUS
44.65	ESOPHAGOGASTROPLASTY
44.66	OTHER PROCEDURES FOR CREATION OF ESOPHAGOGASTRIC SPHINCTERIC COMPETENCE
81.04	DORSAL AND DORSO-LUMBAR FUSION, ANTERIOR TECHNIQUE

Transferred to acute care facility

DISCHARGE DISPOSITION RECORDED AS TRANSFER TO ANOTHER ACUTE CARE FACILITY

Transferred from acute care facility

ADMISSION SOURCE IS RECORDED AS ACUTE CARE FACILITY

Transfusion reaction

ICD-9-CM diagnosis codes:

999.6	ABO INCOMPATIBILITY REACTION
999.7	RH INCOMPATIBILITY REACTION
E876.0	MISMATCHED BLOOD IN TRANSFUSION

Trauma

ICD-9-CM diagnosis codes (includes 4th and 5th digits):

800	FRACTURE OF VAULT OF SKULL
801	FRACTURE OF BASE OF SKULL
802	FRACTURE OF FACE BONES
803	OTHER AND UNQUALIFIED SKULL FRACTURES
804	MULTIPLE FRACTURES INVOLVING SKULL OR FACE WITH OTHER BONES
805	FRACTURE OF VERTEBRAL COLUMN WITHOUT MENTION OF SPINAL CORD INJURY
806	FRACTURE OF VERTEBRAL COLUMN WITH SPINAL CORD INJURY
807	FRACTURE OF RIB[S] STERNUM, LARYNX, AND TRACHEA
808	FRACTURE OF PELVIS
809	ILL-DEFINED FRACTURES OF BONES OF TRUNK
810	FRACTURE OF CLAVICLE
811	FRACTURE OF SCAPULA
812	FRACTURE OF HUMEROUS
813	FRACTURE OF RADIUS AND ULNA
814	FRACTURE OF CARPAL BONE[S]
815	FRACTURE OF METACARPAL BONE[S]
817	MULTIPLE FRACTURES OF HAND BONES
818	ILL-DEFINED FRACTURES OF UPPER LIMB
819	MULTIPLE FRACTURES INVOLVING BOTH UPPER LIMBS, AND UPPER LIMB WITH RIB AND STERNUM
820	FRACTURE OF NECK OF FEMUR
821	FRACTURE OF OTHER AND UNSPECIFIED PARTS OF FEMUR
822	FRACTURE OF PATELLA
823	FRACTURE OF TIBIA AND FIBULA
824	FRACTURE OF ANKLE
825	FRACTURE OF ONE OR MORE TARSAL AND METATARSAL BONES
827	OTHER, MULTIPLE, AND ILL-DEFINED FRACTURES OF LOWER LIMB
828	MULTIPLE FRACTURES INVOLVING BOTH LOWER LIMBS, LOWER WITH UPPER LIMB, AND LOWER LIMB WITH RIB AND STERNUM
829	FRACTURE OF UNSPECIFIED BONES
830	DISLOCATION OF JAW
831	DISLOCATION OF SHOULDER
832	DISLOCATION OF ELBOW
833	DISLOCATION OF WRIST
835	DISLOCATION OF HIP
836	DISLOCATION OF KNEE
837	DISLOCATION OF ANKLE
838	DISLOCATION OF FOOT
839	OTHER, MULTIPLE, AND ILL-DEFINED DISLOCATIONS
850	CONCUSSION
851	CEREBRAL LACERATION AND CONTUSION
852	SUBARACHNOID, SUBDURAL, AND EXTRADURAL HEMORRHAGE, FOLLOWING INJURY
853	OTHER AND UNSPECIFIED INTRACRANIAL HEMORRHAGE FOLLOWING INJURY
854	INTRACRANIAL INJURY OF OTHER AND UNSPECIFIED NATURE
860	TRAUMATIC PNEUMOTHORAX
861	INJURY TO HEART AND LUNG

862	INJURY TO OTHER AND UNSPECIFIED INTRATHORACIC ORGANS
863	INJURY TO GASTROINTESTINAL TRACT
864	INJURY TO LIVER
865	INJURY TO SPLEEN
866	INJURY TO KIDNEY
867	INJURY TO PELVIC ORGANS
868	INJURY TO OTHER INTRA-ABDOMINAL ORGANS
869	INTERNAL INJURY TO UNSPECIFIED OR ILL-DEFINED ORGANS
870	OPEN WOUND OF OCULAR ADNEXA
871	OPEN WOUND OF EYEBALL
872	OPEN WOUND OF EAR
873	OTHER OPEN WOUND OF HEAD
874	OPEN WOUND OF NECK
875	OPEN WOUND OF CHEST [WALL]
876	OPEN WOUND OF BACK
877	OPEN WOUND OF BUTTOCK
878	OPEN WOUND OF GENITAL ORGANS [EXTERNAL] INCLUDING TRAUMATIC AMPUTATION
879	OPEN WOUND OF OTHER AND UNSPECIFIED SITES, EXCEPT LIMBS
880	OPEN WOUND OF SHOULDER AND UPPER ARM
881	OPEN WOUND OF ELBOW, FOREARM, AND WRIST
882	OPEN WOUND OF HAND EXCEPT FINGER ALONE
884	MULTIPLE AND UNSPECIFIED OPEN WOUND OF UPPER LIMB
887	TRAUMATIC AMPUTATION OF ARM AND HAND (COMPLETE) (PARTIAL)
890	OPEN WOUND OF HIP AND THIGH
891	OPEN WOUND OF KNEE, LEG (EXCEPT THIGH) AND ANKLE
892	OPEN WOUND OF FOOT EXCEPT TOE ALONE
894	MULTIPLE AND UNSPECIFIED OPEN WOUND OF LOWER LIMB
896	TRAUMATIC AMPUTATION OF FOOT (COMPLETE) (PARTIAL)
897	TRAUMATIC AMPUTATION OF LEG(S) (COMPLETE) (PARTIAL)
900	INJURY TO BLOOD VESSELS OF HEAD AND NECK
901	INJURY TO BLOOD VESSELS OF THORAX
902	INJURY TO BLOOD VESSELS OF ABDOMEN AND PELVIS
903	INJURY TO BLOOD VESSELS OF UPPER EXTREMITY
904	INJURY TO BLOOD VESSELS OF LOWER EXTREMITY AND UNSPECIFIED SITES
925	CRUSHING INJURY OF FACE, SCALP, AND NECK
926	CRUSHING INJURY OF TRUNK
927	CRUSHING INJURY OF UPPER LIMB
928	CRUSHING INJURY OF LOWER LIMB
929	CRUSHING INJURY OF MULTIPLE AND UNSPECIFIED SITES
940	BURN CONFINED TO EYE AND ADNEXA
941	BURN OF FACE, HEAD, AND NECK
942	BURN OF TRUNK
943	BURN OF UPPER LIMB, EXCEPT WRIST AND HAND
944	BURN OF WRIST[S] AND HAND[S]
945	BURN OF LOWER LIMB[S]
946	BURNS OF MULTIPLE SPECIFIED SITES
947	BURN OF INTERNAL ORGANS
948	BURNS CLASSIFIED ACCORDING TO EXTENT OF BODY SURFACE INVOLVED
949	BURN, UNSPECIFIED
952	SPINAL CHORD INJURY WITHOUT EVIDENCE OF SPINAL BONE INJURY
953	INJURY TO NERVE ROOTS AND SPINAL PLEXUS
958	CERTAIN EARLY COMPLICATIONS OF TRAUMA
E800	RAILWAY ACCIDENT INVOLVING COLLISION WITH ROLLING STOCK
E801	RAILWAY ACCIDENT INVOLVING COLLISION WITH OTHER OBJECT
E802	RAILWAY ACCIDENT INVOLVING DERAILMENT WITHOUT ANTECEDENT COLLISION
E803	RAILWAY ACCIDENT INVOLVING EXPLOSION, FIRE, OR BURNING
E804	FALL IN, ON, OR FROM RAILWAY TRAIN
E805	HIT BY ROLLING STOCK
E806	OTHER SPECIFIED RAILWAY ACCIDENT
E807	RAILWAY ACCIDENT OF UNSPECIFIED NATURE
E810	MOTOR VEHICLE TRAFFIC ACCIDENT INVOLVING COLLISION WITH TRAIN
E811	MOTOR VEHICLE TRAFFIC ACCIDENT INVOLVING RE-ENTERANT COLLISION WITH ANOTHER MOTOR VEHICLE
E812	OTHER MOTOR VEHICLE TRAFFIC ACCIDENT INVOLVING COLLISION WITH MOTOR VEHICLE
E813	MOTOR VEHICLE TRAFFIC ACCIDENT INVOLVING COLLISION WITH OTHER VEHICLE
E814	MOTOR VEHICLE TRAFFIC ACCIDENT INVOLVING COLLISION WITH PEDESTRIAN
E815	OTHER MOTOR VEHICLE TRAFFIC ACCIDENT INVOLVING COLLISION ON THE HIGHWAY
E816	MOTOR VEHICLE TRAFFIC ACCIDENT DUE TO LOSS OF CONTROL, WITHOUT COLLISION ON THE HIGHWAY
E817	NONCOLLISION MOTOR VEHICLE TRAFFIC ACCIDENT WHILE BOARDING OR ALIGHTING
E818	OTHER NONCOLLISION MOTOR VEHICLE TRAFFIC ACCIDENT
E819	MOTOR VEHICLE TRAFFIC ACCIDENT OF UNSPECIFIED NATURE
E820	NONTRAFFIC ACCIDENT INVOLVING MOTOR-DRIVEN SNOW VEHICLE
E821	NONTRAFFIC ACCIDENT INVOLVING OTHER OFF-ROAD MOTOR VEHICLE
E822	OTHER MOTOR VEHICLE NONTRAFFIC ACCIDENT INVOLVING COLLISION WITH MOVING OBJECT
E823	OTHER MOTOR VEHICLE NONTRAFFIC ACCIDENT INVOLVING COLLISION WITH STATIONARY OBJECT
E824	OTHER MOTOR VEHICLE NONTRAFFIC ACCIDENT WHILE BOARDING AND ALIGHTING
E825	OTHER MOTOR VEHICLE NONTRAFFIC ACCIDENT OF OTHER AND UNSPECIFIED NATURE
E826	PEDAL CYCLE ACCIDENT
E827	ANIMAL-DRAWN VEHICLE ACCIDENT
E828	ACCIDENT INVOLVING ANIMAL BEING RIDDEN
E829	OTHER ROAD VEHICLE ACCIDENTS
E830	ACCIDENT TO WATERCRAFT CAUSING SUBMERSION
E831	ACCIDENT TO WATERCRAFT CAUSING OTHER INJURY
E832	OTHER ACCIDENTAL SUBMERSION OR DROWNING IN WATER TRANSPORT ACCIDENT

E833	FALL ON STAIRS OR LADDERS IN WATER TRANSPORT
E834	OTHER FALL FROM ONE LEVEL TO ANOTHER IN WATER TRANSPORT
E835	OTHER AND UNSPECIFIED FALL IN WATER TRANSPORT
E836	MACHINERY ACCIDENT IN WATER TRANSPORT
E837	EXPLOSION, FIRE, OR BURNING IN WATERCRAFT
E838	OTHER AND UNSPECIFIED WATER TRANSPORT ACCIDENT
E840	ACCIDENT TO POWERED AIRCRAFT AT TAKEOFF OR LANDING
E841	ACCIDENT TO POWERED AIRCRAFT, OTHER AND UNSPECIFIED
E842	ACCIDENT TO UNPOWERED AIRCRAFT
E843	FALL IN, ON, OR FROM AIRCRAFT
E844	OTHER SPECIFIED AIR TRANSPORT ACCIDENTS
E845	ACCIDENT INVOLVING SPACECRAFT
E846	ACCIDENTS INVOLVING POWERED VEHICLES USED SOLELY WITHIN THE BUILDINGS AND PREMISES AND INDUSTRIAL OR COMMERCIAL ESTABLISHMENT
E847	ACCIDENTS TO UNPOWERED AIRCRAFT
E848	ACCIDENTS INVOLVING OTHER VEHICLES, NEC
E849	PLACE OF OCCURRENCE
E880	FALL ON OR FROM STAIRS OR STEPS
E881	FALL ON OR FROM LADDERS OR SCAFFOLDING
E882	FALL FROM OR OUT OF BUILDING OR OTHER STRUCTURE
E883	FALL INTO HOLE OR OTHER OPENING IN SURFACE
E884	OTHER FALL FROM ONE LEVEL TO ANOTHER
E885	FALL ON SAME LEVEL FROM SLIPPING, TRIPPING, OR STUMBLING
E886	FALL ON SAME LEVEL FROM COLLISION, PUSHING, OR SHOVING BY OR WITH OTHER PERSON
E887	FRACTURE, CAUSE UNSPECIFIED
E888	OTHER AND UNSPECIFIED FALL
E890	CONFLAGRATION IN PRIVATE DWELLING
E891	CONFLAGRATION IN OTHER AND UNSPECIFIED BUILDING OR STRUCTURE
E892	CONFLAGRATION NOT IN BUILDING OR STRUCTURE
E893	ACCIDENT CAUSED BY IGNITION OF CLOTHING
E894	IGNITION OF HIGHLY INFLAMMABLE MATERIAL
E895	ACCIDENT CAUSED BY CONTROLLED FIRE IN PRIVATE DWELLING
E896	ACCIDENT CAUSE BY CONTROLLED FIRE IN OTHER AND UNSPECIFIED BUILDING OR STRUCTURE
E897	ACCIDENT CAUSED BY CONTROLLED FIRE NOT IN BUILDING OR STRUCTURE
E898	ACCIDENT CAUSED BY OTHER SPECIFIED FIRE AND FLAMES
E899	ACCIDENT CAUSED BY UNSPECIFIED FIRE
E910	ACCIDENTAL DROWNING AND SUBMERSION
E913	ACCIDENTAL MECHANICAL SUFFOCATION
E914	FOREIGN BODY ACCIDENTALLY ENTERING EYE AND ADNEXA
E915	FOREIGN BODY ACCIDENTALLY ENTERING OTHER ORIFICE
E916	STRUCK ACCIDENTALLY BY FALLING OBJECT
E917	STRIKING AGAINST OR STRUCK ACCIDENTALLY BY OBJECTS OR PERSONS
E918	CAUGHT ACCIDENTALLY IN OR BETWEEN OBJECTS
E919	ACCIDENTS CAUSED BY MACHINERY
E920	ACCIDENTS CAUSED BY CUTTING AND PIERCING INSTRUMENTS OR OBJECTS
E921	ACCIDENT CAUSED BY EXPLOSION OF PRESSURE VESSEL
E922	ACCIDENT CAUSED BY FIREARM AND AIR GUN MISSILE
E923	ACCIDENT CAUSED BY EXPLOSIVE MATERIAL
E924	ACCIDENT CAUSED BY HOT SUBSTANCE OR OBJECT, CAUSTIC OR CORROSIVE MATERIAL, AND STEAM
E925	ACCIDENT CAUSED BY ELECTRIC CURRENT
E926	EXPOSURE TO RADIATION
E927	OVEREXERTION AND STRENUOUS MOVEMENTS
E928	OTHER AND UNSPECIFIED ENVIRONMENTAL AND ACCIDENTAL CAUSES
E960	FIGHT, BRAWL, RAPE
E961	ASSAULT BY CORROSIVE OR CAUSTIC SUBSTANCE, EXCEPT POISONING
E962	ASSAULT BY POISONING
E963	ASSAULT BY HANGING AND STRANGULATION
E964	ASSAULT BY SUBMERSION [DROWNING]
E965	ASSAULT BY FIREARMS AND EXPLOSIVES
E966	ASSAULT BY CUTTING AND PIERCING INSTRUMENT
E967	PERPETRATOR OF CHILD AND ADULT ABUSE
E968	ASSAULT BY OTHER AND UNSPECIFIED MEANS
E969	LATE EFFECTS OF INJURY PURPOSELY INFLICTED BY OTHER PERSON
E970	INJURY DUE TO LEGAL INTERVENTION BY FIREARMS
E971	INJURY DUE TO LEGAL INTERVENTION BY EXPLOSIVES
E972	INJURY DUE TO LEGAL INTERVENTION BY GAS
E973	INJURY DUE TO LEGAL INTERVENTION BY BLUNT OBJECT
E974	INJURY DUE TO LEGAL INTERVENTION BY CUTTING AND PIERCING INSTRUMENT
E975	INJURY DUE TO LEGAL INTERVENTION BY OTHER SPECIFIED MEANS
E976	INJURY DUE TO LEGAL INTERVENTION BY UNSPECIFIED MEANS
E977	LATE EFFECTS OF INJURIES DUE TO LEGAL INTERVENTION
E978	LEGAL EXECUTION
E980	POISONING BY SOLID OR LIQUID SUBSTANCES, UNDETERMINED WHETHER ACCIDENTALLY OR PURPOSELY INFLICTED
E981	POISONING BY GASES IN DOMESTIC USE, UNDETERMINED WHETHER ACCIDENTALLY OR PURPOSELY INFLICTED
E982	POISONING BY OTHER GASES, UNDETERMINED WHETHER ACCIDENTALLY OR PURPOSELY INFLICTED

E983	HANGING, STRANGULATION, OR SUFFOCATION, UNDETERMINED WHETHER ACCIDENTALLY OR PURPOSELY INFLICTED
E984	SUBMERSION [DROWNING] UNDETERMINED WHETHER ACCIDENTALLY OR PURPOSELY INFLICTED
E985	INJURY BY FIREARMS, AIR GUNS AND EXPLOSIVES, UNDETERMINED WHETHER ACCIDENTALLY OR PURPOSELY INFLICTED
E986	INJURY BY CUTTING AND PIERCING INSTRUMENTS, UNDETERMINED WHETHER ACCIDENTALLY OR PURPOSELY INFLICTED
E987	FALLING FROM HIGH PLACE, UNDETERMINED WHETHER ACCIDENTALLY OR PURPOSELY INFLICTED
E988	INJURY BY OTHER AND UNSPECIFIED MEANS, UNDETERMINED WHETHER ACCIDENTALLY OR PURPOSELY INFLICTED
E989	LATE EFFECTS OF INJURY, UNDETERMINED WHETHER ACCIDENTALLY OR PURPOSELY INFLICTED
E990	INJURY DUE TO WAR OPERATIONS BY FIRES AND CONFLAGRATIONS
E991	INJURY DUE TO WAR OPERATIONS BY BULLETS AND FRAGMENTS
E992	INJURY DUE TO WAR OPERATIONS BY EXPLOSION OF MARINE WEAPONS
E993	INJURY DUE TO WAR OPERATIONS BY OTHER EXPLOSION
E994	INJURY DUE TO WAR OPERATIONS BY DESTRUCTION OF AIRCRAFT
E995	INJURY DUE TO WAR OPERATIONS BY OTHER AND UNSPECIFIED FORMS OF CONVENTIONAL WARFARE
E996	INJURY DUE TO WAR OPERATIONS BY NUCLEAR WEAPONS
E997	INJURY DUE TO WAR OPERATIONS BY OTHER FORMS OF UNCONVENTIONAL WARFARE
E998	INJURY DUE TO WAR OPERATIONS BUT OCCURRING AFTER CESSATION OF HOSTILITIES
E999	LATE EFFECT OF INJURY DUE TO WAR OPERATIONS

Diagnostic Related Groups (DRGs):

002	CRANIOTOMY FOR TRAUMA, AGE GREATER THAN 17
027	TRAUMATIC STUPOR AND COMA, COMA GREATER THAN ONE HOUR
028	TRAUMATIC STUPOR AND COMA, COMA LESS THAN ONE HOUR, AGE GREATER THAN 17 WITH CC
029	TRAUMATIC STUPOR AND COMA, COMA LESS THAN ONE HOUR, AGE GREATER THAN 17 WITHOUT CC
031	CONCUSSION, AGE GREATER THAN 17 WITH CC
032	CONCUSSION, AGE GREATER THAN 17 WITHOUT CC
072	NASAL TRAUMA AND DEFORMITY
083	MAJOR CHEST TRAUMA WITH CC
084	MAJOR CHEST TRAUMA WITHOUT CC
235	FRACTURES OF FEMUR
236	FRACTURE OF HIP AND PELVIS
237	SPRAINS, STRAINS AND DISLOCATIONS OF HIP, PELVIS AND THIGH
440	WOUND DEBRIDEMENTS FOR INJURIES
441	HAND PROCEDURES FOR INJURIES
442	OTHER OR PROCEDURES FOR INJURIES WITH CC
443	OTHER OR PROCEDURES FOR INJURIES WITHOUT CC
444	TRAUMATIC INJURY, AGE GREATER THAN 17 WITH CC
445	TRAUMATIC INJURY, AGE GREATER THAN 17 WITHOUT CC
446	TRAUMATIC INJURY, AGE 0-17
447	ALLERGIC REACTIONS, AGE GREATER THAN 17
448	ALLERGIC REACTIONS, AGE 0-17
449	POISONING AND TOXIC EFFECTS OF DRUGS, AGE GREATER THAN 17 WITH CC
450	POISONING AND TOXIC EFFECTS OF DRUGS, AGE GREATER THAN 17 WITHOUT CC
451	POISONING AND TOXIC EFFECTS OF DRUGS, AGE 0-17
452	COMPLICATIONS OF TREATMENT WITH CC
453	COMPLICATIONS OF TREATMENT WITHOUT CC
454	OTHER INJURY, POISONING AND TOXIC EFFECT DIAGNOSES WITH CC
455	OTHER INJURY, POISONING AND TOXIC EFFECT DIAGNOSES WITHOUT CC
460	NO LONGER VALID
484	CRANIOTOMY FOR MULTIPLE SIGNIFICANT TRAUMA
485	LIMB REATTACHMENT, HIP AND FEMUR PROCEDURES FOR MULTIPLE SIGNIFICANT TRAUMA
486	OTHER OR PROCEDURES FOR MULTIPLE SIGNIFICANT TRAUMA
487	OTHER MULTIPLE SIGNIFICANT TRAUMAS
491	MAJOR JOINT AND LIMB REATTACHMENT PROCEDURES OF UPPER EXTREMITY

Vaginal delivery

Diagnostic Related Groups (DRGs):

372	VAGINAL DELIVERY WITH COMPLICATING DIAGNOSES
373	VAGINAL DELIVERY WITHOUT COMPLICATING DIAGNOSES
374	VAGINAL DELIVERY WITH STERILIZATION AND/OR D AND C
375	VAGINAL DELIVERY WITH OR PROCEDURE EXCEPT STERILIZATION AND/OR D AND C

FTR-FAILURE TO RESCUE

FTR-Acute Renal Failure

ICD-9-CM diagnosis codes (all 4th and 5th digits included):

ACUTE RENAL FAILURE:

584.5	WITH LESION OF TUBULAR NECROSIS
584.6	WITH LESION OF RENAL CORTICAL NECROSIS
584.7	WITH LESION OF RENAL MEDULLARY [PAPILLARY] NECROSIS
584.8	WITH OTHER SPECIFIED PATHOLOGICAL LESION IN KIDNEY
584.9	ACUTE RENAL FAILURE, UNSPECIFIED

ICD-9-CM diagnosis codes exclude:

PRINCIPAL DIAGNOSIS OF **[AMI]**, **[CARDIAC ARRHYTHMIA]**, **[SHOCK]** OR **[CARDIAC ARREST]**, **[HEMORRHAGE]**

FTR-DVT/PE

Include
ICD-9-CM diagnosis codes:

PHLEBITIS AND THROMBOPHLEBITIS OF:
451.11 FEMORAL VEIN (DEEP) (SUPERFICIAL)
451.19 OTHER
451.2 LOWER EXTREMITIES
451.81 ILIAC VEIN
451.9 UNSPECIFIED SITE

ACUTE PULMONARY HEART DISEASE:
415.11 IATROGENIC PULMONARY EMBOLISM AND INFARCTION
415.19 OTHER

453.8 OTHER VENOUS EMBOLISM AND THROMBOSIS OF OTHER SPECIFIED VEINS
453.9 OTHER VENOUS EMBOLISM AND THROMBOSIS OF UNSPECIFIED SITE

Exclude
ICD-9-CM codes:

PRINCIPAL DIAGNOSIS OF **[DEEP VEIN THROMBOSIS]**

FTR-Pneumonia

Include
ICD-9-CM diagnosis codes:

507.0 DUE TO INHALATION OF FOOD OR VOMITUS
514 PULMONARY CONGESTION AND HYPOSTASIS

OTHER BACTERIAL PNEUMONIA:
482.0 PNEUMONIA DUE TO KLEBSIELLA PNEUMONIAE
482.1 PNEUMONIA DUE TO PSEUDOMONAS
482.2 PNEUMONIA DUE TO HEMOPHILUS INFLUENZAE [H. INFLUENZAE]
482.30 PNEUMONIA DUE TO STREPTOCOCCUS - STREPTOCOCCUS, UNSPECIFIED
482.31 PNEUMONIA DUE TO STREPTOCOCCUS - GROUP A
482.32 PNEUMONIA DUE TO STREPTOCOCCUS - GROUP B
482.39 PNEUMONIA DUE TO STREPTOCOCCUS - OTHER STREPTOCOCCUS
482.40 PNEUMONIA DUE TO STAPHYLOCOCCUS -PNEUMONIA DUE TO STAPHYLOCOCCUS, UNSPECIFIED
482.41 PNEUMONIA DUE TO STAPHYLOCOCCUS -PNEUMONIA DUE TO STAPHYLOCCOCCUS AUREUS
482.49 PNEUMONIA DUE TO STAPHYLOCOCCUS -OTHER STAPHYLOCOCCUS PNEUMONIA
482.81 PNEUMONIA DUE TO OTHER SPECIFIED BACTERIA -ANAEROBES
482.82 PNEUMONIA DUE TO OTHER SPECIFIED BACTERIA - ESCHERICHIA COLI [E COLI]
482.83 PNEUMONIA DUE TO OTHER SPECIFIED BACTERIA - OTHER GRAM-NEGATIVE BACTERIA
482.84 PNEUMONIA DUE TO OTHER SPECIFIED BACTERIA - LEGIONNAIRES' DISEASE
482.89 PNEUMONIA DUE TO OTHER SPECIFIED BACTERIA - OTHER SPECIFIED BACTERIA
482.9 BACTERIAL PNEUMONIA UNSPECIFIED
485 BRONCHOPNEUMONIA, ORGANISM UNSPECIFIED
486 PNEUMONIA, ORGANISM UNSPECIFIED

Exclude
ICD-9-CM principal diagnosis codes:

480 VIRAL PNEUMONIA
481 PNEUMOCOCCAL PNEUMONIA [STREPTOCOCCUS PNEUMONIAE PNEUMONIA]
482 OTHER BACTERIAL PNEUMONIA
483 PNEUMONIA DUE TO OTHER SPECIFIED ORGANISM
484 PNEUMONIA IN INFECTIOUS DISEASES CLASSIFIED ELSEWHERE
485 BRONCHOPNEUMONIA, ORGANISM UNSPECIFIED
486 PNEUMONIA, ORGANISM UNSPECIFIED
487 INFLUENZA
507.0 DUE TO INHALATION OF FOOD OR VOMITUS
514 PULMONARY CONGESTION AND HYPOSTASIS
997.3 RESPIRATORY COMPLICATIONS
MDC 4 DISEASES AND DISORDERS OF THE RESPIRATORY SYSTEM

ICD-9-CM secondary diagnosis codes:

480 VIRAL PNEUMONIA
481 PNEUMOCOCCAL PNEUMONIA [STREPTOCOCCUS PNEUMONIAE PNEUMONIA]
483 PNEUMONIA DUE TO OTHER SPECIFIED ORGANISM
484 PNEUMONIA IN INFECTIOUS DISEASES CLASSIFIED ELSEWHERE
487 INFLUENZA

[IMMUNOCOMPROMISED] STATES

FTR-Sepsis

Include
ICD-9-CM diagnosis codes:

790.7 OTHER NONSPESIFIC FINDINGS ON EXAMINATION OF BLOOD

SEPTICEMIA:
038.0 STREPTOCOCCAL SEPTICEMIA
038.1X STAPHYLOCOCCAL SEPTICEMIA
038.2 PNEUMOCOCCAL SEPTICEMIA [STREPTOCOCCUS PNEUMONIAE SEPTICEMIA]
038.3 SEPTICEMIA DUE TO ANAEROBES
038.40 SEPTICEMIA DUE TO GRAM NEGATIVE ORGANISM, UNSPECIFIED
038.41 HEMOPHILUS INFLUENZE [H. INFLUENZAE]
038.42 ESCHERICHIA COLI [E COLI]
038.43 PSEUDOMONAS
038.44 SERRATIA
038.49 OTHER
038.8 OTHER SPECIFIED SEPTICEMIAS
038.9 UNSPECIFIED SEPTICEMIA

Exclude
ICD-9-CM diagnosis codes

[IMMUNOCOMPROMISED]
LOS>3 DAYS
[INFECTION]

FTR-Shock or cardiac arrest

Include
ICD-9-CM diagnosis codes:

995.0 OTHER ANAPHYLACTIC SHOCK
995.4 SHOCK DUE TO ANESTHESIA
998.0 POSTOPERATIVE SHOCK

SHOCK DURING OR FOLLOWING LABOR AND DELIVERY:
669.10 SHOCK DURING OR FOLLOWING LABOR AND DELIVERY - UNSPECIFIED AS TO EPISODE OF CARE OR NOT APPLICABLE
669.11 SHOCK DURING OR FOLLOWING LABOR AND DELIVERY - DELIVERED, WITH OR WITHOUT MENTION OF ANTEPARTUME CONDITION
669.12 SHOCK DURING OR FOLLOWING LABOR AND DELIVERY - DELIVERED, WITH MENTION OF POSTPARTUM COMPLICATION
669.13 SHOCK DURING OR FOLLOWING LABOR AND DELIVERY - ANTEPARTUM CONDITION OR COMPLICATION
669.14 SHOCK DURING OR FOLLOWING LABOR AND DELIVERY - POSTPARTUM CONDITION OR COMPLICATION

999.4 ANAPHYLACTIC SHOCK DUE TO SERUM
427.5 CARDIAC ARREST
785.5 SHOCK WITHOUT MENTION OF TRAUMA
785.50 SHOCK, UNSPECIFIED
785.51 CARDIOGENIC SHOCK
785.59 SHOCK WITHOUT MENTION OF TRAUMA- OTHER
799.1 RESPIRATORY ARREST

ICD-9-CM procedure codes:

93.93 NONMECHANICAL METHODS OF RESUSCITATION
99.60 CARDIOPULMONARY RESUSCITATION, NOS
99.63 CLOSED CHEST CARDIAC MASSAGE

Exclude:
ICD-9-CM diagnosis codes:

MDC 4 DISEASES AND DISORDERS OF THE RESPIRATORY SYSTEM
MDC 5 DISEASES AND DISORDERS OF THE CIRCULATORY SYSTEM

Exclude principal diagnosis of **[hemorrhage]** or **[trauma]**

FTR-GI hemorrhage/acute ulcer

Include:
ICD-9-CM diagnosis codes:

456.0 ESOPHAGEAL VARICES WITH BLEEDING
546.20 ESOPHAGEAL VARICES IN DISEASES CLASSIFIED ELSEWHERE WITH BLEEDING

GASTRIC ULCER:
531.30 ACUTE WITHOUT MENTION OF HEMORRHAGE OR PERFORATION – WITHOUT MENTION OF OBSTRUCTION
531.31 ACUTE WITHOUT MENTION OF HEMORRHAGE OR PERFORATION - WITH OBSTRUCTION
531.90 UNSPECIFIED AS ACUTE OR CHRONIC, WITHOUT MENTION OF HEMORRHAGE OR PERFORATION - WITHOUT MENTION OF OBSTRUCTION
531.91 UNSPECIFIED AS ACUTE OR CHRONIC, WITHOUT MENTION OF HEMORRHAGE OR PERFORATION - WITH OBSTRUCTION

DUODENAL ULCER:
532.30 ACUTE WITHOUT MENTION OF HEMORRHAGE OR PERFORATION - WTHOUT MENTION OF OBSTRUCTION
532.31 ACUTE WITHOUT MENTION OF HEMORRHAGE OR PERFORATION - WITH OBSTRUCTION
532.90 UNSPECIFIED AS ACUTE OR CHRONIC, WITHOUT MENTION OF HEMORRHAGE OR PERFORATION - WITHOUT MENTION OF OBSTRUCTION
532.91 UNSPECIFIED AS ACUTE OR CHRONIC, WITHOUT MENTION OF HEMORRHAGE OR PERFORATION - WITH OBSTRUCTION

PEPTIC ULCER:
533.30 SITE UNSPECIFIED ACUTE WITHOUT MENTION OF HEMORRHAGE AND PERFFORATION - WITHOUT MENTION OF OBSTRUCTION
533.31 SITE UNSPECIFIED ACUTE WITHOUT MENTION OF HEMORRHAGE AND PERFORATION - WITH OBSTRUCTION
533.90 SITE UNSPECIFIED UNSPECIFIED AS ACUTE OR CHRONIC, WITHOUT MENTION OF HEMORRHAGE OR PERFORATION - WITHOUT MENTION OF OBSTRUCTION
533.91 UNSPECIFIED AS ACUTE OR CHRONIC, WITHOUT MENTION OF HEMORRHAGE OR PERFORATION - WITH OBSTRUCTION

GASTROJEJUNAL ULCER:
534.30 ACUTE WITHOUT MENTION OF HEMORRHAGE OR PERFORATION - WITHOUT MENTION OF OBSTRUCTION
534.31 ACUTE WITHOUT MENTION OF HEMORRHAGE OR PERFORATION - WITH OBSTRUCTION
534.90 UNSPECIFIED AS ACUTE OR CHRONIC, WITHOUT MENTION OF HEMORRHAGE OR PERFORATION - WITHOUT MENTION OF OBSTRUCTION
534.91 UNSPECIFIED AS ACUTE OR CHRONIC, WITHOUT MENTION OF HEMORRHAGE OR PERFORATION - WITH OBSTRUCTION

530.7 GASTROESOPHAGEAL LACERATION-HEMORRHAGE SYNDROME
530.82 ESOPHAGEAL HEMORRHAGE

GASTRIC ULCER:
531.00 ACUTE WITH HEMORRHAGE - WITHOUT MENTION OF OBSTRUCTION
531.01 ACUTE WITH HEMORRHAGE - WITH OBSTRUCTION
531.10 ACUTE WITH PERFORATION - WITHOUT MENTION OF OBSTRUCTION

531.11 ACUTE WITH PERFORATION - WITH OBSTRUCTION
531.20 ACUTE WITH HEMORRHAGE AND PERFORATION - WITHOUT MENTION OF OBSTRUCTION
531.21 ACUTE WITH HEMORRHAGE AND PERFORATION - WITH OBSTRUCTION

DUODENAL ULCER:
532.00 ACUTE WITH HEMORRHAGE - WITHOUT MENTION OF OBSTRUCTION
532.01 ACUTE WITH HEMORRHAGE - WITH OBSTRUCTION
532.10 ACUTE WITH PERFORATION - WITHOUT MENTION OF OBSTRUCTION
532.11 ACUTE WITH PERFORATION - WITH OBSTRUCTION
532.20 ACUTE WITH HEMORRHAGE AND PERFORATION - WITHOUT MENTION OF OBSTRUCTION
532.21 ACUTE WITH HEMORRHAGE AND PERFORATION - WITH OBSTRUCTION

PEPTIC ULCER:
533.00 SITE UNSPECIFIED ACUTE WITH HEMORRHAGE - WITHOUT MENTION OF OBSTRUCTION
533.01 SITE UNSPECIFIED ACUTE WITH HEMORRHAGE - WITH OBSTRUCTION
533.10 SITE UNSPECIFIED ACUTE WITH PERFORATION - WITHOUT MENTION OF OBSTRUCTION
533.11 SITE UNSPECIFIED ACUTE WITH - PERFORATION WITH OBSTRUCTION
533.20 SITE UNSPECIFIED ACUTE WITH HEMORRHAGE AND PERFORATION - WITHOUT MENTION OF OBSTRUCTION
533.21 SITE UNSPECIFIED ACUTE WITH HEMORRHAGE AND PERFORATION - WITHOUT MENTION OF OBSTRUCTION

GASTROJEJUNAL ULCER:
534.00 ACUTE WITH HEMORRHAGE -WITHOUT MENTION OF OBSTRUCTION
534.01 ACUTE WITH HEMORRHAGE - WITH OBSTRUCTION
534.10 ACUTE WITH PERFORATION - WITHOUT MENTION OF OBSTRUCTION
534.11 ACUTE WITH PERFORATION – WITH OBSTRUCTION
534.20 ACUTE WITH HEMORRHAGE AND PERFORATION - WITHOUT MENTION OF OBSTRUCTION
534.21 ACUTE WITH HEMORRHAGE AND PERFORATION - WITH OBSTRUCTION

GASTRITIS AND DUODENITIS:
535.01 ACUTE GASTRITIS - WITH HEMORRHAGE
535.11 ATROPHIC GASTRITIS - WITH HEMORRHAGE
535.21 GASTRIC MUCOSAL HYPERTROPHY - WITH HEMORRHAGE
535.31 ALCOHOLIC GASTRITIS - WITH HEMORRHAGE
535.41 OTHER SPECIFIED GASTRITIS - WITH HEMORRHAGE
535.51 UNSPECIFIED GASTRITIS AND GASTRODUODENITIS - WITH HEMORRHAGE
535.61 DUODENITIS - WITH HEMORRHAGE

537.83 ANGIODYSPLASIA OF STOMACH AND DUODENUM WITH HEMORRHAGE
562.02 DIVERTICULOSIS OF SMALL INTESTINE WITH HEMORRHAGE
562.03 DIVERTICULITIS OF SMALL INTESTINE WITH HEMORRHAGE
562.12 DIVERTICULOSIS OF COLON WITH HEMORRHAGE
562.13 DIVERTICULITIS OF COLON WITH HEMORRHAGE
569.3 HEMORRHAGE OF RECTUM AND ANUS
569.85 ANGIODYSPLASIA OF INTESTINE WITH HEMORRHAGE
578.0 HEMATEMESIS
578.1 BLOOD IN STOOL
578.9 HEMORRHAGE OF GASTROINTESTINAL TRACT, UNSPECIFIED

Exclude

MDC 6 DISEASES AND DISORDERS OF THE DIGESTIVE SYSTEM
MDC 7 DISEASES AND DISORDERS OF THE HEPATOBILIARY SYSTEM AND PANCREAS

ICD-9-CM principal diagnosis codes:

280.0 SECONDARY TO BLOOD LOSS [CHRONIC]
285.1 ACUTE POSTHEMORRHAGIC ANEMIA

TRAUMA OR BURN OR ALCHOLISM

Section 2A. Accepted Area-Level Indicator Definitions

Items in bold and brackets are fully specified in the ICD-9-CM and DRG listings in Section 1B, "Coding Details for Accepted Hospital-Level Indicators."

Indicator Name	Definition and Numerator	Denominator
• Foreign body left in during procedure	Discharges with ICD-9-CM codes for **[foreign body left in during procedure]** in any diagnosis field per 100 surgical discharges.	All **[surgical]** and **[medical]** discharges.
• Iatrogenic pneumothorax	Discharges with ICD-9-CM code of 512.1 in any diagnosis field per 100 discharges.	All discharges. Exclude patients with any diagnosis of **[trauma].** Exclude patients with any code indicating **[thoracic surgery]** or **[lung or pleural biopsy]** or assigned to **[cardiac surgery].**
• Infection due to medical care	Discharges with ICD-9-CM code of 999.3 or 996.62 in any diagnosis field per 100 discharges.	All **[medical]** and **[surgical]** discharges. Excludes patients with any diagnosis code for **[immunocompromised]** state or **[cancer]**.
• Technical difficulty with medical care	Discharges with ICD-9-CM code denoting an **[technical difficulty]** (e.g. accidental cut, puncture, perforation or laceration during a procedure) in any diagnosis field per 100 discharges.	All **[medical]** and **[surgical]** discharges. Exclude all obstetric admissions (MDC 14 and 15).
• Transfusion reaction	Discharges with ICD-9-CM codes for **[transfusion reaction]** in any diagnosis field per 100 discharges.	All **[medical]** and **[surgical]** discharges.
• Postoperative wound dehiscence	Discharges with ICD-9-CM codes for reclosure of postoperative disruption of abdominal wall (54.61) in any procedure field per 100 discharges.	All **[abdominopelvic]** surgical discharges. Exclude all obstetric admissions (MDC 14 and 15).

Section 3A. Experimental Provider-Level Indicator Definitions

Items in bold and brackets are fully specified in Section 3B, "Coding Details for Experimental Indicators," after this table.

INDICATOR NAME	DEFINITION and NUMERATOR	POPULATION AT RISK (DENOMINATOR)
• Aspiration pneumonia	Discharges with ICD-9-CM codes for **[aspiration pneumonia]** in any secondary diagnosis field per 100 surgical discharges.	All **[elective] [surgical]** discharges. Exclude patients with a principal diagnosis of **[seizure]**, **[trauma]**, **[drug overdose]**, or **[poisoning]**. Exclude all obstetric admissions (MDC 14 and 15).
• CABG following PTCA	Discharges with ICD-9-CM codes for **[CABG]** in any procedure field per 100 discharges with PTCA in any procedure field. CABG must occur on the same day or the day after the PTCA procedure.	All discharges with ICD-9-CM code for **[PTCA]** in any procedure field.
• Decubitus ulcer in high risk patients	Discharges with ICD-9-CM code for decubitus ulcer (707.0) in any secondary diagnosis code per 100 at risk population.	All patients with any diagnosis of **[hemiplegia, paraplegia, or quadriplagia]** or patients admitted from a **[long term care facility]**. Exclude patients with a length of stay less than or equal to 4 days. Exclude patients with diseases and disorders of the skin, subcutaneous tissue and breast (MDC 9).
• In-hospital fractures possibly related to falls	Discharges with ICD-9-CM code for **[fracture]** in any secondary diagnosis field per 100 surgical discharges.	All **[surgical]** discharges. Exclude all patients with diseases and disorders of the musculoskeletal system and connective tissue (MDC 8). Excludes patients with principal diagnosis codes for **[seizure], [syncope], [stroke],**

INDICATOR NAME	DEFINITION and NUMERATOR	POPULATION AT RISK (DENOMINATOR)
		[coma], [cardiac arrest], [anoxic brain injury], [poisoning], [delirium or other psychoses], [trauma], [minor trauma and/or physical abuse], indication of **[alcohol or drug abuse]**, or **[self-inflicted injury].** Exclude patients with any diagnosis of **[metastatic cancer], [lymphoid malignancy]** or **[bone malignancy]**.
• Intraoperative nerve compression injuries	Discharges with ICD-9-CM code for **[nerve compression injuries]** AND a diagnosis code of 997.09 in any secondary diagnosis field per 100 surgical discharges.	All **[surgical]** discharges. Exclude patients with a principal diagnosis of **[trauma].** Exclude patients with a principal diagnosis of **[disorders of the peripheral nervous system]** or **[dorsopathies].**
• Malignant hyperthermia	Discharges with ICD-9-CM codes for malignant hyperthermia (995.86) in any diagnosis field per 100 surgical discharges.	All **[surgical]** discharges. Exclude all obstetric admissions (MDC 14 and 15).
• Postoperative iatrogenic complications - cardiac system	Discharges with ICD-9-CM codes of 997.1 in any secondary diagnosis field per 100 surgical discharges.	All **[surgical]** discharges. Exclude all obstetric admissions (MDC 14 and 15).
• Postoperative iatrogenic complications - nervous system	Discharges with ICD-9-CM codes of **[iatrogenic nervous system complications]** in any secondary diagnosis field per 100 surgical discharges.	All **[surgical]** discharges. Exclude all obstetric admissions (MDC 14 and 15).
• Postoperative acute myocardial infarction	Discharges with ICD-9-CM codes for **[Acute Myocardial Infarction]** in any secondary diagnosis field per 100 non-cardiac surgical discharges.	**[Elective]**, **[surgical]** discharges. Exclude patients undergoing **[cardiac surgery]**. Exclude all obstetric admissions (MDC 14 and 15).

INDICATOR NAME	DEFINITION and NUMERATOR	POPULATION AT RISK (DENOMINATOR)
• Reopening of a surgical site	Discharges with ICD-9-CM codes for **[reopening of a surgical site]** in any secondary procedure field per 100 surgical discharges. Reopening of surgical site must occur at least one day after the principal procedure. Revision of vascular procedure 39.49 must occur within 24 hours of principal procedure.	All **[surgical]** discharges.
• Suture of laceration	Discharges with ICD-9-CM codes for **[suture of laceration]** in any secondary procedure field per 100 surgical discharges. Suture of laceration must occur on the same day or after the principal procedure.	All **[surgical]** discharges. Exclude patients with any diagnosis code for **[foreign body]** or **[trauma].** Exclude all obstetric admissions (MDC 14 and 15).
• Other obstetric complication of delivery	Discharges with ICD-9-CM codes for **[other obstetrical complications]** in any diagnosis field per 100 deliveries.	All **[deliveries]**.
• Obstetric wound complications - cesarean section delivery	Discharges with ICD-9-CM codes for **[cesarean wound complications]** in any diagnosis field per 100 deliveries.	All **[cesarean delivery]** discharges.
• Obstetric wound complications - vaginal delivery	Discharges with ICD-9-CM codes for **[perineal wound complications]** in any diagnosis field per 100 deliveries.	All **[vaginal delivery DRGs].**
• Post-partum urinary tract infection	Discharges with ICD-9-CM code of 646.62 or 646.64 in any diagnosis per 100 deliveries.	All **([cesarean delivery]** and **[vaginal delivery] discharges)**
• Third or fourth degree obstetric lacerations	Discharges with ICD-9-CM codes for **[3rd or fourth degree lacerations]** in any diagnosis field per 100 vaginal deliveries.	All **[vaginal deliveries during stay].** Exclude patients with a procedure code for **[cesarean section delivery]** or diagnosis code for **[abortion].**
• Uterine rupture	Discharges with ICD-9-CM codes for **[rupture of uterus during or after labor]** in any diagnosis field per 100 deliveries with trial of labor.	All deliveries with a **[trial of labor].**

Section 3B. Coding Details for Experimental Indicators

Acute myocardial infarction

ICD-9-CM diagnosis codes:

410.00	AMI OF ANTEROLATERAL WALL – EPISODE OF CARE UNSPECIFIED
410.01	AMI OF ANTEROLATERAL WALL - INITIAL EPISODE OF CARE
410.10	AMI OF OTHER ANTERIOR WALL – EPISODE OF CARE UNSPECIFIED
410.11	AMI OF OTHER ANTERIOR WALL – INITIAL EPISODE OF CARE
410.20	AMI OF INFEROLATERAL WALL – EPISODE OF CARE UNSPECIFIED
410.21	AMI OF INFEROLATERAL WALL – INITIAL EPISODE OF CARE
410.30	AMI OF INFEROPOSTERIOR WALL – EPISODE OF CARE UNSPECIFIED
410.31	AMI OF INFEROPOSTERIOR WALL — INITIAL EPISODE OF CARE
410.40	AMI OF INFERIOR WALL - EPISODE OF CARE UNSPECIFIED
410.41	AMI OF INFERIOR WALL - INITIAL EPISODE OF CARE
410.50	AMI OF OTHER LATERAL WALL - EPISODE OF CARE UNSPECIFIED
410.51	AMI OF OTHER LATERAL WALL - INITIAL EPISODE OF CARE
410.60	AMI TRUE POSTERIOR WALL INFARCTION - EPISODE OF CARE UNSPECIFIED
410.61	AMI TRUE POSTERIOR WALL INFARCTION - INITIAL EPISODE OF CARE
410.70	AMI SUBENDOCARDIAL INFARCTION - EPISODE OF CARE UNSPECIFIED
410.71	AMI SUBENDOCARDIAL INFARCTION - INITIAL EPISODE OF CARE
410.80	AMI OF OTHER SPECIFIED SITES - EPISODE OF CARE UNSPECIFIED
410.81	AMI OF OTHER SPECIFIED SITES - - INITIAL EPISODE OF CARE
410.90	AMI UNSPECIFIED SITE - EPISODE OF CARE UNSPECIFIED
410.91	AMI UNSPECIFIED SITE - INITIAL EPISODE OF CARE

Alcohol or drug abuse

ICD-9-CM diagnosis codes:

(includes all 4th and 5th digits)

291	ALCOHOLIC PSYCHOSES
292	DRUG PSYCHOSES
303	ALCOHOL DEPENDENCE SYNDROME
304	DRUG DEPENDENCE
305.0	ALCOHOL ABUSE
305.2	CANNABIS ABUSE
305.3	HALLUCINOGEN ABUSE
305.4	BARBITURATE AND SIMILARLY ACTING SEDATIVE OR HYPNOTIC ABUSE
305.5	OPIOID ABUSE
305.6	COCAINE ABUSE
305.7	AMPHETAMINE OR RELATED ACTING SYMPATHOMIMETIC ABUSE
305.8	ANTIDEPRESSANT TYPE ABUSE
305.9	OTHER MIXED OR UNSPECIFIED DRUG ABUSE
980	TOXIC EFFECT OF ALCOHOL
981	TOXIC EFFECT OF PETROLEUM PRODUCTS
982	TOXIC EFFECT OF SOLVENTS OTHER THAN PETROLEUM-BASED
983	TOXIC EFFECT OF CORROSIVE AROMATICS, ACIDS, AND CAUSTIC ALKALIS
984	TOXIC EFFECT OF LEAD AND ITS COMPOUNDS (INCLUDING FUMES)
985	TOXIC EFFECT OF OTHER METALS
986	TOXIC EFFECT OF CARBON MONOXIDE
987	TOXIC EFFECT OF OTHER GASES, FUMES, OR VAPORS
988	TOXIC EFFECT OF NOXIOUS SUBSTANCES EATEN AS FOOD
989	TOXIC EFFECT OF OTHER SUBSTANCES, CHIEFLY NONMEDICINAL AS TO SOURCE

Aspiration pneumonia

ICD-9-CM diagnosis codes:

507.0 PNEUMONITIS DUE TO SOLIDS AND LIQUIDS, DUE TO INHALATION OF FOOD OR VOMITUS
E911 INHALATION AND INGESTION OF FOOD CAUSING OBSTRUCTION OF RESPIRATORY TRACT OR SUFFOCATION
E912 INHALATION AND INGESTION OF OTHER OBJECT CAUSING OBSTRUCTION OF RESPIRATORY TRACT OR SUFFOCATION

CABG

ICD-9-CM procedure codes

36.10 BYPASS ANASTOMOSIS FOR HEART REVASCULARIZATION
36.11 OPEN HEART VALVULOPLASTY WITHOUT REPLACEMENT
36.12 AORTOCORONARY BYPASS OF TWO CORONARY ARTERIES
36.13 AORTOCORONARY BYPASS OF THREE CORONARY ARTERIES
36.14 AORTOCORONARY BYPASS OF FOUR OR MORE CORONARY ARTERIES
36.15 SINGLE INTERNAL MAMMARY-CORONARY ARTERY BYPASS
36.16 BYPASS ANASTOMOSIS FOR HEART REVASCULARIZATION, DOUBLE INTERNAL MAMMARY-CORONARY ARTERY BYPASS
36.17 ABDOMINAL-CORONARY ARTERY BYPASS
36.19 OTHER BYPASS ANASTOMOSIS FOR HEART REVASCULARIZATION

Cardiac surgery

Diagnostic Related Groups (DRGs):

103 HEART TRANSPLANT
104 CARDIAC VALVE AND OTHER MAJOR CARDIOTHORACIC PROCEDURES WITH CARDIAC CATHETERIZATION
105 CARDIAC VALVE AND OTHER MAJOR CARDIOTHORACIC PROCEDURES WITHOUT CARDIAC CATHETERIZATION
106 CORONARY BYPASS WITH PTCA
107 CORONARY BYPASS WITH CARDIAC CATHETERIZATION
108 OTHER CARDIOTHORACIC PROCEDURES
110 MAJOR CARDIOVASCULAR PROCEDURES WITH CC
111 MAJOR CARDIOVASCULAR PROCEDURES WITHOUT CC
112 PERCUTANEOUS CARDIOVASCULAR PROCEDURES

Cesarean section delivery

ICD-9-CM procedure codes:

74.0 CLASSICAL CESAREAN SECTION
74.1 LOW CERVICAL CESAREAN SECTION
74.2 EXTRAPERITONEAL CESAREAN SECTION
74.4 CESAREAN SECTION OF OTHER SPECIFIED TYPE
74.99 OTHER CESAREAN SECTION OF UNSPECIFIED TYPE

Cesarean section wound complications

ICD-9-CM diagnosis codes:

67410 DISRUPTION OF CESAREAN WOUND-UNSPECIFIED AS TO EPISODE OF CARE OR NOT APPLICABLE
67412 DISRUPTION OF CESAREAN WOUND-DELIVERED, WITH MENTION OF POSTPARTUM COMPLICATION
67414 DISRUPTION OF CESAREAN WOUND-POSTPARTUM CONDITION OR COMPLICATION
67430 OTHER COMPLICATIONS OF OBSTETRICAL SURGICAL WOUNDS-UNSPECIFIED AS TO EPISODE OF CARE OR NOT APPLICABLE
67432 OTHER COMPLICATIONS OF OBSTETRICAL SURGICAL WOUNDS-DELIVERED, WITH MENTION OF POSTPARTUM COMPLICATION
67434 OTHER COMPLICATIONS OF OBSTETRICAL SURGICAL WOUNDS-POSTPARTUM CONDITION OR COMPLICATION

Deliveries

Diagnostic Related Groups(DRGs):

370 CESAREAN SECTION WITH CC
371 CESAREAN SECTION WITHOUT CC
372 VAGINAL DELIVERY WITH COMPLICATING DIAGNOSES
373 VAGINAL DELIVERY WITHOUT COMPLICATING DIAGNOSES
374 VAGINAL DELIVERY WITH STERILIZATION AND/OR D AND C
375 VAGINAL DELIVERY WITH OR PROCEDURE EXCEPT STERILIZATION AND/OR D AND C

Disorders of the peripheral nervous system

ICD-9-CM diagnosis codes:

350 TRIGEMINAL NERVE DISORDERS
351 FACIAL NERVE DISORDERS
352 DISORDERS OF OTHER CRANIAL NERVES
353 NERVE ROOT AND PLEXUS DISORDERS
354 MONOEURITIS OF UPPER LIMB AND MONOEURITIS MULTIPLEX
355 MONOEURITIS OF LOWER LIMB
356 HEREDITARY AND IDIOPATHIC PERIPHERAL NEUROPATHY
357 INFLAMMATORY AND TOXIC NEUROPATHY
358 MYONEURAL DISORDERS
359 MUSCULAR DYSTROPHIES AND OTHER MYOPATHIES

Dorsopathies

ICD-9-CM diagnosis codes:

720 ANKYLOSING SPONDYLITIS AND OTHER INFLAMMATORY SPONDYLOPATHIES
721 SPONDYLOSIS AND ALLIED DISORDERS
722 INTERVERTEBRAL DISC DISORDERS
723 OTHER DISORDERS OF CERVICAL REGION
724 OTHER AND UNSPECIFIED DISORDERS OF BACK

Drug overdose

ICD-9-CM diagnosis codes:

291 ALCOHOLIC PSYCHOSES
292 DRUG PSYCHOSES
303.00 ACUTE ALCOHOLIC INTOXICATION - UNSPECIFIED
303.01 ACUTE ALCOHOLIC INTOXICATION - CONTINUOUS
303.02 ACUTE ALCOHOLIC INTOXICATION - EPISODIC

NONDEPENDENT ABUSE OF DRUGS:
305.00 ALCOHOL ABUSE - UNSPECIFIED
305.01 ALCOHOL ABUSE - CONTINUOUS
305.02 ALCOHOL ABUSE - EPISODIC
305.20 CANNABIS ABUSE – UNSPECIFIED
305.21 CANNABIS ABUSE – CONTINUOUS
305.22 CANNABIS ABUSE – EPISODIC
305.30 HALLUCINOGEN ABUSE – UNSPECIFIED
305.31 HALLUCINOGEN ABUSE – CONTINUOUS
305.32 HALLUCINOGEN ABUSE – EPISODIC
305.40 BARBITURATE AND SIMILARLY ACTING SEDATIVE OR HYPNOTIC ABUSE – UNSPECIFIED
305.41 BARBITURATE AND SIMILARLY ACTING SEDATIVE OR HYPNOTIC ABUSE – CONTINUOUS
305.42 BARBITURATE AND SIMILARLY ACTING SEDATIVE OR HYPNOTIC ABUSE – EPISODIC
305.50 OPIOID ABUSE – UNSPECIFIED
305.51 OPIOID ABUSE – CONTINUOUS
305.52 OPIOID ABUSE – EPISODIC
305.70 AMPHETAMINE OR RELATED ACTING – UNSPECIFIED
305.71 AMPHETAMINE OR RELATED ACTING – CONTINUOUS
305.72 AMPHETAMINE OR RELATED ACTING – EPISODIC
305.80 ANTIDEPRESSANT TYPE ABUSE – UNSPECIFIED
305.81 ANTIDEPRESSANT TYPE ABUSE – CONTINUOUS
305.82 ANTIDEPRESSANT TYPE ABUSE – EPISODIC
305.90 OTHER MIXED, OR UNSPECIFIED DRUG ABUSE – UNSPECIFIED
305.91 OTHER MIXED, OR UNSPECIFIED DRUG ABUSE – CONTINUOUS
305.92 OTHER MIXED, OR UNSPECIFIED DRUG ABUSE – EPISODIC
965.0 POISONING BY ANALGESICS, ANTIPYRETICS, AND ANTIRHEUMATICS, OPIATES AND RELATED NARCOTICS
967.0 POISONING BY SEDATIVES AND HYPNOTICS
968.5 POISONING BY OTHER CENTRAL NERVOUS SYSTEM DEPRESSANT AND ANESTHETICS SURFACE [TOPICAL] AND INFILTRATION ANESTHETICS
969 POISONING BY PSYCHOTROPIC AGENTS
980 TOXIC EFFECT OF ALCOHOL

ACCIDENTAL POISONING BY ANALGESICS, ANTIPYRETICS, AND ANTIRHEYUMATICS:
E850.0 HEROIN
E850.1 METHADONE
E850.2 OTHER OPIATES AND RELATED NARCOTICS
E851 ACCIDENTAL POISONING BY BARBITURATES
E852 ACCIDENTAL POISONING BY OTHER SEDATIVES AND HYPNOTICS
E853 ACCIDENTAL POISONING BY TRANQUILIZERS
E854 ACCIDENTAL POISONING BY OTHER PSYCHOTROPIC AGENTS
E860 ACCIDENTAL POISONING BY ALCOHOL, NEC

SUICIDE AND SELF-INFLICTED POISONING BY SOLID OR LIQUID SUBSTANCES:
E950.0 ANALGESICS, ANTIPYRETICS, AND ANTIRHEYMATICS
E950.1 BARBITURATES
E950.2 OTHER SEDATIVES AND HYPNOTICS
E950.3 TRANQUILIZERS AND OTHER PSYCHOTROPIC AGENTS
E950.4 OTHER SPECIFIED DRUGS AND MEDICINAL SUBSTANCES
E950.5 UNSPECIFIED DRUG OR MEDICINAL SUBSTANCE
E980.0 UNDETERMINED WHETHER ACCIDENTALLY OR PURPOSELY INFLICTED – ANALGESICS, ANTIPYRETICS, AND ANTIRHEUMATICS
E980.1 UNDETERMINED WHETHER ACCIDENTALLY OR PURPOSELY INFLICTED – BARBITURATES
E980.2 UNDETERMINED WHETHER ACCIDENTALLY OR PURPOSELY INFLICTED – OTHER SEDATIVES AND HYPNOTICS
E980.3 UNDETERMINED WHETHER ACCIDENTALLY OR PURPOSELY INFLICTED – TRANQUILIZERS AND OTHER PSYCHOTROPIC AGENTS

Elective

ADMISSION TYPE IS RECORDED AS ELECTIVE

Foreign body

ICD-9-CM diagnosis codes:

FOREIGN BODY IN:

933.0 PHARYNX
933.1 LARYNX
934.0 TRACHEA
934.1 MAIN BRONCHUS
934.8 OTHER SPECIFIED PARTS
935.1 MOUTH
935.2 ESOPHAGUS
936 INTESTINE AND COLON
937 ANUS AND RECTUM
938 DIGESTIVE SYSTEM UNSPECIFIED
939.0 GENITOURINARY TRACT, BLADDER AND URETHRA
939.1 FOREIGN BODY IN GENITOURINARY TRACT, UTERUS, ANY PART

Fracture

ICD-9-CM diagnosis codes (include 4th or 5th digits):

FRACTURE OF VERTEBRAL COLUMN WITH SPINAL CORD INJURY:
806.6 SACRUM AND COCYX CLOSED
806.7 SACRUM AND COCYX OPEN

808 FRACTURE OF PELVIS
810 FRACTURE OF CLAVICLE
811 FRACTURE OF SCAPULA
812 FRACTURE OF HUMERUS
813 FRACUTRE OF RADIUS AND ULNA
820 FRACTURE OF NECK OF FEMUR
821 FRACTURE OF OTHER AND UNSPECIFIED PARTS OF FEMUR
822 FRACTURE OF PATELLA
823 FRACTURE OF TIBIA AND FIBULA
824 FRACTURE OF ANKLE
825 FRACTURE OF ONE OR MORE TARSAL AND METATARSAL BONES
826 FRACTURE OF ONE OR MORE PHALANGES OF FOOT
827 OTHER, MULTIPLE, AND ILL-DEFINED FRACTURE OF LOWER LIMB
828 MULTIPLE FRACTURE INVOLVING BOTH LOWER LIMBS, LOWER WITH UPPER LIMB, AND LOWER LIMB(S) WITH RIB(S) AND STERNUM
829 FRACTURE OF UNSPECIFIED BONES

Hemiplegia, paraplegia, or quadriplegia

ICD-9-CM diagnosis codes (includes 5th digits):

342.0 FLACCID HEMIPLEGIA
342.1 SPASTIC HEMIPLEGIA
342.8 OTHER SPECIFIED HEMIPLEGIA
342.9 HEMIPLEGIA, UNSPECIFIED
343.0 INFANTILE CEREBRAL PALSY, DIPLEGIC
343.1 INFANTILE CEREBRAL PALSY, HEMIPLEGIC
343.2 INFANTILE CEREBRAL PALSY, QUADRIPLEGIC
343.3 INFANTILE CEREBRAL PALSY, MONOPLEGIC
343.4 INFANTILE CEREBRAL PALSY INFANTILE HEMIPLEGIA
343.8 INFANTILE CEREBRAL PALSY OTHER SPECIFIED INFANTILE CEREBRAL PALSY
343.9 INFANTILE CEREBRAL PALSY, INFANTILE CEREBRAL PALSY, UNSPECIFIED
344.0 QUADRIPLEGIA AND QUADRIPARESIS
344.1 PARAPLEGIA
344.2 DIPLEGIA OF UPPER LIMBS
344.3 MONOPLEGIA OF LOWER LIMB
344.4 MONOPLEGIA OF UPPER LIMB
344.5 UNSPECIFIED MONOPLEGIA
344.6 CAUDA EQUINA SYNDROME
344.8 OTHER SPECIFIED PARALYTIC SYNDROMES
344.9 PARALYSIS, UNSPECIFIED
438.2 HEMIPLEGIA/HEMIPARESIS
438.3 MONOPLEGIA OF UPPER LIMB
438.4 MONOPLEGIA OF LOWER LIMB
438.5 OTHER PARALYTIC SYNDROME

Iatrogenic nervous system complications

ICD-9-CM diagnosis codes:

997.00 NERVOUS SYSTEM COMPLICATION, UNSPECIFIED
997.01 CENTRAL NERVOUS SYSTEM COMPLICATIONS
997.02 IATROGENIC CEREBROVASCULAR INFARCTION OR HEMORRHAGE
997.09 OTHER NERVOUS SYSTEM COMPLICATIONS

Long term care

ADMISSION TYPE/SOURCE IS RECORDED AS LONG TERM CARE FACILITY

Nerve compression injuries

ICD-9-CM diagnosis codes:

353.0 BRACHIAL PLEXUS LESIONS
355.1 MERALGIA PARESTHETICA
355.3 LESION OF LATERAL POPLITEAL NERVE

Other obstetrical complications

ICD-9-CM diagnosis codes:

(includes 5th digits):
668.0 PULMONARY COMPLICATIONS
668.1 CARDIAC COMPLICATIONS
668.2 CENTRAL NERVOUS SYSTEM COMPLICATIONS
668.8 OTHER COMPLICATIONS OF ANESTHESIA OR OTHER SEDATION IN LABOR AND DELIVERY
668.9 UNSPECIFIED COMPLICATION OF ANESTHESIA AND OTHER SEDATION
669.1 OTHER COMPLICATIONS OF LABOR AND DELIVERY, NOT ELSEWHERE CLASSIFIED, SHOCK DURING OR FOLLOWING LABOR AND DELIVERY
669.4 OTHER COMPLICATIONS OF OBSTETRICAL SURGERY AND PROCEDURES

669.30, 2, 4 ACUTE RENAL FAILURE FOLLOWING LABOR AND DELIVERY

Perineal wound complications

ICD-9-CM diagnosis codes:

674.20 DISRUPTION OF PERINEAL WOUND-UNSPECIFIED AS TO EPISODE OF CARE OR NOT APPLICABLE
674.22 DISRUPTION OF PERINEAL WOUND-DELIVERY, WITH MENTION OF POSTPARTUM COMPLICATION
674.24 DISRUPTION OF PERINEAL WOUND-POSTPARTUM CONDITION OR COMPLICATION
664.5 VULVAL AND PERINEAL HEMATOMA
665.7 PELVIC HEMATOMA
674.30 OTHER COMPLICATIONS OF OBSTETRICAL SURGICAL WOUNDS-UNSPECIFIED AS TO EPISODE OF CARE OR NOT APPLICABLE
674.32 OTHER COMPLICATIONS OF OBSTETRICAL SURGICAL WOUNDS-DELIVERED, WITH MENTION OF POSTPARTUM COMPLICATION
674.34 OTHER COMPLICATIONS OF OBSTETRICAL SURGICAL WOUNDS-POSTPARTUM CONDITION OR COMPLICATION

Poisoning

ICD-9-CM diagnosis codes (includes 4th and 5th digits):

960 POISONING BY ANTIBIOTICS
961 POISONING BY OTHER ANTI-INFECTIVES
962 POISONING BY HORMONES AND SYNTHETIC SUBSTITUTES
963 POISONING BY PRIMARILY SYSTEMIC AGENTS
964 POISONING BY AGENTS PRIMARILY AFFECTING BLOOD CONSTITUENTS
965 POISONOING BY ANALGESICS, ANTIPYRETICS, AND ANTIRHEUMATICS
966 POISONING BY ANTICONVULSANTS AND ANTI-PARKINSONISM DRUGS
967 POISONING BY SEDATIVES AND HYPNOTICS
968 POISONING BY OTHER CENTRAL NERVOUS SYSTEM DEPRESSANTS AND ANESTHETICS
969 POISONING BY PSYCHOTROPIC AGENTS
970 POISONING BY CENTRAL NERVOUS SYSTEM STIMULANTS
971 POISONING BY DRUGS PRIMARILY AFFECTING THE AUTONOMIC NERVOUS SYSTEM
972 POISONING BY AGENTS PRIMARILY AFFECTING THE CARDIOVASCULAR SYSTEM
973 POISOING BY AGENTS PRIMARILY AFFECTING THE GASTROINTESTINAL SYSTEM
974 POISONING BY WATER, MINERAL, AND URIC ACID METABOLSIM DRUGS
975 POISONING BY AGENTS PRIMARILY ACTING ON THE SMOOTH AND SKELETAL MUSCLES AND RESPIRATORY SYSTEM
976 POISONING BY AGENTS PRIMARILY AFFECTING SKIN AND MUCOUS MEMBRANE, OPTHAMOLOGICAL, OTORHINOLARYNCOLOGICAL AND DENTAL DRUGS
977 POISONING BY OTHER AND UNSPECIFIED DRUGS AND MEDICINAL SUBSTANCES
978 POISONING BY BACTERIAL VACCINES
979 POISONING BY OTHER VACCINES AND BIOLOGICAL SUBSTANCES
E850 ACCIDENTAL POISONING BY ANALGESICS, ANTIPYRETICS, AND ANTIRHEUMATICS
E851 ACCIDENTAL POISONING BY BARBITURATES
E852 ACCIDENTAL POISONING BY OTHER SEDATIVES AND HYPNOTICS
E853 ACCIDENTAL POISONING BY TRANQUILIZERS
E854 ACCIDENTAL POISONING BY OTHER PSYCHOTROPIC AGENTS
E855 ACCIDENTAL POISONING BY OTHER DRUGS ACTING ON CENTRAL AND AUTONOMIC NERVOUS SYSTEM
E856 ACCIDENTAL POISONING BY ANTIBIOTICS
E857 ACCIDENTAL POISONING BY OTHER ANTI-INFECTIVES
E858 ACCIDENTAL POISONING BY OTHER DRUGS
E860 ACCIDENTAL POISONING BY ALCOHOL, NEC
E861 ACCIDENTAL POISONING BY CLEANING AND POLISHING AGENTS, DISINFECTANTS, PAINTS, AND VARNISHES
E862 ACCIDENTAL POISONING BY PETROLEUM PRODUCTS, OTHER SOLVENTS AND THEIR VAPORS, NEC
E863 ACCIDENTAL POISONING BY AGRICULTURAL AND HORTICULTURAL CHEMICAL AND PHARMACEUTICAL PREPARATIONS OTHER THAN PLANT FOODS AND FERTILIZERS
E864 ACCIDENTAL POISONING BY CORROSIVES AND CAUSTICS, NEC
E865 ACCIDENTAL POISONING FROM POISONOUS FOODSTUFFS AND POISONOUS PLANTS
E866 ACCIDENTAL POISONG BY OTHER AND UNSPECIFIED SOLID AND LIQUID SUBSTANCES
E867 ACCIDENTAL POISONOING BY GAS DISTRIBUTED BY PIPELINE
E868 ACCIDENTAL POISONING BY OTHER UTILITY GAS AND OTHER CARBON MONOXIDE
E869 ACCIDENTAL POISONING BY OTHER GASES AND VAPORS
E951 SUICIDE AND SELF-INFLICTED POISONING BY GASES IN DOMESTIC USE

E952 SUICIDE AND SELF-INFLICTED POISONING BY OTHER GASES AND VAPORS
E962 ASSAULT BY POISONING
E980 POISONING BY SOLID OR LIQUID SUBSTANCES, UNDETERMINED WHETHER ACCIDENTALLY OR PURPOSELY INFLICTED
E981 POISONING BY GASES IN DOMESTIC USE, UNDETERMINED WHETHER ACCIDENTALLY OR PURPOSELY INFLICTED
E982 POISONING BY OTHER GASES, UNDETERMINED WHETHER ACCIDENTALLY OR PURPOSELY INFLICTED

PTCA

ICD-9-CM procedure codes:

36.01 SINGLE VESSEL PERCUTANEOUS TRANSLUMINAL CORONARY ANGIOPLASTY [PTCA] OR CORONARY ATHERECTOMY WITHOUT MENTION OF THROMBOLYTIC AGENT
36.02 SINGLE VESSEL PERCUTANEOUS TRANSLUMINAL CORONARY ANGIOPLASTY [PTCA] OR CORONARY ATHERECTOMY WITH MENTION OF THROMBOLYTIC AGENT
36.05 MULTIPLE VESSEL PERCUTANEOUS TRANSLUMINAL CORONARY ANGIOPLSTY [PTCA] OR CORONARY ATHERECTOMY PERFORMED DURING THE SAME OPERATION, WITH OR WITHOUT MENTION OF THROMBOLYTIC AGENT
36.06 INSERTION OF CORONARY ARTERY STENTS

Reopening of a surgical site

ICD-9-CM procedure codes:

12.3 REOPENING OF CRANIOTOMY SITE
30.2 REOPENING OF LAMINECTOMY SITE
60.2 REOPENING OF WOUND OF THYROID FIELD
34.03 REOPENING OF RECENT THORACOTOMY SITE
39.49 OTHER REVISION OF VASCULAR PROCEDURE
54.12 REOPENING OF RECENT LAPAROTOMY SITE

Rupture of uterus during or after labor

ICD-9-CM diagnosis codes:

665.10 RUPTURE OF UTERUS DURING LABOR-UNSPECIFIED AS TO EPISODE OF CARE OR NOT APPLICABLE
665.11 RUPTURE OF UTERUS DURING LABOR-DELIVERED, WITH OR WITHOUT MENTION OF ANTEPARTUM CONDITION

Seizure

ICD-9-CM diagnosis codes:

345.00 GENERALIZED NONCONVULSIVE EPILEPSY - WITHOUT MENTION OF INTRACTABLE EPILEPSY
345.01 GENERALIZED NONCONVULSIVE EPILEPSY - WITH INTRACTABLE EPILEPSY
345.10 GENERALIZED CONVULSIVE EPILEPSY - WITHOUT MENTION OF INTRACTABLE EPILEPSY
345.11 GENERALIZED CONVULSIVE EPILEPSY - WITH INTRACTABLE EPILEPSY
345.2 EPILEPSY-PETIT MAL STATUS
345.3 EPILEPSY-GRAND MAL STATUS
345.40 PARTIAL EPILEPSY, WITH IMPAIRMENT OF CONSCIOUSNESS - WITH INTRACTABLE EPILEPSY
345.41 PARTIAL EPILEPSY, WITH IMPAIRMENT OF CONSCIOUSNESS - WITHOUT MENTION OF INTRACTABLE EPILEPSY
345.50 PARTIAL EPILEPSY, WITHOUT MENTION OF IMPAIRMENT OF CONSCIOUSNESS, - WITHOUT MENTION OF INTRACTABLE EPILEPSY
345.51 PARTIAL EPILEPSY, WITHOUT MENTION OF IMPAIRMENT OF CONSCIOUSNESS - WITH INTRACTABLE EPILEPSY
345.60 INFANTILE SPASMS - WITHOUT MENTION OF INTRACTABLE EPILEPSY
345.61 INFANTILE SPASMS - WITH INTRACTABLE EPILEPSY
345.70 EPILEPSIA PARTIALIS CONTINUA - WITHOUT MENTION OF INTRACTABLE EPILEPSY
345.71 EPILEPSIA PARTIALIS CONTINUA - WITH INTRACTABLE EPILEPSY
345.80 OTHER FORMS OF EPILEPSY - WITHOUT MENTION OF INTRACTABLE EPILEPSY
345.81 OTHER FORMS OF EPILEPSY - WITH INTRACTABLE EPILEPSY
345.90 EPILEPSY, UNSPECIFIED - WITHOUT MENTION OF INTRACTABLE EPILEPSY
345.91 EPILEPSY, UNSPECIFIED - WITH INTRACTABLE EPILEPSY
780.3 CONVULSIONS (OLD CODE NO LONGER VALID)
780.31 FEBRILE CONVULSIONS
780.39 OTHER CONVULSIONS

Surgical

Diagnostic Related Groups (DRGs)

001 CRANIOTOMY, AGE GREATER THAN 17 EXCEPT FOR TRAUMA
002 CRANIOTOMY FOR TRAUMA, AGE GREATER THAN 17
003 CRANIOTOMY, AGE 0-17
004 SPINAL PROCEDURES
005 EXTRACRANIAL VASCULAR PROCEDURES
006 CARPAL TUNNEL RELEASE

007 PERIPHERAL AND CRANIAL NERVE AND OTHER NERVOUS SYSTEM PROCEDURES WITH CC
008 PERIPHERAL AND CRANIAL NERVE AND OTHER NERVOUS SYSTEM PROCEDURES WITHOUT CC
036 RETINAL PROCEDURES
037 ORBITAL PROCEDURES
038 PRIMARY IRIS PROCEDURES
039 LENS PROCEDURES WITH OR WITHOUT VITRECTOMY
040 EXTRAOCULAR PROCEDURES EXCEPT ORBIT, AGE GREATER THAN 17
041 EXTRAOCULAR PROCEDURES EXCEPT ORBIT, AGE 0-17
042 INTRAOCULAR PROCEDURES EXCEPT RETINA, IRIS AND LENS
049 MAJOR HEAD AND NECK PROCEDURES
050 SIALOADENECTOMY
051 SALIVARY GLAND PROCEDURES EXCEPT SIALOADENECTOMY
052 CLEFT LIP AND PALATE REPAIR
053 SINUS AND MASTOID PROCEDURES, AGE GREATER THAN 17
054 SINUS AND MASTOID PROCEDURES, AGE 0-17
055 MISCELLANEOUS EAR, NOSE, MOUTH AND THROAT PROCEDURES
056 RHINOPLASTY
057 TONSILLECTOMY AND ADENOIDECTOMY PROCEDURES EXCEPT TONSILLECTOMY AND/OR ADENOIDECTOMY ONLY, AGE GREATER THAN 17
058 TONSILLECTOMY AND ADENOIDECTOMY PROCEDURES EXCEPT TONSILLECTOMY AND/OR ADENOIDECTOMY ONLY, AGE 0-17
059 TONSILLECTOMY AND/OR ADENOIDECTOMY ONLY, AGE GREATER THAN 17
060 TONSILLECTOMY AND/OR ADENOIDECTOMY ONLY, AGE 0-17
061 MYRINGOTOMY WITH TUBE INSERTION, AGE GREATER THAN 17
062 MYRINGOTOMY WITH TUBE INSERTION, AGE 0-17
063 OTHER EAR, NOSE, MOUTH AND THROAT OR PROCEDURES
075 MAJOR CHEST PROCEDURES
076 OTHER RESPIRATORY SYSTEM OR PROCEDURES WITH CC
077 OTHER RESPIRATORY SYSTEM OR PROCEDURES WITHOUT CC
103 HEART TRANSPLANT
104 CARDIAC VALVE AND OTHER MAJOR CARDIOTHORACIC PROCEDURES WITH CARDIAC CATHETERIZATION
105 CARDIAC VALVE AND OTHER MAJOR CARDIOTHORACIC PROCEDURES WITHOUT CARDIAC CATHETERIZATION
106 CORONARY BYPASS WITH PTCA
107 CORONARY BYPASS WITH CARDIAC CATHETERIZATION
108 OTHER CARDIOTHORACIC PROCEDURES
109 CORONARY BYPASS WITHOUT CARDIAC CATHETERIZATION
110 MAJOR CARDIOVASCULAR PROCEDURES WITH CC
111 MAJOR CARDIOVASCULAR PROCEDURES WITHOUT CC
112 PERCUTANEOUS CARDIOVASCULAR PROCEDURES
113 AMPUTATION FOR CIRCULATORY SYSTEM DISORDERS EXCEPT UPPER LIMB AND TOE
114 UPPER LIMB AND TOES AMPUTATION FOR CIRCULATORY SITE
115 PERMANENT CARDIAC PACEMAKER IMPLANT WITH ACUTE MYOCARDIAL INFARCTION, HEART FAILURE OR SHOCK OR ACID LEAD OR GENERATOR PROCEDURE
116 OTHER PERMANENT CARDIAC PACEMAKER IMPLANT OR PTCA WITH CORONARY ARTERIAL STENT
117 CARDIAC PACEMAKER REVISION EXCEPT DEVICE REPLACEMENT
118 CARDIAC PACEMAKER DEVICE REPLACEMENT
119 VEIN LIGATION AND STRIPPING
120 OTHER CIRCULATORY SYSTEM OR PROCEDURES
146 RECTAL RESECTION WITH CC
147 RECTAL RESECTION WITHOUT CC
148 MAJOR SMALL AND LARGE BOWEL PROCEDURES WITH CC
149 MAJOR SMALL AND LARGE BOWEL PROCEDURES WITHOUT CC
150 PERITONEAL ADHESIOLYSIS WITH CC
151 PERITONEAL ADHESIOLYSIS WITHOUT CC
152 MINOR SMALL AND LARGE BOWEL PROCEDURES WITH CC
153 MINOR SMALL AND LARGE BOWEL PROCEDURES WITHOUT CC
154 STOMACH, ESOPHAGEAL AND DUODENAL PROCEDURES, AGE GREATER THAN 17 WITH CC
155 STOMACH, ESOPHAGEAL AND DUODENAL PROCEDURES, AGE GREATER THAN 17 WIHOUT CC
156 STOMACH, ESOPHAGEAL AND DUODENAL PROCEDURES, AGE 0-17
157 ANAL AND STOMAL PROCEDURES WITH CC
158 ANAL AND STOMAL PROCEDURES WITHOUT CC
159 HERNIA PROCEDURES EXCEPT INGUINAL AND FEMORAL, AGE GREATER THAN 17 WITH CC
160 HERNIA PROCEDURES EXCEPT INGUINAL AND FEMORAL, AGE GREATER THAN 17 WITHOUT CC
161 INGUINAL AND FEMORAL HERNIA PROCEDURES, AGE GREATER THAN 17 WITH CC
162 INGUINAL AND FEMORAL HERNIA PROCEDURES, AGE GREATER THAN 17 WITHOUT CC
163 HERNIA PROCEDURES, AGE 0-17
164 APPENDECTOMY WITH COMPLICATED PRINCIPAL DIAGNOSIS WITH CC
165 APPENDECTOMY WITH COMPLICATED PRINCIPAL DIAGNOSIS WITHOUT CC

166 APPENDECTOMY WITHOUT COMPLICATED PRINCIPAL DIAGNOSIS WITH CC
167 APPENDECTOMY WITHOUT COMPLICATED PRINCIPAL DIAGNOSIS WITHOUT CC
168 MOUTH PROCEDURES WITH CC
169 MOUTH PROCEDURES WITHOUT CC
170 OTHER DIGESTIVE SYSTEM OR PROCEDURES WITH CC
171 OTHER DIGESTIVE SYSTEM OR PROCEDURES WITHOUT CC
191 PANCREAS, LIVER AND SHUNT PROCEDURES WITH CC
192 PANCREAS, LIVER AND SHUNT PROCEDURES WITHOUT CC
193 BILIARY TRACT PROCEDURES EXCEPT ONLY CHOLECYSTECTOMY WITH OR WITHOUT COMMON DUCT EXPLORATION WITH CC
194 BILIARY TRACT PROCEDURES EXCEPT ONLY CHOLECYSTECTOMY WITH OR WITHOUT COMMON DUCT EXPLORATION WITHOUT CC
195 CHOLECYSTECTOMY WITH COMMON DUCT EXPLORATION WITH CC
196 CHOLECYSTECTOMY WITH COMMON DUCT EXPLORATION WITHOUT CC
197 CHOLECYSTECTOMY EXCEPT BY LAPAROSCOPE WITHOUT COMMON DUCT EXPLORATION WITH CC
198 CHOLECYSTECTOMY EXCEPT BY LAPAROSCOPE WITHOUT COMMON DUCT EXPLORATION WITHOUT CC
199 HEPATOBILIARY DIAGNOSTIC PROCEDURE FOR MALIGNANCY
200 HEPATOBILIARY DIAGNOSTIC PROCEDURE FOR NONMALIGNANCY
201 OTHER HEPATOBILIARY OR PANCREAS OR PROCEDURES
209 MAJOR JOINT AND LIMB REATTACHMENT PROCEDURES OF LOWER EXTREMITY
210 HIP AND FEMUR PROCEDURES EXCEPT MAJOR JOINT PROCEDURES, AGE GREATER THAN 17 WITH CC
211 HIP AND FEMUR PROCEDURES EXCEPT MAJOR JOINT PROCEDURES, AGE GREATER THAN 17 WITHOUT CC
212 HIP AND FEMUR PROCEDURES EXCEPT MAJOR JOINT PROCEDURE, AGE 0-17
213 AMPUTATION FOR MUSCULOSKELETAL SYSTEM AND CONNECTIVE TISSUE DISORDERS
214 NO LONGER VALID
215 NO LONGER VALID
216 BIOPSIES OF MUSCULOSKELETAL SYSTEM AND CONNECTIVE TISSUE
217 WOUND DEBRIDEMENT AND SKIN GRAFT EXCEPT HAND FOR MUSCULOSKELETAL AND CONNECTIVE TISSUE DISORDERS
218 LOWER EXTREMITY AND HUMERUS PROCEURES EXCEPT HIP, FOOT AND FEMUR, AGE GREATER THAN 17 WITH CC
219 LOWER EXTREMITY AND HUMERUS PROCEDURES EXCEPT HIP, FOOT AND FEMUR, AGE GREATER THAN 17 WITHOUT CC
220 LOWER EXTREMITY AND HUMERUS PROCEDURES EXCEPT HIP, FOOT AND FEMUR, AGE 0-17
221 NO LONGER VALID
222 NO LONGER VALID
223 MAJOR SHOULDER/ELBOW PROCEDURES OR OTHER UPPER EXTREMITY PROCEDURES WITH CC
224 SHOULDER, ELBOW OR FOREARM PROCEDURES EXCEPT MAJOR JOINT PROCEDURES WITHOUT CC
225 FOOT PROCEDURES
226 SOFT TISSUE PROCEDURES WITH CC
227 SOFT TISSUE PROCEDURES WITHOUT CC
228 MAJOR THUMB OR JOINT PROCEDURES OR OTHER HAND OR WRIST PROCEDURES WITH CC
229 HAND OR WRIST PROCEDURES EXCEPT MAJOR JOINT PROCEDURES WITHOUT CC
230 LOCAL EXCISION AND REMOVAL OF INTERNAL FIXATION DEVICES OF HIP AND FEMUR
231 LOCAL EXCISION AND REMOVAL OF INTERNAL FIXATION DEVICES EXCEPT HIP AND FEMUR
232 ARTHROSCOPY
233 OTHER MUSCULOSKELETAL SYSTEM AND CONNECTIVE TISSUE OR PROCEDURES WITH CC
234 OTHER MUSCULOSKELETAL SYSTEM AND CONNECTIVE TISSUE OR PROCEDURES WITHOUT CC
257 TOTAL MASTECTOMY FOR MALIGNANCY WITH CC
258 TOTAL MASTECTOMY FOR MALIGNANCY WITHOUT CC
259 SUBTOTAL MASTECTOMY FOR MALIGNANCY WITH CC
260 SUBTOTAL MASTECTOMY FOR MALIGNANCY WITHOUT CC
261 BREAST PROCEDURE FOR NONMALIGNANCY EXCEPT BIOPSY AND LOCAL EXCISION
262 BREAST BIOPSY AND LOCAL EXCISION FOR NONMALIGNANCY
263 SKIN GRAFT AND/OR DEBRIDEMENT FOR SKIN ULCER OR CELLULITIS WITH CC
264 SKIN GRAFT AND OR DEBRIDEMENT FOR SKIN ULCER OR CELLULITIS WITHOUT CC
265 SKIN GRAFT AND OR DEBRIDEMENT EXCEPT FOR SKIN ULCER OR CELLULITIS WITH CC
266 SKIN GRAFT AND/OR DEBRIDEMENT EXCEPT FOR SKIN ULCER OR CELLULITIS WITHOUT CC
267 PERIANAL AND PILONIDAL PROCEDURES
268 SKIN, SUBCUTANEOUS TISSUE AND BREAST PLASTIC PROCEDURES
269 OTHER SKIN, SUBCUTANEOUS TISSUE AND BREAST PROCEDURES WITH CC
270 OTHER SKIN, SUBCUTANEOUS TISSUE AND BREAST PROCEDURS WITHOUT CC

285 AMPUTATION OF LOWER LIMB FOR ENDOCRINE, NUTRITIONAL AND METABOLIC DISORDERS
286 ADRENAL AND PITUITARY PROCEDURES
287 SKIN GRAFTS AND WOUND DEBRIDEMENTS FOR ENDOCRINE, NUTRITIONAL AND METABOLIC DISORDERS
288 OR PROCEDURES FOR OBESITY
289 PARATHYROID PROCEDURES
290 THYROID PROCEDURES
291 THYROGLOSSAL PROCEDURES
292 OTHER ENDOCRINE, NUTRITIONAL AND METABOLIC OR PROCEDURES WITH CC
293 OTHER ENDOCRINE, NUTRITIONAL AND METABOLIC OR PROCEDURES WITHOUT CC
302 KIDNEY TRANSPLANT
303 KIDNEY, URETER AND MAJOR BLADDER PROCEDURES FOR NEOPLASM
304 KIDNEY, URETER AND MAJOR BLADDER PROCEDURES FOR NONNEOPLASMS WITH CC
305 KIDNEY, URETER AND MAJOR BLADDER PROCEDURES FOR NONNEOPLASMS WITHOUT CC
306 PROSTATECTOMY WITH CC
307 PROSTATECTOMY WITHOUT CC
308 MINOR BLADDER PROCEDURES WITH CC
309 MINOR BLADDER PROCEDURES WITHOUT CC
310 TRANSURETHRAL PROCEDURES WITH CC
311 TRANSURETHRAL PROCEDURES WITHOUT CC
312 URETHRAL PROCEDURES, AGE GREATER THAN 17 WITH CC
313 URETHRAL PROCEDURES, AGE GREATER THAN 17 WITHOUT CC
314 URETHRAL PROCEDURES, AGE 0-17
315 OTHER KIDNEY AND URINARY TRACT OR PROCEDURES
334 MAJOR MALE PELVIC PROCEDURES WITH CC
335 MAJOR MALE PELVIC PROCEDURES WITHOUT CC
336 TRANSURETHRAL PROSTATECTOMY WITH CC
337 TRANSURETHRAL PROSTATECTOMY WITHOUT CC
338 TESTES PROCEDURES FOR MALIGNANCY
339 TESTES PROCEDURES FOR NONMALIGNANCY, AGE GREATER THAN 17
340 TESTES PROCEDURES FOR NONMALIGNANCY, AGE 0-17
341 PENIS PROCEDURES
342 CIRCUMCISION, AGE GREATER THAN 17
343 CIRCUMCISION, AGE 0-17
344 OTHER MALE REPRODUCTIVE SYSTEM OR PROCEDURES FOR MALIGNANCY
345 OTHER MALE REPRODUCTIVE SYSTEM OR PROCEDURES EXCEPT FOR MALIGNANCY
353 PELVIC EVISCERATION, RADICAL HYSTERECTOMY AND RADICAL VULVECTOMY
354 UTERINE AND ADNEXA PROCEDURES FOR NONOVARIAN/ADNEXAL MALIGNANCY WITH CC
355 UTERINE AND ADNEXA PROCEDURES FOR NONOVARIAN/ADNEXA PROCEDURES FOR NONOVARIAN/ADNEXAL MALIGNANCY WITHOUT CC
356 FEMALE REPRODUCTIVE SYSTEM RECONSTRUCTIVE PROCEDURES
357 UTERINE AND ADNEXA PROCEDURES FOR OVARIAN OR ADNEXAL MALIGNANCY
358 UTERINE AND ADNEXA PROCEDURES FOR NONMALIGNANCY WITH CC
359 UTERINE AND ADNEXA PROCEDURES FOR NONMALIGNANCY WITHOUT CC
360 VAGINA, CERVIX AND VULVA PROCEDURES
361 LAPAROSCOPY AND INCISIONAL TUBAL INTERRUPTION
362 ENDOSCOPIC TUBAL INTERRUPTION
363 D AND C, CONIZATION AND RADIOIMPLANT FOR MALIGNANCY
364 D AND C, CONIZATION EXCEPT FOR MALIGNANCY
365 OTHER FEMALE REPRODUCTIVE SYSTEM OR PROCEDURES
370 CESAREAN SECTION WITH CC
371 CESAREAN SECTION WITHOUT CC
374 VAGINAL DELIVERY WITH STERILIZATION AND/OR D AND C
375 VAGINAL DELIVERY WITH OR PROCEDURE EXCEPT STERILIZATION AND/OR D AND C
377 POSTPARTUM AND POSTABORTION DIAGNOSES WITH OR PROCEDURE
381 ABORTION WITH D AND C ASPIRATION CURETTAGE OR HYSTERECTOMY
392 SPLENECTOMY, AGE GREATER THAN 17
393 SPLENECTOMY, AGE 0-17
394 OTHER OR PROCEDURES OF THE BLOOD AND BLOOD-FORMING ORGANS
400 LYMPHOMA AND LEUKEMIA WITH MAJOR OR PROCEDURES
401 LYMPHOMA AND NONACUTE LEUKEMIA WITH OTHER OR PROCEDURE WITH CC
402 LYMPHOMA AND NONACUTE LEUKEMIA WITH OTHER OR PROCEDURE WITHOUT CC
406 MYELOPROLIFERATIVE DISORDERS OR POORLY DIFFERENTIATED NEOPLASMS WITH MAJOR OR PROCEDURES WITH CC
407 MYELOPROLIFERATIVE DISORDERS OR POORLY DIFFERENTIATED NEOPLASMS WITH MAJOR OR PROCEDURES WITHOUT CC
408 MYELOPROLIFERATIVE DISORDERS OR POORLY DIFFERENTIATED NEOPLASMS WITH OTHER OR PROCEDURES
415 OR PROCEDURE FOR INFECTIOUS AND PARASITIC DISEASES
424 OR PROCEDURES WITH PRINCIPAL DIAGNOSIS OF MENTAL ILLNESS
439 SKIN GRAFTS FOR INJURIES
440 WOUND DEBRIDEMENTS FOR INJURIES
441 WOUND HAND PROCEDURES FOR INJURIES

442	OTHER OR PROCEDURES FOR INJURIES WITH CC
443	OTHER OR PROCEDURES FOR INJURIES
458	NO LONGER VALID
459	NO LONGER VALID
461	OR PROCEDURES WITH DIAGNOSES OF OTHER CONTACT WITH HEALTH SERVICES
468	EXTENSIVE OR PROCEDURE UNRELATED TO PRINCIPAL DIAGNOSIS
471	BILATERAL OR MULTIPLE MAJOR JOINT PROCEDURES OF LOWER EXTREMITY
472	NO LONGER VALID
476	PROSTATIC OR PROCEDURE UNRELATED TO PRINCIPAL DIAGNOSIS
477	NONEXTENSIVE OR PROCEDURE UNRELATED TO PRINCIPAL DIAGNOSIS
478	OTHER VASCULAR PROCEDURES WITH CC
479	OTHER VASCULAR PROCEDURES WITHOUT CC
480	LIVER TRANSPLANT
481	BONE MARROW TRANSPLANT
482	TRACHEOSTOMY FOR FACE, MOUTH AND NECK DIAGNOSES
483	TRACHEOSTOMY EXCEPT FOR FACE, MOUTH AND NECK DIAGNOSES
484	CRANIOTOMY FOR MULTIPLE SIGNIFICANT TRAUMA
485	LIMB REATTACHMENT, HIP AND FEMUR PROCEDURES FOR MULTIPLE SIGNIFICANT TRAUMA
486	OTHER OR PROCEDURES FOR MULTIPLE SIGNIFICANT TRAUMA
488	HIV WITH EXTENSIVE OR PROCEDURE
491	MAJOR JOINT AND LIMB REATTACHMENT PROCEDURES OF UPPER EXTREMITY
493	LAPAROSCOPIC CHOLECYSTECTOMY WITHOUT COMMON DUCT EXPLORATION WITH CC
494	LAPAROSCOPIC CHOLECYSTECTOMY WITHOUT COMMON DUCT EXPLORATION WITHOUT CC
495	LUNG TRANSPLANT
496	COMBINED ANTERIOR/POSTERIOR SPINAL FUSION
497	SPINAL FUSION WITH CC
498	SPINAL FUSION WITHOUT CC
499	BACK AND NECK PROCEDURES EXCEPT SPINAL FUSION WITH CC
500	BACK AND NECK PROCEDURES EXCEPT SPINAL FUSION WITHOUT CC
501	KNEE PROCEDURES WITH PRINCIPAL DIAGNOSIS OF INFECTION, WITH CC
502	KNEE PROCEDURES WITH PRINCIPAL DIAGNOSIS OF INFECTION, WITHOUT CC
503	KNEE PROCEDURES WITHOUT PRINCIPAL DIAGNOSIS OF INFECTION

Suture of laceration

ICD-9-CM procedure codes:

04.3	SUTURE OF CRANIAL AND PERIPHERAL NERVES
29.51	SUTURE OF LACERATION OF PHARYNX
31.61	SUTURE OF LACERATION OF LARYNX
33.41	SUTURE OF LACERATION OF BRONCHUS
33.43	CLOSURE OF LACERATION OF LUNG
34.82	SUTURE OF LACERATION OF DIAPHRAGM
39.30	SUTURE OF UNSPECIFIED BLOOD VESSEL
39.31	SUTURE OF ARTERY
39.32	SUTURE OF VEIN
42.82	SUTURE OF LACERATION OF ESOPHAGUS
44.61	SUTURE OF LACERATION OF STOMACH
46.71	SUTURE OF LACERATION OF DUODENUM
46.73	SUTURE OF LACERATION OF SMALL INTESTINE, EXCEPT DUODENUM
46.75	SUTURE OF LACERATION OF LARGE INTESTINE
48.71	SUTURE OF LACERATION OF RECTUM
49.71	SUTURE OF LACERATION OF ANUS
55.81	SUTURE OF LACERATION OF KIDNEY
56.82	SUTURE OF LACERATION OF URETER
57.81	SUTURE OF LACERATION OF BLADDER
58.41	SUTURE OF LACERATION OF URETHRA
50.61	CLOSURE OF LACERATION OF LIVER
51.91	REPAIR OF LACERATION OF GALLBLADDER
67.61	SUTURE OF LACERATION OF CERVIX
69.41	SUTURE OF LACERATION OF UTERUS

Third or fourth degree obstetric lacerations

ICD-9-CM diagnosis codes:

664.21	THIRD DEGREE PERINEAL LACERATION-DELIVERED, WITH OR WITHOUT MENTION OF ANTEPARTUM CONDITION
664.31	FOURTH-DEGREE PERINEAL LACERATION - DELIVERED, WITH OR WITHOUT MENTION OF ANTEPARTUM CONDITION

Trauma

ICD-9-CM diagnosis codes (includes 4th and 5th digits):

800	FRACTURE OF VAULT OF SKULL
801	FRACTURE OF BASE OF SKULL
802	FRACTURE OF FACE BONES
803	OTHER AND UNQUALIFIED SKULL FRACTURES
804	MULTIPLE FRACTURES INVOLVING SKULL OR FACE WITH OTHER BONES
805	FRACTURE OF VERTEBRAL COLUMN WITHOUT MENTION OF SPINAL CHORD INJURY
806	FRACTURE OF VERTEBRAL COLUMN WITH SPINAL CORD INJURY
807	FRACTURE OF RIB[S] STERNUM, LARYNX, AND TRACHEA
808	FRACTURE OF PELVIS
809	ILL-DEFINED FRACTURES OF BONES OF TRUNK
810	FRACTURE OF CLAVICLE
811	FRACTURE OF SCAPULA
812	FRACTURE OF HUMEROUS

813	FRACTURE OF RADIUS AND ULNA
814	FRACTURE OF CARPAL BONE[S]
815	FRACTURE OF METACARPAL BONE[S]
817	MULTIPLE FRACTURES OF HAND BONES
818	ILL-DEFINED FRACTURES OF UPPER LIMB
819	MULTIPLE FRACTURES INVOLVING BOTH UPPER LIMBS, AND UPPER LIMB WITH RIB AND STERNUM
820	FRACTURE OF NECK OF FEMUR
821	FRACTURE OF OTHER AND UNSPECIFIED PARTS OF FEMUR
822	FRACTURE OF PATELLA
823	FRACTURE OF TIBIA AND FIBULA
824	FRACTURE OF ANKLE
825	FRACTURE OF ONE OR MORE TARSAL AND METATARSAL BONES
827	OTHER, MULTIPLE, AND ILL-DEFINED FRACTURES OF LOWER LIMB
828	MULTIPLE FRACTURES INVOLVING BOTH LOWER LIMBS, LOWER WITH UPPER LIMB, AND LOWER LIMB WITH RIB AND STERNUM
829	FRACTURE OF UNSPECIFIED BONES
830	DISLOCATION OF JAW
831	DISLOCATION OF SHOULDER
832	DISLOCATION OF ELBOW
833	DISLOCATION OF WRIST
835	DISLOCATION OF HIP
836	DISLOCATION OF KNEE
837	DISLOCATION OF ANKLE
838	DISLOCATION OF FOOT
839	OTHER, MULTIPLE, AND ILL-DEFINED DISLOCATIONS
850	CONCUSSION
851	CEREBRAL LACERATION AND CONTUSION
852	SUBARACHNOID, SUBDURAL, AND EXTRADURAL HEMORRHAGE, FOLLOWING INJURY
853	OTHER AND UNSPECIFIED INTRACRANIAL HEMORRHAGE FOLLOWING INJURY
854	INTRACRANIAL INJURY OF OTHER AND UNSPECIFIED NATURE
860	TRAUMATIC PNEUMOTHORAX
861	INJURY TO HEART AND LUNG
862	INJURY TO OTHER AND UNSPECIFIED INTRATHORACIC ORGANS
863	INJURY TO GASTROINTESTINAL TRACT
864	INJURY TO LIVER
865	INJURY TO SPLEEN
866	INJURY TO KIDNEY
867	INJURY TO PELVIC ORGANS
868	INJURY TO OTHER INTRA-ABDOMINAL ORGANS
869	INTERNAL INJURY TO UNSPECIFIED OR ILL-DEFINED ORGANS
870	OPEN WOUND OF OCULAR ADNEXA
871	OPEN WOUND OF EYEBALL
872	OPEN WOUND OF EAR
873	OTHER OPEN WOUND OF HEAD
874	OPEN WOUND OF NECK
875	OPEN WOUND OF CHEST [WALL]
876	OPEN WOUND OF BACK
877	OPEN WOUND OF BUTTOCK
878	OPEN WOUND OF GENITAL ORGANS [EXTERNAL] INCLUDING TRAUMATIC AMPUTATION
879	OPEN WOUND OF OTHER AND UNSPECIFIED SITES, EXCEPT LIMBS
880	OPEN WOUND OF SHOULDER AND UPPER ARM
881	OPEN WOUND OF ELBOW, FOREARM, AND WRIST
882	OPEN WOUND OF HAND EXCEPT FINGER ALONE
884	MULTIPLE AND UNSPECIFIED OPEN WOUND OF UPPER LIMB
887	TRAUMATIC AMPUTATION OF ARM AND HAND (COMPLETE) (PARTIAL)
890	OPEN WOUND OF HIP AND THIGH
891	OPEN WOUND OF KNEE, LEG (EXCEPT THIGH) AND ANKLE
892	OPEN WOUND OF FOOT EXCEPT TOE ALONE
894	MULTIPLE AND UNSPECIFIED OPEN WOUND OF LOWER LIMB
896	TRAUMATIC AMPUTATION OF FOOT (COMPLETE) (PARTIAL)
897	TRAUMATIC AMPUTATION OF LEG(S) (COMPLETE) (PARTIAL)
900	INJURY TO BLOOD VESSELS OF HEAD AND NECK
901	INJURY TO BLOOD VESSELS OF THORAX
902	INJURY TO BLOOD VESSELS OF ABDOMEN AND PELVIS
903	INJURY TO BLOOD VESSELS OF UPPER EXTREMITY
904	INJURY TO BLOOD VESSELS OF LOWER EXTREMITY AND UNSPECIFIED SITES
925	CRUSHING INJURY OF FACE, SCALP, AND NECK
926	CRUSHING INJURY OF TRUNK
927	CRUSHING INJURY OF UPPER LIMB
928	CRUSHING INJURY OF LOWER LIMB
929	CRUSHING INJURY OF MULTIPLE AND UNSPECIFIED SITES
940	BURN CONFINED TO EYE AND ADNEXA
941	BURN OF FACE, HEAD, AND NECK
942	BURN OF TRUNK
943	BURN OF UPPER LIMB, EXCEPT WRIST AND HAND
944	BURN OF WRIST[S] AND HAND[S]
945	BURN OF LOWER LIMB[S]
946	BURNS OF MULTIPLE SPECIFIED SITES
947	BURN OF INTERNAL ORGANS
948	BURNS CLASSIFIED ACCORDING TO EXTENT OF BODY SURFACE INVOLVED
949	BURN, UNSPECIFIED
952	SPINAL CHORD INJURY WITHOUT EVIDENCE OF SPINAL BONE INJURY
953	INJURY TO NERVE ROOTS AND SPINAL PLEXUS
958	CERTAIN EARLY COMPLICATIONS OF TRAUMA
E800	RAILWAY ACCIDENT INVOLVING COLLISION WITH ROLLING STOCK
E801	RAILWAY ACCIDENT INVOLVING COLLISION WITH OTHER OBJECT
E802	RAILWAY ACCIDENT INVOLVING DERAILMENT WITHOUT ANTECEDENT COLLISION
E803	RAILWAY ACCIDENT INVOLVING EXPLOSION, FIRE, OR BURNING
E804	FALL IN, ON, OR FROM RAILWAY TRAIN
E805	HIT BY ROLLING STOCK
E806	OTHER SPECIFIED RAILWAY ACCIDENT

E807 RAILWAY ACCIDENT OF UNSPECIFIED NATURE
E810 MOTOR VEHICLE TRAFFIC ACCIDENT INVOLVING COLLISION WITH TRAIN
E811 MOTOR VEHICLE TRAFFIC ACCIDENT INVOLVING RE-ENTERANT COLLISION WITH ANOTHER MOTOR VEHICLE
E812 OTHER MOTOR VEHICLE TRAFFIC ACCIDENT INVOLVING COLLISION WITH MOTOR VEHICLE
E813 MOTOR VEHICLE TRAFFIC ACCIDENT INVOLVING COLLISION WITH OTHER VEHICLE
E814 MOTOR VEHICLE TRAFFIC ACCIDENT INVOLVING COLLISION WITH PEDESTRIAN
E815 OTHER MOTOR VEHICLE TRAFFIC ACCIDENT INVOLVING COLLISION ON THE HIGHWAY
E816 MOTOR VEHICLE TRAFFIC ACCIDENT DUE TO LOSS OF CONTROL, WITHOUT COLLISION ON THE HIGHWAY
E817 NONCOLLISION MOTOR VEHICLE TRAFFIC ACCIDENT WHILE BOARDING OR ALIGHTING
E818 OTHER NONCOLLISION MOTOR VEHICLE TRAFFIC ACCIDENT
E819 MOTOR VEHICLE TRAFFIC ACCIDENT OF UNSPECIFIED NATURE
E820 NONTRAFFIC ACCIDENT INVOLVING MOTOR-DRIVEN SNOW VEHICLE
E821 NONTRAFFIC ACCIDENT INVOLVING OTHER OFF-ROAD MOTOR VEHICLE
E822 OTHER MOTOR VEHICLE NONTRAFFIC ACCIDENT INVOLVING COLLISION WITH MOVING OBJECT
E823 OTHER MOTOR VEHICLE NONTRAFFIC ACCIDENT INVOLVING COLLISION WITH STATIONARY OBJECT
E824 OTHER MOTOR VEHICLE NONTRAFFIC ACCIDENT WHILE BOARDING AND ALIGHTING
E825 OTHER MOTOR VEHICLE NONTRAFFIC ACCIDENT OF OTHER AND UNSPECIFIED NATURE
E826 PEDAL CYCLE ACCIDENT
E827 ANIMAL-DRAWN VEHICLE ACCIDENT
E828 ACCIDENT INVOLVING ANIMAL BEING RIDDEN
E829 OTHER ROAD VEHICLE ACCIDENTS
E830 ACCIDENT TO WATERCRAFT CAUSING SUBMERSION
E831 ACCIDENT TO WATERCRAFT CAUSING OTHER INJURY
E832 OTHER ACCIDENTAL SUBMERSION OR DROWNING IN WATER TRANSPORT ACCIDENT
E833 FALL ON STAIRS OR LADDERS IN WATER TRANSPORT
E834 OTHER FALL FROM ONE LEVEL TO ANOTHER IN WATER TRANSPORT
E835 OTHER AND UNSPECIFIED FALL IN WATER TRANSPORT
E836 MACHINERY ACCIDENT IN WATER TRANSPORT
E837 EXPLOSION, FIRE, OR BURNING IN WATERCRAFT
E838 OTHER AND UNSPECIFIED WATER TRANSPORT ACCIDENT
E840 ACCIDENT TO POWERED AIRCRAFT AT TAKEOFF OR LANDING
E841 ACCIDENT TO POWERED AIRCRAFT, OTHER AND UNSPECIFIED
E842 ACCIDENT TO UNPOWERED AIRCRAFT
E843 FALL IN, ON, OR FROM AIRCRAFT
E844 OTHER SPECIFIED AIR TRANSPORT ACCIDENTS
E845 ACCIDENT INVOLVING SPACECRAFT
E846 ACCIDENTS INVOLVING POWERED VEHICLES USED SOLELY WITHIN THE BUILDINGS AND PREMISES AND INDUSTRIAL OR COMMERCIAL ESTABLISHMENT
E847 ACCIDENTS TO UNPOWERED AIRCRAFT
E848 ACCIDENTS INVOLVING OTHER VEHICLES, NEC
E849 PLACE OF OCCURRENCE
E880 FALL ON OR FROM STAIRS OR STEPS
E881 FALL ON OR FROM LADDERS OR SCAFFOLDING
E882 FALL FROM OR OUT OF BUILDING OR OTHER STRUCTURE
E883 FALL INTO HOLE OR OTHER OPENING IN SURFACE
E884 OTHER FALL FROM ONE LEVEL TO ANOTHER
E885 FALL ON SAME LEVEL FROM SLIPPING, TRIPPING, OR STUMBLING
E886 FALL ON SAME LEVEL FROM COLLISION, PUSHING, OR SHOVING BY OR WITH OTHER PERSON
E887 FRACTURE, CAUSE UNSPECIFIED
E888 OTHER AND UNSPECIFIED FALL
E890 CONFLAGRATION IN PRIVATE DWELLING
E891 CONFLAGRATION IN OTHER AND UNSPECIFIED BUILDING OR STRUCTURE
E892 CONFLAGRATION NOT IN BUILDING OR STRUCTURE
E893 ACCIDENT CAUSED BY IGNITION OF CLOTHING
E894 IGNITION OF HIGHLY INFLAMMABLE MATERIAL
E895 ACCIDENT CAUSED BY CONTROLLED FIRE IN PRIVATE DWELLING
E896 ACCIDENT CAUSE BY CONTROLLED FIRE IN OTHER AND UNSPECIFIED BUILDING OR STRUCTURE
E897 ACCIDENT CAUSED BY CONTROLLED FIRE NOT IN BUILDING OR STRUCTURE
E898 ACCIDENT CAUSED BY OTHER SPECIFIED FIRE AND FLAMES
E899 ACCIDENT CAUSED BY UNSPECIFIED FIRE
E910 ACCIDENTAL DROWNING AND SUBMERSION
E913 ACCIDENTAL MECHANICAL SUFFOCATION
E914 FOREIGN BODY ACCIDENTALLY ENTERING EYE AND ADNEXA
E915 FOREIGN BODY ACCIDENTALLY ENTERING OTHER ORIFICE
E916 STRUCK ACCIDENTALLY BY FALLING OBJECT
E917 STRIKING AGAINST OR STRUCK ACCIDENTALLY BY OBJECTS OR PERSONS

E918 CAUGHT ACCIDENTALLY IN OR BETWEEN OBJECTS
E919 ACCIDENTS CAUSED BY MACHINERY
E920 ACCIDENTS CAUSED BY CUTTING AND PIERCING INSTRUMENTS OR OBJECTS
E921 ACCIDENT CAUSED BY EXPLOSION OF PRESSURE VESSEL
E922 ACCIDENT CAUSED BY FIREARM AND AIR GUN MISSILE
E923 ACCIDENT CAUSED BY EXPLOSIVE MATERIAL
E924 ACCIDENT CAUSED BY HOT SUBSTANCE OR OBJECT, CAUSTIC OR CORROSIVE MATERIAL, AND STEAM
E925 ACCIDENT CAUSED BY ELECTRIC CURRENT
E926 EXPOSURE TO RADIATION
E927 OVEREXERTION AND STRENUOUS MOVEMENTS
E928 OTHER AND UNSPECIFIED ENVIRONMENTAL AND ACCIDENTAL CAUSES
E960 FIGHT, BRAWL, RAPE
E961 ASSAULT BY CORROSIVE OR CAUSTIC SUBSTANCE, EXCEPT POISONING
E962 ASSAULT BY POISONING
E963 ASSAULT BY HANGING AND STRANGULATION
E964 ASSAULT BY SUBMERSION [DROWNING]
E965 ASSAULT BY FIREARMS AND EXPLOSIVES
E966 ASSAULT BY CUTTING AND PIERCING INSTRUMENT
E967 PERPETRATOR OF CHILD AND ADULT ABUSE
E968 ASSAULT BY OTHER AND UNSPECIFIED MEANS
E969 LATE EFFECTS OF INJURY PURPOSELY INFLICTED BY OTHER PERSON
E970 INJURY DUE TO LEGAL INTERVENTION BY FIREARMS
E971 INJURY DUE TO LEGAL INTERVENTION BY EXPLOSIVES
E972 INJURY DUE TO LEGAL INTERVENTION BY GAS
E973 INJURY DUE TO LEGAL INTERVENTION BY BLUNT OBJECT
E974 INJURY DUE TO LEGAL INTERVENTION BY CUTTING AND PIERCING INSTRUMENT
E975 INJURY DUE TO LEGAL INTERVENTION BY OTHER SPECIFIED MEANS
E976 INJURY DUE TO LEGAL INTERVENTION BY UNSPECIFIED MEANS
E977 LATE EFFECTS OF INJURIES DUE TO LEGAL INTERVENTION
E978 LEGAL EXECUTION
E980 POISONING BY SOLID OR LIQUID SUBSTANCES, UNDETERMINED WHETHER ACCIDENTALLY OR PURPOSELY INFLICTED
E981 POISONING BY GASES IN DOMESTIC USE, UNDETERMINED WHETHER ACCIDENTALLY OR PURPOSELY INFLICTED
E982 POISONING BY OTHER GASES, UNDETERMINED WHETHER ACCIDENTALLY OR PURPOSELY INFLICTED
E983 HANGING, STRANGULATION, OR SUFFOCATION, UNDETERMINED WHETHER ACCIDENTALLY OR PURPOSELY INFLICTED
E984 SUBMERSION [DROWNING] UNDETERMINED WHETHER ACCIDENTALLY OR PURPOSELY INFLICTED
E985 INJURY BY FIREARMS, AIR GUNS AND EXPLOSIVES, UNDETERMINED WHETHER ACCIDENTALLY OR PURPOSELY INFLICTED
E986 INJURY BY CUTTING AND PIERCING INSTRUMENTS, UNDETERMINED WHETHER ACCIDENTALLY OR PURPOSELY INFLICTED
E987 FALLING FROM HIGH PLACE, UNDETERMINED WHETHER ACCIDENTALLY OR PURPOSELY INFLICTED
E988 INJURY BY OTHER AND UNSPECIFIED MEANS, UNDETERMINED WHETHER ACCIDENTALLY OR PURPOSELY INFLICTED
E989 LATE EFFECTS OF INJURY, UNDETERMINED WHETHER ACCIDENTALLY OR PURPOSELY INFLICTED
E990 INJURY DUE TO WAR OPERATIONS BY FIRES AND CONFLAGRATIONS
E991 INJURY DUE TO WAR OPERATIONS BY BULLETS AND FRAGMENTS
E992 INJURY DUE TO WAR OPERATIONS BY EXPLOSION OF MARINE WEAPONS
E993 INJURY DUE TO WAR OPERATIONS BY OTHER EXPLOSION
E994 INJURY DUE TO WAR OPERATIONS BY DESTRUCTION OF AIRCRAFT
E995 INJURY DUE TO WAR OPERATIONS BY OTHER AND UNSPECIFIED FORMS OF CONVENTIONAL WARFARE
E996 INJURY DUE TO WAR OPERATIONS BY NUCLEAR WEAPONS
E997 INJURY DUE TO WAR OPERATIONS BY OTHER FORMS OF UNCONVENTIONAL WARFARE
E998 INJURY DUE TO WAR OPERATIONS BUT OCCURRING AFTER CESSATION OF HOSTILITIES
E999 LATE EFFECT OF INJURY DUE TO WAR OPERATIONS

DIAGNOSTIC RELATED GROUPS (DRGS)

002 CRANIOTOMY FOR TRAUMA, AGE GREATER THAN 17
027 TRAUMATIC STUPOR AND COMA, COMA GREATER THAN ONE HOUR
028 TRAUMATIC STUPOR AND COMA, COMA LESS THAN ONE HOUR, AGE GREATER THAN 17 WITH CC
029 TRAUMATIC STUPOR AND COMA, COMA LESS THAN ONE HOUR, AGE GREATER THAN 17 WITHOUT CC
031 CONCUSSION, AGE GREATER THAN 17 WITH CC
032 CONCUSSION, AGE GREATER THAN 17 WITHOUT CC

072 NASAL TRAUMA AND DEFORMITY
083 MAJOR CHEST TRAUMA WITH CC
084 MAJOR CHEST TRAUMA WITHOUT CC
235 FRACTURES OF FEMUR
236 FRACTURE OF HIP AND PELVIS
237 SPRAINS, STRAINS AND DISLOCATIONS OF HIP, PELVIS AND THIGH
441 WOUND DEBRIDEMENTS FOR INJURIES
441 HAND PROCEDURES FOR INJURIES
442 OTHER OR PROCEDURES FOR INJURIES WITH CC
456 OTHER OR PROCEDURES FOR INJURIES WITHOUT CC
457 TRAUMATIC INJURY, AGE GREATER THAN 17 WITH CC
458 TRAUMATIC INJURY, AGE GREATER THAN 17 WITHOUT CC
459 TRAUMATIC INJURY, AGE 0-17
460 ALLERGIC REACTIONS, AGE GREATER THAN 17
461 ALLERGIC REACTIONS, AGE 0-17
462 POISONING AND TOXIC EFFECTS OF DRUGS, AGE GREATER THAN 17 WITH CC
463 POISONING AND TOXIC EFFECTS OF DRUGS, AGE GREATER THAN 17 WITHOUT CC
464 POISONING AND TOXIC EFFECTS OF DRUGS, AGE 0-17
465 COMPLICATIONS OF TREATMENT WITH CC
466 COMPLICATIONS OF TREATMENT WITHOUT CC
467 OTHER INJURY, POISONING AND TOXIC EFFECT DIAGNOSES WITH CC
468 OTHER INJURY, POISONING AND TOXIC EFFECT DIAGNOSES WITHOUT CC
460 NO LONGER VALID
484 CRANIOTOMY FOR MULTIPLE SIGNIFICANT TRAUMA
488 LIMB REATTACHMENT, HIP AND FEMUR PROCEDURES FOR MULTIPLE SIGNIFICANT TRAUMA
489 OTHER OR PROCEDURES FOR MULTIPLE SIGNIFICANT TRAUMA
490 OTHER MULTIPLE SIGNIFICANT TRAUMAS
491 MAJOR JOINT AND LIMB REATTACHMENT PROCEDURES OF UPPER EXTREMITY

Trial of labor

Diagnostic Related Groups (DRGs)

372 VAGINAL DELIVERY WITH COMPLICATING DIAGNOSES
373 VAGINAL DELIVERY WITHOUT COMPLICATING DIAGNOSES
374 VAGINAL DELIVERY WITH STERILZATION AND/OR D AND C
375 VAGINAL DELIVERY WITH OR PROCEDURE EXCEPT STERILIZATION AND/OR D AND C

or

ICD-9-CM diagnosis codes (includes all 4th and 5th digits):

653 DISPROPORTION
660 OBSTRUCTED LABOR
661 ABNORMALITY OF FORCES OF LABOR
662 LONG LABOR

(Includes all 5th digits):
652.1 BREECH OR OTHER MALPRESENTATION SUCCESSFULLY CONVERTED TO CEPHALIC PRESENTATION
659.0 FAILED MECHANICAL INDUCTION
659.1 FAILED MEDICAL OR UNSPECIFIED INDUCTION
659.2 MATERNAL PYREXIA DURING LABOR, UNSPECIFIED
659.3 GENERALIZED INFECTION DURING LABOR
656.3 FETAL DISTRESS
663.0 PROLAPSE OF CORD
663.1 CORD AROUND NECK, WITH COMPRESSION
663.2 OTHER AND UNSPECIFIED CORD ENTANGLEMENT, WITH COMPRESSION
663.3 OTHER AND UNSPECIFIED CORD ENTANGLEMENT, WITHOUT MENTION OF COMPRESSION
663.4 SHORT CORD
663.5 VASA PREVIA
663.6 VASCULAR LESIONS OF CORD
663.8 OTHER UMBILICAL CORD COMPLICATIONS
663.9 UNSPECIFIED UMBILICAL CORD COMPLICATION

Vaginal delivery

Diagnostic Related Groups (DRGs):

372 VAGINAL DELIVERY WITH COMPLICATING DIAGNOSES
373 VAGINAL DELIVERY WITHOUT COMPLICATING DIAGNOSES
374 VAGINAL DELIVERY WITH STERILAIZATION AND/OR D AND C
375 VAGINAL DELIVERY WITH/ OR PROCEDURE EXCEPT STERILIZATION AND/ OR D AND C

Vaginal delivery during stay

ICD-9-CM diagnosis codes (includes all 4th digits, #1 and # 2 5th digits):

640.8 OTHER SPECIFIED HEMORRHAGE IN EARLY PREGNANCY
640.9 UNSPECIFIED HEMORRHAGE IN EARLY PREGNANCY
641 ANTEPARTUM HEMORRHAGE, ABRUPTIO PACENTAE, AND PLACENTA PREVIA
642 HYPERTENSION COMPLICATING PREGNANCY, CHILDBIRTH, AND THE PUERPERIUM
643 EXCESSIVE VOMITING IN PREGNANCY
644 EARLY OR THREATENED LABOR

645 LATE PREGNANCY
646 OTHER COMPLICATIONS OF PREGNANCY, NEC
647 INFECTIOUS AND PARASITIC CONDITIONS IN THE MOTHER CLASSIFIABLE ELSEWHERE, BUT COMPLICATING PREGNANCY, CHILDBIRTH, OR THE PUERPERIUM
648 OTHER CURRENT CONDITIONS IN THE MOTHER CLASSIFIABLE ELSEWHERE, BUT COMPLICATING PREGNANCY, CHILDBIRTH, OR THE PUERPERIUM
650 NORMAL DELIVERY
651 MULTIPLE GESTATION
652 MALPOSITION AND MALPRESENTATION OF FETUS
653 DISPROPORTION
654 ABNORMALITY OF ORGANS AND SOFT TISSUES OF PELVIS
655 KNOWN OR SUSPECTED FETAL ABNORMALITY AFFECTING MANAGEMENT OF MOTHER
656 OTHER FETAL AND PLACENTAL PROBLEMS AFFECTING MANAGEMENT OF MOTHER
657 POLYHYDRAMNIOS
658 OTHER PROBLEMS ASSOCIATED WITH AMNIOTIC CAVITY AND MEMBRANES
659 OTHER INDICATION FOR CARE OR INTERVENTION RELATED TO LABOR AND DELIVERY, NEC
660 OBSTRUCTED LABOR
661 ABNORMALITY OF FORCES OF LABOR
662 LONG LABOR
663 UMBILICAL CORD COMPLICATIONS
664 TRAUMA TO PERINEUM AND VULVA DURING DELIVERY
665 OTHER OBSTETRICAL TRAUMA
666 POSTPARTUM HEMORRHAGE
667 RETAINED PLACENTA OR MEMBRANES, WITHOUT HEMORRHAGE
668 COMPLICATIONS OF THE ADMINISTRATION OF ANESTHETIC OR OTHER SEDATION IN LABOR AND DELIVERY
669 OTHER COMPLICATIONS OF LABOR AND DELIVERY, NEC
670 MAJOR PUERPERAL INFECTION
671 VENOUS COMPLICATIONS IN PREGNANCY AND THE PUERPERIUM
672 PYREXIA OF UNKNOWN ORIGIN DURING THE PUERPERIUM
673 OBSTETRICAL PULMONARY EMBOLISM
674 OTHER AND UNSPECIFIED COMPLICATIONS OF THE PUERPERIUM, NEC
675 INFECTIONS OF THE BREAST AND NIPPLE ASSOCIATED WITH CHILDBIRTH
676.91 UNSPECIFIED DISORDER OF LACTATION - DELIVERED, WITH OR WITHOUT MENTION OF ANTEPARTUM CONDITION

or

V27.0 SINGLE LIVEBORN
V27.1 SINGLE STILLBORN
V27.2 TWINS, BOTH LIVEBORN
V27.3 TWINS, ONE LIVEBORN AND ONE STILLBORN
V27.4 TWINS, BOTH STILLBORN
V27.5 OTHER MULTIPLE BIRTH, ALL LIVEBORN
V27.6 OTHER MULTIPLE BIRTH, SOME LIBEBORN
V27.7 OTHER MULTIPLE BIRTH, ALL STILLBORN
V27.9 UNSPECIFIED OUTCOME OF DELIVERY

Section 4A. Definitions of Rejected Indicators (after panel discussion and rating)

Denominator items in bold and brackets are fully specified in Section 1B, "Coding Details for Accepted Hospital-Level Indicators."

Indicator	Definition and Numerator	Population at Risk (Denominator)
• Obstetric thrombosis or embolism	Discharges with ICD-9-CM codes for obstetric thrombosis or embolism [DVT –postpartum unspecified (671.40), DVT- delivered with mention of postpartum complication (671.42), DVT - postpartum condition or complication (671.44), Obstetric pulmonary embolism (673.20)] in any diagnosis field per 100 deliveries.	All deliveries **([vaginal delivery],[cesarean delivery]).**
• Puerperal infection	Discharges with ICD-9-CM codes for major puerperal infection [Major puerperal infection, unspecified as to episode of care (670.00), Major puerperal infection, delivered with mention of post-partum complication (670.02), Major puerperal infection, post-partum condition or complication (670.04)] in any diagnosis field per 100 deliveries.	All deliveries **([vaginal delivery],[cesarean delivery]).** Exclude patients with a diagnosis code of antepartum infection of amniotic cavity [65840, 1, 3].
• Postoperative pneumonia	Discharges with ICD-9-CM codes for pneumonia [pneumococcal pneumonia (481), other bacterial pneumonia {Klebsiella pneumoniae, pseudomoniae, pseudomonas, Hemophilis pneumoniae, streptococcus, stapnylococcus, anaerobes, E. coli, other gram negative, Legionnaires disease} (482.0-482.99)] in any secondary diagnosis field per 100 surgical discharges.	All **[surgical]** discharges Exclude patients in MDC 4. Exclude patients with any diagnosis of **[immunocompromised]** state (including any diagnosis of AIDS), or **[cancer]**
• Iatrogenic hypotension	Discharges with ICD-9-CM code of 458.2 in any diagnosis field per 100 discharges.	Exclude all obstetric admissions (MDC 14 and 15). Exclude patients with any diagnosis of **[trauma]**
• Intestinal infection due to C*lostridium difficile*	Discharges with ICD-9-CM code of 008.45 in any secondary diagnosis field per 100 discharges.	Exclude all obstetric admissions (MDC 14 and 15).
• Dosage complications	Discharges with ICD-9-CM code denoting a dosage complication [Failure in dosage. Excessive amount of blood or other fluid during transfusion or infusion (E873.0), Failure in dosage. Incorrect dilution of fluid during infusion. (E873.1), Failure in dosage. Overdose of radiation in therapy (E873.2) Failure in dosage.	Exclude all obstetric admissions (MDC 14 and 15).

	Inadvertent exposure of patient to radiation during medical care (E873.3) Failure in dosage in electroshock or insulin-shock therapy (E873.4), Failure in dosage. Inappropriate too hot or too cold temperature in local application and packing (E873.5), Failure in dosage, Non -administration of necessary drug or medicinal substance (E873.6), Other specific failure in dosage excludes accidental overdose of drug (E873.8) Unspecified failure in dosage (E873.9), Wrong fluid in infusion (E876.1)] in any diagnosis field per 100 discharges.	
• Postoperative iatrogenic complications -digestive	Secondary dx codes of iatrogenic complication of digestive system (997.4)	**[Surgical]** patients
• Postoperative iatrogenic complications - respiratory	Secondary dx code of iatrogenic complication of respiratory system (997.3)	**[Surgical]** patients
• Postoperative iatrogenic complications - urinary	Secondary dx code of iatrogenic complications of urinary system (997.5)	**[Surgical]** patients
• Postoperative iatrogenic complications - vascular	Secondary dx code of iatrogenic peripheral vascular complication (997.2)	**[Surgical]** patients
• Unexpected LOS/Conditional LOS	Unexpected: For each patient a predicted length of stay is calculated using a multiple linear regression model. The predicted length of stay depends on the principal diagnosis, age, and comorbidities of the patient. Then, an unexpected length of stay percentage is calculated: (actual LOS – predicted LOS)/predicted LOS. Patients whose percentage is in the upper quartile (top 25%) are considered to have unusually long lengths of stay. (Kuykendall, 1995) Conditional: Patients with an extended length of stay have a hospital stay that is longer than the "extended length of stay point" defined as the point in the distribution (days stayed) where, for any particular DRG, the rate of discharge changes from increasing to decreasing. In other words, at some point, for a group of patients within a DRG, fewer patients are discharged than were discharged on the previous day, and more patients are held in the hospital for longer stays (Silber, 1999).	All **[Surgical]** and **[Medical]** patients.

Appendix F

Detailed Results for Rejected Indicators

This appendix presents the literature review and clinician panel review results for all indicators rejected either pre- or post-panel review. It is organized into three sections.

Section 1 presents the literature review results for indicators rejected pre-panel review.

Section 2 presents the literature review results for indicators rejected post-panel review.

Section 3 presents the clinician panel review results for indicators rejected post-panel review.

APPENDIX F. DETAILED RESULTS FOR REJECTED INDICATORS

Section 1. Literature Review Results for Indicators Rejected Pre-panel Review

Complications of Anesthesia - Shock

Source. This indicator was originally proposed by Iezzoni et al.[1] as part of the CSP (CSP 8, "post or intraoperative shock due to anesthesia"). Shock due to anesthesia (995.4) is the sole ICD-9-CM code in their original definition. It was also included as one component of a broader indicator ("adverse events and iatrogenic complications") in AHRQ's original HCUP Quality Indicators.[2]

Evidence

We were unable to find evidence on validity from prior studies, because this complication is quite rare.

Complications Relating to Drugs

Source. This indicator (precise definition not available) was originally proposed by Hannan et al. as a criterion for targeting "cases that would have a higher percentage of quality of care problems than cases without the criterion, as judged by medical record review."[3] It was redefined and endorsed by Iezzoni et al.[1] in the CSP (CSP 28, "complications related to drugs"), based on major drug classes: antibiotics, antifungals, antivirals, non-narcotic and narcotic analgesics, antipyretics, anesthetics, anticoagulants, fibrinolytics, blood products, anticonvulsant and anti-Parkinsonian agents, sedatives/hypnotics, psychotropics, stimulants, antineoplastics, immunosuppressants and antirheumatics, hormones, antiasthmatics, antiarrhythmics and other cardiovascular agents. Needleman and Buerhaus [4] considered adverse drug events as an "Outcome Potentially Sensitive to Nursing," based on input from their Technical Expert Panel, but discarded it because the "event rate was too low to be useful."

Evidence

Coding validity. This indicator, as defined in CSP, is highly problematic among medical cases (10% confirmation by coders, 20% by physicians), apparently because most drug-related complications are present at admission.[5, 6]

Construct validity. Explicit process of care failures in the CSP validation study were very unusual among medical cases with CSP 28 (2%), and no more frequent than among unflagged controls (5%). Physician reviewers identified potential quality problems in 16% of medical patients with CSP 28 (versus 2% of unflagged controls).[6] Based on two-stage implicit review of 8,109 randomly selected deaths from 104 New York hospitals in 1985-86, Hannan et al.[3] found that cases with a secondary diagnosis of "selected drug poisonings" were no more likely to have received care that departed from professionally recognized standards than cases without such codes (2.5% versus 1.7%, OR=1.09), after adjusting for patient demographic, geographic, and hospital characteristics. We were unable to find other evidence on the validity of this indicator.

Death Within One (or Two) Days of Any Surgical Procedure

Source. This indicator (with alternative time windows) was originally proposed by Hannan et al. as a criterion for targeting "cases that would have a higher percentage of

quality of care problems than cases without the criterion, as judged by medical record review."[3] The University HealthSystem Consortium adopted this indicator for procedures involving anesthesia (2836).

Evidence

Construct validity. Based on two-stage review of 8,109 randomly selected deaths from 104 New York hospitals in 1985-86, Hannan et al.[3] reported that patients who died within one day of a significant surgical procedure (except for cancer or trauma) were 2.8 times more likely to have received care that departed from professionally recognized standards than other patients who died (4.8% versus 1.7%), after adjusting for patient demographic, geographic, and hospital characteristics. In 46 of these 59 cases (78%) of substandard care, the patient's death was attributed at least partially to that care. A two-day window detected 35 additional cases of substandard care, but the association between second-day deaths and substandard care was weaker (4.4% versus 1.7%, OR=2.0). We were unable to find other evidence on the validity of this indicator.

In-hospital Burns

Source. This indicator (940.0-949.5) was originally proposed by Hannan et al. as a criterion for targeting "cases that would have a higher percentage of quality of care problems than cases without the criterion, as judged by medical record review."[3]

Evidence

Construct validity. Based on two-stage review of 8,109 randomly selected deaths from 104 New York hospitals in 1985-86, Hannan et al.[3] reported that cases with a secondary diagnosis of burn were **not** significantly more likely to have received care that departed from professionally recognized standards than cases without that code (7.4% versus 1.7%, OR=3.4), after adjusting for patient demographic, geographic, and hospital characteristics. We were unable to find other evidence on the validity of this indicator.

Mechanical Complications

Source. This indicator was originally proposed by Iezzoni et al.[1] as part of the CSP (CSP 10, "mechanical complication due to device, implant or graft, except organ transplant"). Their definition excludes mechanical complications due to prosthetic heart valves, coronary bypass grafts, other vascular devices or grafts, and nervous system devices, implants, or graft. The University HealthSystem Consortium and AHRQ's original HCUP Quality Indicators adopted this CSP indicator for major surgery patients (2932); Version 1.3 of the QIs included several additional (new) ICD-9-CM updates.[2]

Evidence

Coding validity. CSP 10 had a borderline confirmation rate among major surgical cases (61% by coders' review, 56% by physicians' review, 73% by nurse-abstracted clinical documentation).[5-7] In comparison with the VA's National Surgical Quality Improvement Program database from 123 hospitals in 1994-95, in which "graft/prosthetic failure within 30 days after surgery" is the only mechanical complication qualifying for documentation, ICD-9-CM diagnoses (996.0x-996.5x) had a sensitivity of 14% and a predictive value of 2%.[8]

Construct validity. Explicit process of care failures in the CSP validation study were only moderately frequent among major surgical cases with CSP 10 (33%), after excluding a few patients who had mechanical complications at admission, but unflagged controls were not evaluated on the same criteria. Physician reviewers identified potential quality problems in 31% of major surgery patients with CSP 10 (versus 2% of unflagged controls). [6] Kovner and Gergen reported that among 506 community hospitals in the 1993 Nationwide Inpatient Sample, having more registered nurse hours per adjusted patient day was not associated with rates of mechanical complications due to a device, implant, or graft.[9]

Other Complications of Surgery

Source. This indicator (996-999) was originally proposed by Hannan et al. as a criterion for targeting "cases that would have a higher percentage of quality of care problems than cases without the criterion, as judged by medical record review."[3] However, subsequent authors found this list of ICD-9-CM codes to be overly broad, and created more specific indicators from the same list of codes.

Evidence

Construct validity. Based on two-stage review of 8,109 randomly selected deaths from 104 New York hospitals in 1985-86, Hannan et al.[3] reported that cases with a secondary diagnosis of 996-999 were 2.5 times more likely to have received care that departed from professionally recognized standards than cases without that code (3.7% versus 1.7%), after adjusting for patient demographic, geographic, and hospital characteristics. In 24 of these 35 cases (69%) of substandard care, the patient's death was attributed at least partially to that care.

Postoperative Cardiac Abnormalities Except AMI

Source. This indicator was originally proposed by Iezzoni et al.[1] as part of the CSP (CSP 15, "postoperative cardiac abnormalities except AMI"). Their definition includes complete atrioventricular block, ventricular tachycardia, ventricular fibrillation, and functional abnormalities following cardiac surgery among persons less than 65 years of age.

Evidence

Coding validity. No evidence on validity is available from CSP studies. Geraci et al.[10] confirmed only 3 of 20 episodes of ventricular tachycardia, fibrillation, or flutter (427.1, 427.4x) reported on discharge abstracts of VA patients hospitalized in 1987-89 for CHF, COPD, or diabetes; the sensitivity for ventricular tachycardia was 43% (3/7). We were unable to find other evidence on the validity of this indicator.

Postoperative Cerebral Infarction

Source. This indicator was originally proposed by Iezzoni et al.[1] as part of the CSP (CSP 1, "postoperative cerebral infarction"). Their definition is limited to infarctions secondary to occlusion or stenosis of precerebral or cerebral arteries, and excludes nonspecific strokes. The University HealthSystem Consortium adopted this CSP indicator for major surgery patients (2919).

Evidence

Coding validity. CSP 1 had a high confirmation rate among major surgical cases (83% by coders' review, 86% by physicians' review).[5, 6] Nurse reviews were not performed. An earlier study of elderly Medicare beneficiaries from Massachusetts, Alabama, Iowa, and New York in FY1993 revealed a similarly high confirmation rate of 78% (43/55) among major surgical cases, although 28% of those patients (12/43) lacked clear documentation of a new or worsening neurologic deficit.[11]

Geraci et al.[12] confirmed 0 of 26 episodes of cerebrovascular disease (436, 437) reported on discharge abstracts of VA patients hospitalized in 1987-89 for CHF, COPD, or diabetes; the sensitivity for stroke was 0% (0/2). However, the clinical definition of this complication (stroke) was much different from the ICD-9-CM definition ("acute, but ill-defined" and "other and ill-defined" cerebrovascular disease). Romano et al. identified 2 of 6 episodes of cerebrovascular disease (433.x-435.1, 435.8, 436) using discharge abstracts of diskectomy patients at 30 California hospitals in 1990-91; there was one false positive. In comparison with the VA's National Surgical Quality Improvement Program database from 123 hospitals in 1994-95, the ICD-9-CM diagnosis of stroke (431-434.xx, 436) had a sensitivity of 70% and a predictive value of 6% for acute stroke within 30 days after surgery.[8] The 1985 National DRG Validation Study also suggested that the sensitivity of Medicare hospital claims data exceeds 75% for stroke (431, 432.9, 434.x, 436), even when it is coded as a secondary diagnosis (n=36) rather than as the reason for admission. [13]

Hartz and Kuhn identified only 59 of 125 (47%) strokes by applying a related indicator (997.0x) to Medicare patients who underwent coronary artery bypass surgery in Wisconsin in 1990-91; the predictive value was 54% (59/117).[14] Unfortunately, we found no evidence on the validity of the specific ICD-9-CM code for postoperative cerebral infarction (997.02), which was introduced in 1995.

Construct validity. Explicit process of care failures in the CSP validation study were no more frequent among cases with CSP 1 (43%) than among unflagged controls (46%), after excluding one patient who had stroke at admission. Indeed, cases flagged on this indicator were no more likely than unflagged controls (49% versus 52%) to have at least one of five specific process-of-care problems in the earlier study of elderly Medicare beneficiaries from Massachusetts, Alabama, Iowa, and New York.[11] Physician reviewers identified potential quality problems in 31% of medical patients with CSP 1 (versus 2% of unflagged controls).[6]

Postoperative Coma or Stupor

Source. This indicator was originally proposed by Iezzoni et al.[1] as part of the CSP (CSP 18, "postoperative coma or stupor"). Their original definition was limited to coma, stupor, and persistent vegetative state. Needleman and Buerhaus[4] identified postoperative central nervous system (CNS) complications as an "Outcome Potentially Sensitive to Nursing," but their broader definition also includes acute delirium (293.0), reactive confusion (298.2), and reactive depression (309).

Evidence

Coding validity. In comparison with the VA's National Surgical Quality Improvement Program database from 123 hospitals in 1994-95, in which only coma

"persisting >24 hours postoperatively" qualifies for documentation, the ICD-9-CM diagnosis of coma (780-780.01) had a sensitivity of 16% and an uninterpretable predictive value. [8]

Construct validity. Needleman and Buerhaus[4] found that nurse staffing was inconsistently associated with the occurrence of CNS complications among major surgery patients from 799 hospitals in 11 states in 1997, and was independent of CNS complications among medical patients.

Postoperative Complications Related to Urinary Tract Anatomy

Source. This indicator was originally proposed by Iezzoni et al.[1] as part of the CSP (CSP 5, "postoperative complications related to urinary tract anatomy"). Their definition includes stricture or kinking or ureter and other ureteric obstruction.

Evidence

We were unable to find evidence on validity from prior studies, because this complication is quite rare.

Postoperative Gastrointestinal Hemorrhage or Ulceration

Source. This indicator was originally proposed by Iezzoni et al.[1] as part of the CSP (CSP 4, "postoperative gastrointestinal hemorrhage or ulceration following non-GI surgery"). Their definition includes hemorrhage or acute nontraumatic perforation involving the esophagus, stomach, duodenum, jejunum, or unspecified gastrointestinal tract. The University HealthSystem Consortium (2928) and AHRQ's original HCUP Quality Indicators adopted this CSP indicator for major surgery patients.[2] Needleman and Buerhaus[4] identified postoperative gastrointestinal hemorrhage as an "Outcome Potentially Sensitive to Nursing," but their definition excludes alcoholic, atrophic, and hypertrophic gastritis (535.11, 535.21, 535.31, 535.51, 535.61), excludes hemorrhage due to chronic ulcer, and includes acute and unspecified ulcers without hemorrhage or perforation.

Evidence

Coding validity. CSP 4 had a moderately high confirmation rate among major surgical cases (66% by coders' review, 73% by physicians' review, 68% by nurse-abstracted clinical documentation, and 75% if nurses also accepted physicians' notes as adequate documentation).[5-7] An earlier study of elderly Medicare beneficiaries from Massachusetts, Alabama, Iowa, and New York in FY1993 revealed a similarly high confirmation rate of 83% (68/82) among major surgical cases, although 26% (18/68) of those patients lacked laboratory or clinical evidence of significant blood loss.[11]

By contrast, Geraci et al.[12] confirmed 1 of 10 episodes of gastrointestinal hemorrhage (531.0, 531.2, 531.4, 531.6, 532.0, 532.2, 532.4, 532.6, 533.0, 533.2, 533.4, 533.6, 534.0, 534.2, 534.4, 534.6, 535.1, 537.83, 562.02-562.03, 562.12-562.13, 569.3, 569.85, 596.7) reported on discharge abstracts of VA patients hospitalized in 1987-89 for CHF, COPD, or diabetes; the sensitivity for hemorrhage requiring transfusion was 11% (1/9).

Construct validity. Explicit process of care failures in the CSP validation study were only moderately frequent among major surgical cases with CSP 4 (28%), after

excluding one patient who had gastrointestinal hemorrhage at admission.[15] Cases flagged on this indicator and unflagged controls did not differ significantly on a composite of 17 generic process criteria. Similarly, cases flagged on this indicator were no more likely than unflagged controls (26% versus 22%) to have at least one of four specific process-of-care problems in the earlier study of elderly Medicare beneficiaries from Massachusetts, Alabama, Iowa, and New York.[11] Physician reviewers identified potential quality problems in 38% of major surgery patients with CSP 4 (versus 2% of unflagged controls).[6]

Needleman and Buerhaus[4] found that higher registered nurse staffing (RN hours/adjusted patient day) and better nursing skill mix (RN hours/licensed nurse hours) were consistently associated with the occurrence of upper gastrointestinal hemorrhage among medical patients from 799 hospitals in 11 states in 1997, but were independent of gastrointestinal hemorrhage among major surgery patients. An increase from the 25th to the 75th percentile on these two measures of staffing was associated with 5.2% (95% CI, 1.4% to 8.9%) and 5.1% (95% CI, 0.5% to 9.7%) decreases, respectively, in the rate of upper gastrointestinal hemorrhage among medical patients.[16] Kovner and Gergen reported that among 506 community hospitals in the 1993 Nationwide Inpatient Sample, having more registered nurse hours per adjusted patient day was not associated with rates of upper gastrointestinal hemorrhage after major surgery.[9]

Postoperative Infection

Source. This indicator was originally proposed by Iezzoni et al.[1] as part of the CSP (CSP 23, "wound infection"). Their definition, which includes both posttraumatic wound infection and unspecified postoperative infection, was included in AHRQ's original HCUP Quality Indicators.[2] Needleman and Buerhaus[4] identified postoperative infection as an "Outcome Potentially Sensitive to Nursing," using the same CSP definition. It was endorsed by Miller et al. [17] in the original "AHRQ PSI Algorithms and Groupings," although their definition excluded posttraumatic wound infection (958.3).

Evidence

Coding validity. CSP 23 (including both 998.5x and 958.3) had a high confirmation rate among major surgical cases (91% by coders' review, 61% by physicians' review, 60% by nurse-abstracted clinical documentation), but a poor confirmation rate among medical cases (28% by coders' review, 24% by physicians' review).[5-7] Nurse reviews were not performed on medical cases, most of which were apparently present at admission. An earlier study of elderly Medicare beneficiaries from Massachusetts, Alabama, Iowa, and New York in FY1993 revealed even poorer confirmation rates of 43% (40/93) among major surgical cases (of whom 20 or 50% lacked physical examination evidence of the diagnosis) and 8% (7/86) among medical cases (of whom 2 or 29% lacked physical examination evidence of the diagnosis).[11]

Keeler et al.[18] reported a confirmation rate of 75% (6/8) but a sensitivity of only 27% (6/22) for postoperative infection (998.5x) among Medicare hip fracture patients from 297 hospitals in 1985-86. Massanari et al. [19] identified 45% of cases of "nosocomial wound infection" using 1984 hospital discharge data from the University of Iowa, but no definitions were provided. Faciszewski et al.[20] confirmed 71% (5/7) of reported cases of postoperative infection (998.5x) among 310 patients who underwent spinal fusion at the

Marshfield Clinic in 1991-92. The sensitivity of coding for this complication was 28% (5/18). Among 185 total knee replacement patients from 5 Ontario hospitals in 1984-90, Hawker et al.[21] found that the sensitivity and predictive value of unspecified postoperative infection codes were both 50% (2/4). Romano et al.[22] identified 5 of 8 episodes of postoperative infection (998.5x, 999.3, 996.62) using discharge abstracts of diskectomy patients at 30 California hospitals in 1990-91; there were two false positives. Hartz and Kuhn identified only 46 of 385 (12%) infections by applying this indicator (998.5, 999.3, 996.6x) to Medicare patients who underwent coronary artery bypass surgery in Wisconsin in 1990-91; the predictive value was 84% (46/55).[14] Belio-Blasco et al.[23] reported that "discharge forms" had a sensitivity of 57% (132/230) and a specificity of 99.9% for identifying nosocomial surgical wound infection among surgical patients in a Spanish teaching hospital. In comparison with the VA's National Surgical Quality Improvement Program database from 123 hospitals in 1994-95, the ICD-9-CM diagnosis of wound infection (998.5x) had a sensitivity of 21% and a predictive value of 35% for wound infection within 30 days after surgery.[8]

Construct validity. Explicit process of care failures in the CSP validation study were only moderately frequent among major surgical cases with CSP 23 (24%), after excluding two patients who had wound infections at admission, and no more frequent among medical cases with CSP 23 than among unflagged controls (2% versus 5%, respectively). Major surgical cases flagged on this indicator and unflagged controls did not differ significantly on a composite of 17 generic process criteria. Similarly, cases flagged on this indicator did not differ significantly from unflagged controls (among either major surgical or medical cases) on one specific process-of-care problem in the earlier study of elderly Medicare beneficiaries from Massachusetts, Alabama, Iowa, and New York.[11] Physician reviewers identified potential quality problems in 26% of major surgery patients and 3% of medical patients with CSP 23 (versus 2% of unflagged controls for each risk group).[6] Needleman and Buerhaus[4] found that nurse staffing was independent of the occurrence of wound infection among major surgery patients from 799 hospitals in 11 states in 1997.

Postoperative Infections Except Pneumonia and Wound

Source. This indicator was originally proposed by Iezzoni et al.[1] as part of the CSP (CSP 16, "postoperative infections except pneumonia and wound"). Their original definition included *Clostridium difficile* infection (which we also considered as a separate indicator, rejected #3), bacterial meningitis, empyema with or without fistula, mediastinal abscess, mediastinitis, acute or unspecified pyelonephritis, acute lymphadenitis. The University HealthSystem Consortium adopted this CSP indicator for major surgery patients (2937). Needleman and Buerhaus [4] considered "miscellaneous nosocomial infections" as an "Outcome Potentially Sensitive to Nursing," based on input from their Technical Expert Panel, but discarded it after concluding that it was "not codable on the basis of discharge abstracts."

Evidence

Coding validity. CSP 16 had a relatively high confirmation rate among major surgical cases (72% by coders' review, 73% by physicians' review, 73% by nurse-abstracted clinical documentation, and 77% if nurses also accepted physicians' notes as adequate documentation).[5-7]

Construct validity. Explicit process of care failures in the CSP validation study were only moderately frequent among major surgical cases with CSP 16 (44%), after excluding a few patients who had infections at admission, but unflagged controls were not evaluated on the same criteria. Physician reviewers identified potential quality problems in 40% of major surgery patients with CSP 16 (versus 2% of unflagged controls).[6] Nursing skill mix was significantly associated (in the expected direction) with the aggregate rate of postoperative infections among 352 and 295 California hospitals in 1992 and 1994, respectively, but not among 126 and 131 New York hospitals in the same years.[24] However, these authors used an entirely different definition of postoperative infections, which only partially overlapped the CSP 16 definition.

Shock or Cardiopulmonary Arrest In-hospital

Source. This indicator was originally proposed by Iezzoni et al.[1] as part of the CSP (CSP 12, "shock or cardiopulmonary arrest in hospital"). Their definition includes cardiac arrest, respiratory arrest, shock, and cardiogenic shock. Needleman and Buerhaus[4] identified shock or cardiac arrest as an "Outcome Potentially Sensitive to Nursing," but their definition also includes various resuscitative procedures (93.93, 99.60, 99.63).

Evidence

Coding validity. CSP 12 had a borderline confirmation rate among major surgical cases (53% by coders' review, 74% by physicians' review).[5, 6] Nurse reviews were not performed. An earlier study of elderly Medicare beneficiaries from Massachusetts, Alabama, Iowa, and New York in FY1993 revealed a similar confirmation rate of 72% (58/81) among major surgical cases, although 2% (1/58) of those patients lacked clear documentation of cardiac arrest, respiratory arrest, hypotension, or poor perfusion.[11]

Geraci et al.[10] confirmed only 4 of 16 episodes of cardiac arrest (427.5), hypotension, or shock (458, 785.5x) reported on discharge abstracts of VA patients hospitalized in 1987-89 for CHF, COPD, or diabetes; the sensitivity for cardiac arrest or shock was 19% (4/21). Romano et al. identified 3 of 16 episodes of hypotension, shock, or cardiac arrest (785.5x, 427.5, 458.9, 998.0, 37.91) using discharge abstracts of diskectomy patients at 30 California hospitals in 1990-91; there were no false positives (but these findings are driven mostly by hypotension, a far milder diagnosis than shock). Although postoperative shock is properly assigned a different code (998.0) than other causes of shock, Keeler et al.[18] reported a sensitivity of only 2% (1/55), with no false positives, for this diagnosis among Medicare hip fracture patients from 297 hospitals in 1985-86. In comparison with the VA's National Surgical Quality Improvement Program database from 123 hospitals in 1994-95, in which "cardiac arrest" is defined as involving cardiopulmonary resuscitation within 30 days after surgery, the ICD-9-CM diagnosis (427.5) had a sensitivity of 27% and a predictive value of 56%.[8]

Construct validity. Explicit process of care failures in the CSP validation study were no more frequent among cases with CSP 12 (44%) than among unflagged controls (46%), after excluding one patient who had shock at admission. Physician reviewers identified potential quality problems in 18% of major surgery patients with CSP 12 (versus 2% of unflagged controls).[6]

Needleman and Buerhaus[4] found that higher registered nurse staffing (RN hours/adjusted patient day) and better nursing skill mix (RN hours/licensed nurse hours)

were consistently associated with the occurrence of shock or cardiorespiratory arrest among medical patients from 799 hospitals in 11 states in 1997, but were independent of these outcomes among major surgery patients. An increase from the 25th to the 75th percentile on these two measures of staffing was associated with 4.1% (95% CI, -2.5% to 10.8%) and 9.4% (95% CI, 2.6% to 16.3%) decreases, respectively, in the rate of shock or cardiorespiratory arrest among medical patients.[16]

Urinary Tract Infection

Source. This indicator (599.0) was originally developed under the auspices of the Healthcare Cost and Utilization Project. Needleman and Buerhaus[4] identified urinary tract infection (599.0, 996.64) as an "Outcome Potentially Sensitive to Nursing."

Evidence

Coding validity. Massanari et al.[19] identified 62% of cases of "nosocomial urinary tract infection" (UTI) using 1984 hospital discharge data from the University of Iowa, but no definitions were provided. Geraci et al.[10] confirmed only 7 of 86 (8%) episodes of UTI (599.x) reported on discharge abstracts of Veterans Affairs (VA) patients hospitalized in 1987-89 for congestive heart failure (CHF), chronic obstructive pulmonary disease (COPD), or diabetes; the sensitivity for a urinary tract infection was 64% (7/11). Romano et al.[22] identified 17 of 36 episodes of UTI (590.1x, 590.2, 590.8x, 590.9, 595.0, 595.9, 599.0, 996.64) using discharge abstracts of diskectomy patients at 30 California hospitals in 1990-91; there were five false positives. Belio-Blasco et al.[23] reported that "discharge forms" had a sensitivity of 38% (33/87) and a specificity of 99.9% for identifying nosocomial UTIs among surgical patients in a Spanish teaching hospital. In comparison with the VA's National Surgical Quality Improvement Program database from 123 hospitals in 1994-95, an ICD-9-CM diagnosis of kidney, bladder, or urinary tract infection (590.x, 595.x, 599.0) had a sensitivity of 45% and a predictive value of 24% for UTIs within 30 days after surgery (excluding catheter-related infections, 996.64).[8]

Construct validity. Needleman and Buerhaus[4] found that higher registered nurse staffing (RN hours/adjusted patient day) and better nursing skill mix (RN hours/licensed nurse hours) were consistently associated with the occurrence of UTI among medical patients from 799 hospitals in 11 states in 1997. An increase from the 25th to the 75th percentile on these two measures of staffing was associated with 3.6% (95% CI, 1.2% to 6.0%) and 9.0% (95% CI, 6.1% to 11.9%) decreases, respectively, in the rate of UTI among medical patients.[16] Nursing skill mix was associated with the UTI rate among major surgery patients (rate ratio 0.48, 95% CI 0.38-0.61), but aggregate registered nurse staffing was not (rate ratio 0.99, 95% CI 0.98-1.00). An increase from the 25th to the 75th percentile on nursing skill mix was associated with a 4.9% (95% CI, 0.3% to 9.5%) decrease in the rate of UTI among major surgery patients. These findings are consistent with Kovner and Gergen, who reported that among 506 community hospitals in the 1993 Nationwide Inpatient Sample, having more registered nurse hours per adjusted patient day was associated with a lower rate of UTI after major surgery.[9] Nursing skill mix was significantly associated (in the expected direction) with the UTI rate among 352 and 295 California hospitals in 1992 and 1994, respectively, and among 131 New York hospitals in 1994.[24] Total licensed nurses were not associated with the UTI rate in either state or either time period.

Section 2. Literature Review Results for Indicators Rejected Post-panel Review

Dosage Complications

Source. This diagnosis code was originally proposed by Iezzoni et al.[1] as one component of a much broader indicator (CSP 28, "complications related to drugs"), which was part of the CSP. It was endorsed by Miller et al. [17] as one component of a broader indicator ("E codes") in the original "AHRQ PSI Algorithms and Groupings."

Evidence

Coding validity. This indicator, as defined in CSP, is highly problematic among medical cases (10% confirmation by coders, 20% by physicians), apparently because most drug-related complications are present at admission.[5, 6] The AHRQ definition, and the present PSI definition, differ by excluding all of the poisoning codes. No evidence on the validity of the E code subset, by itself, is available from prior studies.

Construct validity. Explicit process of care failures in the CSP validation study were very unusual among medical cases with CSP 28 (2%), and no more frequent than among unflagged controls (5%). Physician reviewers identified potential quality problems in 16% of medical patients with CSP 28 (versus 2% of unflagged controls).[6] Based on two-stage implicit review of 8,109 randomly selected deaths from 104 New York hospitals in 1985-86, Hannan et al. found that cases with a secondary diagnosis of "selected drug poisonings" were no more likely to have received "care that departed from professionally recognized standards" than cases without such codes (2.5% versus 1.7%, OR=1.09), after adjusting for patient demographic, geographic, and hospital characteristics.[3]

Iatrogenic Hypotension

Source. This diagnosis code was proposed by Miller et al.[17] as one component of a broader indicator ("iatrogenic conditions"), which was part of the original "AHRQ PSI Algorithms and Groupings." It was also included as one component of a broader indicator ("adverse events and iatrogenic complications") in AHRQ's Version 1.3 HCUP Quality Indicators.[2]

Evidence

We were unable to find evidence on validity from prior studies, because this diagnosis code was introduced in 1995.

Intestinal Infection Due to *Clostridium difficile*

Source. This diagnosis code was originally proposed by Iezzoni et al.[1] as one component of a much broader indicator (CSP 16, "postoperative infections except pneumonia and wound"), which was part of the CSP.

Evidence

Coding validity. No evidence on validity is available from CSP studies, because this code was grouped with other postoperative infections. Geraci et al.[12] identified 0 of 6 episodes of antibiotic-associated diarrhea using the discharge abstracts of VA patients hospitalized in 1987-89 for CHF, COPD, or diabetes. However, the clinical definition of

this complication (antibiotic-associated diarrhea) was much broader than the ICD-9-CM definition (*Clostridium difficile* colitis).

Postoperative Iatrogenic Complications - Digestive

Source. This diagnosis code was originally proposed by Iezzoni et al.[1] as one component of a much broader indicator (CSP 26, "iatrogenic complications"), which was part of the CSP. Their definition includes central nervous system, cardiac, peripheral vascular, respiratory, gastrointestinal, urinary, and unspecified amputation stump complications, as well as complications affecting other body systems. It was also included as one component of a broader indicator ("adverse events and iatrogenic complications") in AHRQ's original HCUP Quality Indicators.[2] The University HealthSystem Consortium adopted this CSP indicator for cardiac procedure patients (2913).

Evidence

Coding validity. CSP 26 had a very high confirmation rate among major surgical cases (92% by coders' review) and a borderline confirmation rate among medical cases (59% by coders' review).[5] Physician reviews were not performed. Faciszewski et al. [20] confirmed 48% (10/21) of reported cases of gastrointestinal complications (997.4) among 310 patients who underwent spinal fusion at the Marshfield Clinic in 1991-92. The sensitivity of coding for this complication was 40% (10/25). Romano et al.[22] identified 7 of 15 episodes of gastrointestinal complications (with 3 false positives) using discharge abstracts of diskectomy patients at 30 California hospitals in 1990-91.

Construct validity. Explicit process of care failures in the CSP validation study were slightly but not significantly more frequent among cases with CSP 26 (58% surgical, 9% medical) than among unflagged controls (46% surgical, 5% medical).

Postoperative Iatrogenic Complications - Respiratory

Source. This diagnosis code was originally proposed by Iezzoni et al.[1] as one component of a much broader indicator (CSP 26, "iatrogenic complications"), which was part of the CSP. Their definition includes central nervous system, cardiac, peripheral vascular, respiratory, gastrointestinal, urinary, and unspecified amputation stump complications, as well as complications affecting other body systems. It was also included as one component of a broader indicator ("adverse events and iatrogenic complications") in AHRQ's original HCUP Quality Indicators.[2] The University HealthSystem Consortium adopted this CSP indicator for cardiac procedure patients (2913).

Evidence

Coding validity. CSP 26 had a very high confirmation rate among major surgical cases (92% by coders' review) and a borderline confirmation rate among medical cases (59% by coders' review).[5] Physician reviews were not performed. Faciszewski et al.[20] confirmed 48% (11/23) of reported cases of respiratory complications (997.3) among 310 patients who underwent spinal fusion at the Marshfield Clinic in 1991-92. The sensitivity of coding for this complication was 55% (11/20). Romano et al.[22] identified 2 of 10

episodes of respiratory complications (with 7 false positives) using discharge abstracts of diskectomy patients at 30 California hospitals in 1990-91.

Construct validity. Explicit process of care failures in the CSP validation study were slightly but not significantly more frequent among cases with CSP 26 (58% surgical, 9% medical) than among unflagged controls (46% surgical, 5% medical). We were unable to find other evidence on the validity of this indicator.

Postoperative Iatrogenic Complications - Urinary

Source. This indicator was originally proposed by Hannan et al. as a criterion for targeting "cases that would have a higher percentage of quality of care problems than cases without the criterion, as judged by medical record review."[3] It was endorsed by Iezzoni et al.[1] as one component of a much broader indicator (CSP 26, "iatrogenic complications") in the CSP. The definition of that indicator includes central nervous system, cardiac, peripheral vascular, respiratory, gastrointestinal, urinary, and unspecified amputation stump complications, as well as complications affecting other body systems. It was also included as one component of a broader indicator ("adverse events and iatrogenic complications") in AHRQ's original HCUP Quality Indicators.[2] The University HealthSystem Consortium adopted this CSP indicator for cardiac procedure patients (2913).

Evidence

Coding validity. CSP 26 had a very high confirmation rate among major surgical cases (92% by coders' review) and a borderline confirmation rate among medical cases (59% by coders' review).[5] Physician reviews were not performed. Faciszewski et al. [20] confirmed 56% (5/9) of reported cases of genitourinary complications (997.5) among 310 patients who underwent spinal fusion at the Marshfield Clinic in 1991-92. The sensitivity of coding for this complication was 19% (5/26). Among 185 total knee replacement patients from 5 Ontario hospitals in 1984-90, Hawker et al.[21] found that the sensitivity and predictive value of urinary tract complications (definition not given) were 38% (6/16) and 50% (6/12), respectively. Romano et al. identified 5 of 17 episodes of urinary complications (996.76, 997.5), with 8 false positives, using discharge abstracts of diskectomy patients at 30 California hospitals in 1990-91. Hartz and Kuhn identified only 18 of 113 (16%) episodes of acute renal failure (defined as an increase in serum creatinine of more than 1.0 mg/dL, resulting in a final value greater than 2.5 mg/dL) by applying this indicator to Medicare patients who underwent coronary artery bypass surgery in Wisconsin in 1990-91; the predictive value was 27% (18/66).[14]

Construct validity. Explicit process of care failures in the CSP validation study were slightly but not significantly more frequent among cases with CSP 26 (58% surgical, 9% medical) than among unflagged controls (46% surgical, 5% medical). Based on two-stage review of 8,109 randomly selected deaths from 104 New York hospitals in 1985-86, Hannan et al.[3] reported that cases with a secondary diagnosis of 997.5 (urinary) were 3.2 times more likely to have received care that departed from professionally recognized standards than cases without that code (6.0% versus 1.7%), after adjusting for patient demographic, geographic, and hospital characteristics. In 4 of these 9 cases (44%) of substandard care, the patient's death was attributed at least partially to that care.

Postoperative Iatrogenic Complications - Vascular

Source. This diagnosis code was originally proposed by Iezzoni et al.[1] as one component of a much broader indicator (CSP 26, "iatrogenic complications"), which was part of the CSP. Their definition includes central nervous system, cardiac, peripheral vascular, respiratory, gastrointestinal, urinary, and unspecified amputation stump complications, as well as complications affecting other body systems. It was also included as one component of a broader indicator ("adverse events and iatrogenic complications") in AHRQ's original HCUP Quality Indicators.[2] The University HealthSystem Consortium adopted this CSP indicator for cardiac procedure patients (2913).

Evidence

Coding validity. CSP 26 had a very high confirmation rate among major surgical cases (92% by coders' review) and a borderline confirmation rate among medical cases (59% by coders' review).[5] Physician reviews were not performed.

Construct validity. Explicit process of care failures in the CSP validation study were slightly but not significantly more frequent among cases with CSP 26 (58% surgical, 9% medical) than among unflagged controls (46% surgical, 5% medical). We were unable to find other evidence on the validity of this indicator.

Postoperative Pneumonia

Source. This indicator was originally proposed by Iezzoni et al.[1] as part of the CSP (CSP 19, "postoperative pneumonia"). Their definition includes virtually all bacterial causes of pneumonia (481-483, 485-486). Needleman and Buerhaus [4] identified postoperative pneumonia as an "Outcome Potentially Sensitive to Nursing," but their definition aggregates bacterial, aspiration (507.0), and "hypostatic" (514) pneumonia, includes nonspecific respiratory complications (997.3), and excludes pneumococcal (481) and atypical (483) pneumonias. The University HealthSystem Consortium (2943) and AHRQ's original HCUP Quality Indicators adopted this CSP indicator for major surgery patients.[2]

Evidence

Coding validity. CSP 19 had a moderate confirmation rate among major surgical cases (unreported by coders' review, 64% by physicians' review, 48% by nurse-abstracted clinical documentation, and 76% if nurses also accepted physicians' notes as adequate documentation). [6, 7] An earlier study of elderly Medicare beneficiaries from Massachusetts, Alabama, Iowa, and New York in FY1993 revealed a similar confirmation rate of 76% (75/99) among major surgical cases, although 17% of those patients (13/75) lacked radiographic or laboratory evidence supporting the diagnosis.[11]

Keeler et al.[18] reported a confirmation rate of 75% (30/40) but a sensitivity of only 26% (30/116) for pneumonia (482.x, 485, 486, 997.3, 998.5, 999.3) among Medicare hip fracture patients from 297 hospitals in 1985-86. All of the false positives in that study were due to 900-series codes. Massanari et al.[19] identified 61% of cases of "nosocomial lower respiratory tract infection" using 1984 hospital discharge data from the University of Iowa, but no definitions were provided. Geraci et al.[12] confirmed (by chest radiography) 0 of 7 episodes of pneumonia (482.9, 507.0) reported on discharge

abstracts of VA patients hospitalized in 1987-89 for CHF, COPD, or diabetes; the sensitivity for a new alveolar infiltrate was 0% (0/5). Romano et al. [22] identified 1 of 1 episode of pneumonia (480.0-487.0, 507.0, 510.x, 513.x), with 3 false positives, using discharge abstracts of diskectomy patients at 30 California hospitals in 1990-91. Belio-Blasco et al. [23] reported that "discharge forms" had a sensitivity of 44% (29/66) and a specificity of 99.9% for identifying nosocomial pneumonia among surgical patients in a Spanish teaching hospital. In comparison with the VA's National Surgical Quality Improvement Program database from 123 hospitals in 1994-95, in which pneumonia is defined as a radiographic infiltrate associated with purulent sputum, positive culture/viral isolation, or seroconversion within 30 days after surgery, ICD-9-CM diagnoses (480-487.0) had a sensitivity of 38% and a predictive value of 41%.[8?] Adding "respiratory complications" (997.3) to the definition increased the sensitivity for pneumonia to 50%, but decreased the positive predictive value to 34%.

Construct validity. Explicit process of care failures in the CSP validation study were very frequent among major surgical cases with CSP 19 (83%), after excluding two patients who had pneumonia at admission.[15] Cases flagged on this indicator and unflagged controls did not differ significantly on a composite of 17 generic process criteria. Indeed, cases flagged on this indicator were significantly **less** likely than unflagged controls (20% versus 64%) to have at least one of four specific process-of-care problems in the earlier study of elderly Medicare beneficiaries from Massachusetts, Alabama, Iowa, and New York.[11] Physician reviewers identified potential quality problems in only 5% of major surgery patients with CSP 19 (versus 2% of unflagged controls).[6] The striking discrepancy between the results of explicit nurse review and implicit physician review is not explained.

Needleman and Buerhaus[4] found that higher registered nurse staffing (RN hours/adjusted patient day) and better nursing skill mix (RN hours/licensed nurse hours) were consistently associated with the occurrence of pneumonia (including aspiration and "hypostatic" pneumonia) among medical patients from 799 hospitals in 11 states in 1997. An increase from the 25th to the 75th percentile on these two measures of staffing was associated with 2.7% (95% CI, -0.4% to 5.8%) and 6.4% (95% CI, 2.8% to 10.0%) decreases, respectively, in the rate of pneumonia.[16] Skill mix was "weakly" associated with the rate of pneumonia among major surgical patients. These findings are consistent with Kovner and Gergen, who reported that among 506 community hospitals in the 1993 Nationwide Inpatient Sample, having more registered nurse hours per adjusted patient day was associated with a lower rate of pneumonia after major surgery.[9] Nurse staffing was not associated with the rate of pneumonia after invasive vascular procedures. Nursing skill mix was significantly associated (in the expected direction) with the pneumonia rate among 352 and 295 California hospitals in 1992 and 1994, respectively, but not among 126 and 131 New York hospitals in the same years.[24]

Unexpected Length of Stay (LOS)/Conditional LOS

Source. This indicator was originally proposed by Kuykendall et al.[25] as a relatively unbiased tool to identify potential quality of care problems. The underlying premise was that significant complications increase LOS, and therefore unexpectedly long LOS may be a marker for inpatient complications. Poor provider adherence to normative practices may lead to either unexpectedly short or unexpectedly long LOS.

Evidence

Kuykendall et al's original analysis was based on linked medical records and administrative data for 1,477 patients who were discharged from 9 VA hospitals in 1987-89 with a primary diagnosis of diabetes, (COPD), or CHF. They used administrative data with or without additional clinical data (e.g., APACHE Acute Physiology Score) to derive expected LOS through multiple linear regression. Outliers were defined as patients whose deviation from expected LOS (expressed as a proportion of expected LOS) was either below the first quartile or above the third quartile. When this method was used to identify possible complications, and then compared with detailed chart abstraction, it had a sensitivity of 40%, 62%, and 54% for complications of diabetes, COPD, and CHF, respectively. By contrast, the sensitivity of the corresponding ICD-9-CM complication codes was 26%, 39%, and 33%, respectively. The confirmation rate, or predictive value, of unexpectedly high LOS was 20%, 29%, and 27% for diabetes, COPD, and CHF, respectively. These estimates were quite similar to the predictive values of ICD-9-CM codes (21%, 32%, and 33%, respectively). We were unable to find any independent validation of these findings.

More recently, Silber et al. proposed a more complex method for using LOS to identify adverse patient outcomes.[26] Their method is based on the observation that with each passing day, patients are increasingly likely to be discharged until a transition point is reached, at which patients become less likely to be discharged the longer they have stayed. Silber et al. focus on the minority of patients whose hospital stay is prolonged beyond the transition point, and estimate the length of additional stay (LAS) beyond this point. Cox proportional hazards models were used to estimate LAS among prolonged-stay patients admitted for appendectomy and pneumonia, adjusting for demographic and clinical characteristics (e.g., MedisGroups severity score). We were unable to find any independent validation of these findings.

Obstetric Thrombosis or Embolism

Source. This indicator was created after review of ICD-9-CM codes.

Evidence

Coding validity. In a stratified probability sample of 1,611 vaginal and cesarean deliveries from 51 California hospitals in 1992-93, the weighted sensitivity and predictive value of coding for thromobembolic complications of delivery, using a broader definition that included all peripheral vascular complications (997.2) and nonthrombotic pulmonary emboli (673.1x, 673.3x, 673.8x), were 0% (0/6) and 100% (6/6), respectively.[27] We were unable to find evidence on validity from prior studies, because this complication is quite rare.

Puerperal Infection

Source. This indicator (670.0x) was created after review of ICD-9-CM codes. It was also included as one component of a broader indicator ("obstetrical complications") in AHRQ's original HCUP Quality Indicators.[2]

Evidence

In a stratified probability sample of 1,611 vaginal and cesarean deliveries from 51 California hospitals in 1992-93, the weighted sensitivity and predictive value of coding for puerperal infection and acute or unspecified endometritis (615.0, 615.9) were 45% (45/124) and 98% (45/53), respectively.[27] We were unable to find other evidence on validity from prior studies.

Section 3. Clinician Panel Review Detailed Results for Rejected Indicators

Dosage Complications

This indicator is intended to flag cases of complications due to dosage errors that can be identified using administrative data. It is intended to capture all cases of dosage complications, not only those occurring in-hospital.

Definition

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM code denoting a dosage complication [Excessive amount of blood or other fluid during transfusion or infusion (E873.0), Incorrect dilution of fluid during infusion. (E873.1), Overdose of radiation in therapy (E873.2) Inadvertent exposure of patient to radiation during medical care (E873.3) Failure in dosage in electroshock or insulin-shock therapy (E873.4), Inappropriate too hot or too cold temperature in local application and packing (E873.5), Non - administration of necessary drug or medicinal substance (E873.6), Other specific failure in dosage excludes accidental overdose of drug (E873.8) Unspecified failure in dosage (E873.9), Wrong fluid in infusion (E876.1)] in any diagnosis field per 100 discharges.
Denominator	Exclude all obstetric admissions (MDC 14 and 15).

Post-conference call panel ratings[a]

Question	*Median*	*Agreement status*
Overall rating	4	Disagreement
Not present on admission	7	Indeterminate agreement
Preventability	8	Agreement
Due to medical error	8	Agreeement
Charting by physicians	3	Indeterminate agreement
Bias (lower rating is favorable)	4	Indeterminate agreement

[a] Medical Complications 2 Multispecialty Panel

Changes to the indicator

Panelists did not suggest any changes to this indicator.

Concerns not addressable through changes

Panelists expressed a multitude of concerns regarding this indicator. The definition of this indicator included a variety of dosage complications, coded as E873.x. These complications do *not* include failure in dosage of a medicinal substance, or accidental poisoning. Adverse drug events are difficult to ascertain from administrative data. Panelists felt that the included dosage complications were often of dubious clinical importance, and in some cases very rare. Panelists also noted that a better denominator, but one that cannot be operationalized using administrative data, would be number of doses, rather than all patients most of whom would never have been exposed to the treatments measured in this indicator.

Panelists also expressed great concern regarding the documentation of these events. According to panelists, most of these events would not result in significant clinical sequelae, and therefore would be unreliably reported. Panelists noted that this indicator would have very poor sensitivity, and thus would not be useful. In addition, using an indicator with such poor sensitivity may unfairly punish those hospitals with the most detailed reporting systems for quality improvement. It may even discourage reporting of these events in some facilities. Due to the difficulties with this indicator, panelists felt that if this indicator were to be implemented, it would have to be used to identify cases for further internal review.

Summary

Because of the serious concerns surrounding this indicator, and since most of these could not be addressed using administrative data, panelists rated this indicator as poor and suggested that it not be used. Although panelists agreed that when the events did occur they were due to error, and expressed interest in following some of these complications, as well as other types of dosage complications, potential problems with this indicator were considered too great for use.

Iatrogenic Hypotension

This indicator is intended to flag cases of hypotension caused by medical care. The area level indicator is intended to capture all cases of iatrogenic hypotension, not only those occurring in-hospital. The hospital level indicator is restricted to secondary diagnoses, and is intended to capture cases occurring during the same hospitalization. Trauma patients are excluded as they may be more susceptible to non-preventable iatrogenic hypotension.

Definition

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM code of 458.2 in any diagnosis field per 100 discharges.
Denominator	Exclude all obstetric admissions (MDC 14 and 15). Exclude patients with any diagnosis of **[trauma]**

Post-conference call panel ratings[a]

Question	*Median*	*Agreement status*
Overall rating	5	Disagreement
Not present on admission	8	Agreement
Preventability	4	Indeterminate agreement
Due to medical error	5	Indeterminate agreement
Charting by physicians	3	Disagreement
Bias (lower rating is favorable)	6	Indeterminate agreement

[a]Procedural Complications Multispecialty Panel

Changes to the indicator

No changes were made to this indicator, as panelists felt that no changes would rectify concerns.

Concerns not addressable through changes

Panelists had many concerns regarding this indicator, especially related to the preventability and charting of this complication. First, panelists commented frequently on the unclear preventability of many cases of hypotension. While some cases may result from poor management of fluids and medication, hypotension in general often has multifactorial etiologies. Comorbidities, such as diabetes or congestive heart failure, or even the psychological state of the patient, may contribute to the development of hypotension. Panelists expressed concern that the cause of the hypotension is often difficult to identify.

Panelists also expressed great concern over the documentation of hypotension. The term 'hypotension' is not intrinsically connected to an objective physiological state. What one physician calls 'hypotension' another physician may not, depending on the severity and duration of the hypotension. This ambiguity leads to variable documentation and potentially systematic bias from variability in reporting. One panelist noted that blood pressures recorded by anesthesiologists may be rounded, effecting reporting as well. Finally, documentation is subject to the vigilance of monitoring of blood pressure. Panelists also expressed concern that hypotension may not be labeled often as iatrogenic, and thus will be coded elsewhere.

Summary

This indicator was rated as poor by panelists, primarily due to concern about the reliability of reporting and coding. In addition, many panelists felt that this complication may be less preventable than others reviewed. Panelists suggested that this indicator be dropped from further consideration.

Intestinal Infection Due to *Clostridium Difficile*

This indicator is intended to identify patients that may have acquired an intestinal infection (due to *C. difficile*) in-hospital. In order to eliminate infections present on admission, this indicator includes only secondary diagnoses (meaning the infection was not designated as the principal diagnosis).

Definition

Methods:	
Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM code of 008.45 in any secondary diagnosis field per 100 discharges.
Denominator	Exclude all obstetric admissions (MDC 14 and 15).
Benchmark	State, regional, or peer group average.

Post-conference call panel ratings[a]

Question	*Median*	*Agreement status*
Overall rating	3	Disagreement
Not present on admission	7	Indeterminate agreement
Preventability	3	Disagreement
Due to medical error	3	Indeterminate agreement
Charting by physicians	7	Disagreement
Bias (lower rating is favorable)	6	Indeterminate agreement

[a] Medical Complications 1 Multispecialty Panel

Changes to the indicator

None of the concerns raised by panelists were addressed by changing the specification of this indicator.

Concerns not addressable through changes

Most of the concerns surrounding this indicator were not addressable using administrative data. Concerns focused primarily on the potential for bias due to varying diagnostic practices, and differences in the number of patients with the infection present on admission. Panelists expressed that particularly for patients admitted from long term care facilities, some patients might have the disorder present on admission. At times, this infection may not be fully symptomatic at admission, but may develop into a fully symptomatic condition during the hospitalization. Similarly, the diagnosis of infection due to *C. difficile* is often missed, or not charted as such. A stool culture is required for a definitive diagnosis. Often physicians may treat "diarrhea" without actually obtaining a culture; in this case "diarrhea not otherwise specified" would be reported, and would include cases of *C. difficile*. The differences in charting may be a significant source of bias for this indicator. Specifically, some hospitals may routinely screen for this common complication, while others may not. The rate as detected by the indicator may be particularly high in facilities that screen. Panelists cautioned that implementation of an administrative data indicator for *C. difficile* has the potential to reduce screening for such infections.

Panelists also expressed that preventability of this complication varies, depending on the cause of the complication. Infections that result from cross-contamination between patients may be prevented through hand washing, isolation procedures, or other precautions. On the other hand, infections may also occur secondary to appropriate antibiotic use.

Summary

Panelists rated this indicator as poor due to concerns that this operationalization did not exclusively pick up nosocomial infections, and that this complication may not be reliably charted or may be screened for in some facilities. Although panelists expressed interest in tracking nosocomial *C. difficile* infections given better data, they suggested that this indicator not be considered further due to the multiplicity of concerns.

Postoperative Iatrogenic Complications – Digestive

Postoperative Iatrogenic Complications – Respiratory

Postoperative Iatrogenic Complications – Vascular

Postoperative Iatrogenic Complications - Urinary

These indicators were rated in one indicator, reported in the "Experimental" indicator results section in the main body of the report.

Postoperative Pneumonia

This indicator is intended to flag cases of postoperative pneumonia. It is identical to an indicator developed as part of the Complications Screening Program. This indicator limits pneumonia codes to secondary diagnosis codes in order to eliminate pneumonia that was present on admission. It further excludes patients who have major respiratory disorders, as these patients may have pneumonia present on admission, or may be more likely to develop pneumonia after surgical procedures. Finally, it excludes patients with immunosupression, including cancer and AIDS patients, as these patients are particularly susceptible to developing pneumonia.

Defintion

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM codes for pneumonia [pneumococcal pneumonia (481), other bacterial pneumonia {Klebsiella pneumoniae, pseudomoniae, pseudomonas, Hemophilis pneumoniae, streptococcus, stapnylococcus, anaerobes, e. coli, other gram negative, Legionnaires disease} (482.0-482.99)] in any secondary diagnosis field per 100 surgical discharges.
Denominator	All **[surgical]** discharges Exclude patients in MDC 4. Exclude patients with any diagnosis of **[AIDS], [immunocompromised]** state or **[cancer]**

Post-conference call panel ratings[a]

Question	*Median (MS)*	*Agreement status (MS)*	*Median (S)*	*Agreement status (S)*
Overall rating	5	Indeterminate	6	Indeterminate
Not present on admission	7	Indeterminate	8	Indeterminate
Preventability	4	Indeterminate	6	Indeterminate
Due to medical error	2	Agreement	6	Indeterminate
Charting by physicians	6	Indeterminate	7	Indeterminate
Bias (lower rating favorable)	7	Agreement	7	Indeterminate

[a]Multispecialty Panel - Surgical Complications 1
Surgical Panel – Surgical Complications 1

Multi-specialty Panel Results

Changes to the indicator

There were no changes suggested to this indicator that would address the specific concerns of the panel.

Concerns not addressable through changes

Panelists were most concerned about the definition of pneumonia. Different physicians utilize different thresholds in diagnosing pneumonia. What some physicians may call atelactasis, other physicians may define as pneumonia. In addition, different methods are used to diagnose pneumonia. Some physicians may use clinical criteria such as examining x-rays for infiltrate, or requiring fever, yellow sputum, or elevated white blood cell count. Others may require a positive bronchoscopy culture. Because these different thresholds will yield different rates, panelists were concerned about the consistency of charting of this complication. They were also concerned that short length of stay would result in missing postoperative pneumonia that develops after discharge. Similarly, outpatient surgeries also involve risk for post operative pneumonia, but this indicator would not capture these cases either.

Panelists did express that despite the problems with this indicator, they remain interested in tracking the pneumonia rate, but believed that current administrative data is not the appropriate data source. It would be important and useful to track ventilator pneumonia, and other nosocomial pneumonias. They believed that many of these pneumonias are preventable, with current interventions, such as bed elevation, cross contamination prevention, and when appropriate, prophylactic antibiotics. Panelists were concerned about some bias with ventilator pneumonia, specifically the development of ventilator pneumonia depends on length of time on the ventilator, and comorbidities in the patient, such as serious illness, or immunocompromised state.

Surgical Panel Results

Changes to the indicator

The surgical panel suggested that trauma to the head and chest should be excluded. Chest trauma patients may appear to have pneumonia upon x-ray evaluation because of pulmonary contusion and or hemorrhage, or may be at higher risk for developing non-preventable pneumonia. Head trauma patients may have aspirated at the time of trauma leading to pneumonia. Although the diagnosis code for aspiration pneumonia is not included in this indicator, pneumonia without specified organisms is included and thus, some aspiration pneumonia may appear in this indicator.

Concerns not addressable through changes

The surgical panel expressed concern regarding potential bias for this indicator, given the potential effects of different patient case mix, particularly for some pre-existing disease (e.g., pulmonary diseases, diabetes) or behavioral risk factors (e.g., smoking). Panelists also indicated that the type of surgery would influence postoperative pneumonia rates (e.g., likely elevated rates for chest surgery or abdominal surgery). They suggested

that this indicator be risk adjusted or stratified according to the type of procedure performed.

Summary across Panels

Both panels rated this indicator relatively poorly. Great concern was expressed regarding variation in diagnosis of pneumonia. Internist, intensivists and nurses directly treating postoperative pneumonia particularly expressed this concern. Although this indicator was not included in the final Accepted or Experimental indicator sets due to the concerns raised, panelists were hopeful that clinical measures to track postoperative pneumonia rate would be developed.

Obstetric Thrombosis or Embolism

This indicator is intended to flag cases of potentially preventable obstetric thrombosis or embolism in women delivering during the index hospitalization.

Definition

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM codes for obstetric thrombosis or embolism [DVT –postpartum unspecified (671.40), DVT- delivered with mention of postpartum complication (671.42), DVT - postpartum condition or complication (671.44), Obstetric pulmonary embolism (673.20)] in any diagnosis field per 100 deliveries.
Denominator	All deliveries **([vaginal delivery],[cesarean delivery]).**

Post-conference call panel ratings[a]

Question	*Median*	*Agreement status*
Overall rating	3.5	Disagreement
Not present on admission	6	Indeterminate agreement
Preventability	2.5	Indeterminate agreement
Due to medical error	2	Indeterminate agreement
Charting by physicians	8	Agreement
Bias (lower rating is favorable)	6.5	Indeterminate Agreement

[a]Obstetric Complications 2 Panel

Changes to the indicator

Panelists suggested no changes to this indicator.

Concerns not addressable through changes

Panelists expressed strong concern about this indicator. First, panelists questioned the preventability of post-partum vascular complications because of their unpredictable nature, and primary relationship to patient factors such as substance use and comorbidities. Some panelists did note that antepartum vascular complications might be preventable; however, it is not possible to track these events using the available administrative data.

Summary

Panelists rated this indicator as poor, and suggested that this is not a complication that was of interest to track and that this indicator should not be considered further.

Puerperal Infection

This indicator is intended to flag cases of potentially preventable puerperal infections in women delivering during the index hospitalization. This indicator excludes patients with infection of the amniotic cavity, as infection in these patients is more likely to be present on admission or non-preventable.

Definition

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Discharges with ICD-9-CM codes for major puerperal infection [Major puerperal infection, unspecified as to episode of care (670.00), Major puerperal infection, delivered with mention of post-partum complication (670.02), Major puerperal infection, post-partum condition or complication (670.04)] in any diagnosis field per 100 deliveries.
Denominator	All deliveries **([vaginal delivery],[cesarean delivery]).** Exclude patients with a diagnosis code of antepartum infection of amniotic cavity [65840, 1, 3].

Post-conference call panel ratings[a]

Question	*Median*	*Agreement status*
Overall rating	5	Agreement
Not present on admission	6.4	Indeterminate agreement
Preventability	4.5	Indeterminate agreement
Due to medical error	3	Indeterminate agreement
Charting by physicians	7	Agreement
Bias (lower rating is favorable)	4.5	Indeterminate agreement

[a]Obstetric Complications 2 Panel

Changes to the indicator

No changes were suggested for this indicator.

Concerns not addressable through changes

Several concerns about this indicator were raised as reasons for the poor overall rating. Panelists felt that some hospitals may have a higher rate of these complications due to patient case mix. Specifically, they noted that patients with sexually transmitted diseases or overall poor health are more likely to develop these complications. They noted that these factors vary systematically with socioeconomic status. Further, many of these complications develop after discharge. Thus, there may be significant underreporting resulting from the exclusive use of inpatient data. Finally, panelists expressed concern that the use of this indicator would lead to the inappropriate overuse of antibiotics.

Summary

This indicator was rated less favorably than most other indicators, and panelists had no suggestions to improve the indicator. This indicator was not considered further.

Unexpected LOS/ Conditional LOS

This indicator is intended to identify patients who have unusually long lengths of stay. It is hypothesized that these patients have unusually long stays because they have developed major complications. Therefore, this measure is intended as a proxy for complications, compensating for problems of undercoding or bias in complications measures. This definition of unexpected length of stay was proposed by David Kuykendall (1995), although the original definition included demographic and longitudinal variables not available using administrative data.

Definition

Quality Measure	Number of events per 100 discharges of population at risk
Numerator	Unexpected: For each patient a predicted length of stay is calculated using a multiple linear regression model. The predicted length of stay depends on the principal diagnosis, age, and comorbidities of the patient. Then, an unexpected length of stay percentage is calculated: (actual LOS – predicted LOS)/predicted LOS. Patients whose percentage is in the upper quartile (top 25%) are considered to have unusually long lengths of stay. (Kuykendall, 1995) Conditional: Patients with an extended length of stay have a hospital stay that is longer than the "extended length of stay point" defined as the point in the distribution (days stayed) where, for any particular DRG, the rate of discharge changes from increasing to decreasing. In other words, at some point, for a group of patients within a DRG, fewer patients are discharged than were discharged on the previous day, and more patients are held in the hospital for longer stays (Silber, 1999).
Denominator	All **[Surgical]** and **[Medical]** patients.

Post-conference call panel ratings

Question	*Median*	*Agreement status*
Overall rating	6	Indeterminate
Not present on admission	Not applicable	Not applicable
Preventability	6	Indeterminate agreement
Due to medical error	4.5	Indeterminate agreement
Charting by physicians	8	Agreement
Bias (lower rating is favorable)	7	Agreement

Changes to the indicator

Panelists did not suggest any changes to this indicator.

Concerns not addressable through changes

Panelists had many concerns and mixed feelings about this indicator. Some panelists felt that length of stay was influenced by many factors besides quality of care. For instance, some providers extend length of stay for social reasons. Patients with little outside social support or resources may be unable to obtain home care, may not have follow-up medical care, or may have other health conditions that affect their ability to heal. For these reasons a patient may be hospitalized longer than other patients with the same condition. Panelists felt that if this indicator were to be used, it would be best used in comparing hospitals with similar case-mixes of underserved populations. Other factors that may influence length of stay that are unrelated to quality of care include age of the patient and certain comorbidities that may not be charted.

Panelists expressed mixed feeling regarding the validity of this indicator as a whole. Some noted that the validity of the concept of unusual length of stay being a proxy for complications may be more valid for surgical patients rather than medical patients, for whom many additional factors besides the development of complications may affect length of stay. Some panelists noted that this indicator is best used internally, as it could be misconstrued by the public, and that length of stay may better measure resource use rather than clinical quality of care.

Summary

Panelists were ambivalent about this indicator. Some felt that this indicator was of interest to track, but more felt that this indicator did not have sufficient face validity as a complications indicator. Panelists felt that this indicator should not be considered further.

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Appendix G

Detailed Empirical Results

This appendix presents the full empirical results for the analyses referenced in Section 3E.

APPENDIX G. DETAILED EMPIRICAL RESULTS

This appendix contains the following empirical tables and figures:

Accepted Indicators

Experimental Indicators

Area Indicators

Supplemental Tables and Figures

Accepted Indicators

Table 1. Discharge Level Accepted Patient Safety Indicators, Florida and National SID, 1997

	Florida			National		
PSI Label	**Num.**	**Den.**	**Rate**	**Num.**	**Den.**	**Rate**
COMPLICATIONS OF ANESTHESIA	408	533,234	0.00077	3,046	4,906,380	0.00062
DEATH IN LOW MORTALITY DRGS	280	619,725	0.00045	3,002	6,866,745	0.00044
DECUBITUS ULCER	12,243	587,557	0.02084	108,042	5,318,472	0.02031
FAILURE TO RESCUE	17,101	93,216	0.18346	135,085	753,174	0.17935
FOREIGN BODY LEFT IN DURING PROC	176	1,747,773	0.00010	1,608	16,575,205	0.00010
IATROGENIC PNEUMOTHORAX	1,551	1,556,307	0.00100	16,574	14,699,703	0.00113
INFECTION DUE TO MEDICAL CARE	3,276	1,504,601	0.00218	27,060	14,411,539	0.00188
POSTOP HEMORRHAGE OR HEMATOMA	981	478,323	0.00205	9,387	4,358,493	0.00215
POSTOP HIP FRACTURE	487	369,503	0.00132	2,918	3,307,360	0.00088
POSTOP PHYSIO METABOL DERANGMNT	366	228,106	0.00160	2,110	2,310,718	0.00091
POSTOP PE OR DVT	3,639	476,243	0.00764	34,167	4,340,545	0.00787
POSTOP RESPIRATORY FAILURE	762	179,162	0.00425	5,349	1,883,955	0.00284
POSTOP SEPSIS	882	72,485	0.01217	6,635	688,606	0.00964
POSTOP WOUND DEHISCENCE	238	115,323	0.00206	2,207	1,066,800	0.00207
TECH DIFFICULTY W PROCEDURE	4,943	1,545,259	0.00320	46,126	14,231,084	0.00324
TRANSFUSION REACTION	16	1,747,773	0.00001	129	16,575,205	0.00001
BIRTH TRAUMA	1,936	180,393	0.01073	27,880	2,052,545	0.01358
OB TRAUMA - C-SECTION	185	41,642	0.00444	2,604	427,558	0.00609
OB TRAUMA - VAGINAL W INSTRUMENT	2,149	10,593	0.20287	36,906	162,662	0.22689
OB TRAUMA - VAGINAL WO INSTRUMENT	9,678	126,782	0.07634	120,858	1,470,327	0.08220

Table 1 shows the total number of adverse events (numerator), the total number of patients at risk (denominator), and the overall rate in Florida and the National SID for each accepted patient safety indicator. Florida was the state used for initial testing and development. The rates are shown to compare with the National SID rates, which are similar.

Table 2. Hospital Level Accepted Patient Safety Indicators, Florida and National SID, 1997

	Florida				National			
PSI Label	**N**	**Rate**	**SD**	**Skew**	**N**	**Rate**	**SD**	**Skew**
COMPLICATIONS OF ANESTHESIA	191	0.00067	0.00100	2.40109	2,275	0.00080	0.00715	44.36257
DEATH IN LOW MORTALITY DRGS	195	0.00124	0.00608	11.62252	2,344	0.00114	0.01194	34.01637
DECUBITUS ULCER	195	0.02417	0.01850	3.61063	2,342	0.02052	0.02069	3.57004
FAILURE TO RESCUE	194	0.18541	0.05659	-0.11446	2,327	0.17031	0.08092	2.13958
FOREIGN BODY LEFT IN DURING PROC	195	0.00008	0.00015	3.49444	2,349	0.00008	0.00018	5.38260
IATROGENIC PNEUMOTHORAX	195	0.00089	0.00080	2.04115	2,349	0.00086	0.00135	5.40259
INFECTION DUE TO MEDICAL CARE	195	0.00204	0.00223	3.65896	2,349	0.00137	0.00175	7.14722
POSTOP HEMORRHAGE OR HEMATOMA	191	0.00198	0.00231	2.98257	2,272	0.00183	0.00314	8.03155
POSTOP HIP FRACTURE	191	0.00191	0.00560	7.73000	2,269	0.00124	0.00594	21.90674
POSTOP PHYSIO METABOL DERANGT	179	0.00149	0.00341	7.94790	2,122	0.00092	0.01112	42.82075
POSTOP PE OR DVT	191	0.00769	0.00510	1.24004	2,272	0.00695	0.01225	16.20401
POSTOP RESPIRATORY FAILURE	179	0.00530	0.00893	4.96602	2,121	0.00268	0.00501	6.15831
POSTOP SEPSIS	177	0.01197	0.01674	5.25552	2,050	0.01000	0.02962	20.53298
POSTOP WOUND DEHISCENCE	190	0.00212	0.00341	2.92101	2,227	0.00243	0.00877	25.50940
TECH DIFFICULTY W PROCEDURE	195	0.00231	0.00225	2.02898	2,348	0.00242	0.00264	2.64406
TRANSFUSION REACTION	195	0.00001	0.00010	10.39826	2,349	0.00001	0.00006	19.53736
BIRTH TRAUMA	122	0.00965	0.01998	5.40175	1,784	0.00936	0.03144	11.85275
OB TRAUMA - C-SECTION	121	0.00433	0.00597	1.78278	1,756	0.00613	0.01612	19.02428
OB TRAUMA - VAGINAL W INSTRUMENT	121	0.17314	0.10291	0.31238	1,697	0.20359	0.14236	1.02616
OB TRAUMA - VAGINAL WO INSTRUMENT	126	0.06878	0.03665	0.48016	1,805	0.07558	0.05789	3.50258

Table 2 shows the hospital level rates for Florida and the National SID, for comparison. The columns labeled 'N' show the number of hospitals with at least one patient in the at-risk denominator.

Table 3. Hospital Level Unadjusted and Age-Gender Adjusted Accepted Patient Safety Indicators, National SID, 1997

		Unadjusted Rate			Age-Gender Adjusted		
PSI Label	**N**	**Rate**	**SD**	**Skew**	**Rate**	**SD**	**Skew**
COMPLICATIONS OF ANESTHESIA	2,275	0.00080	0.00715	44.36257	0.00082	0.00713	44.63764
DEATH IN LOW MORTALITY DRGS	2,344	0.00114	0.01194	34.01637	0.00114	0.01284	30.11021
DECUBITUS ULCER	2,342	0.02052	0.02069	3.57004	0.01777	0.02035	3.82908
FAILURE TO RESCUE	2,327	0.17031	0.08092	2.13958	0.12169	0.07747	2.24665
FOREIGN BODY LEFT IN DURING PROC	2,349	0.00008	0.00018	5.38260			
IATROGENIC PNEUMOTHORAX	2,349	0.00086	0.00135	5.40259	0.00083	0.00130	5.64325
INFECTION DUE TO MEDICAL CARE	2,349	0.00137	0.00175	7.14722	0.00136	0.00172	7.20834
POSTOP HEMORRHAGE OR HEMATOMA	2,272	0.00183	0.00314	8.03155	0.00189	0.00366	15.43509
POSTOP HIP FRACTURE	2,269	0.00124	0.00594	21.90674	0.00126	0.00609	23.09444
POSTOP PHYSIO METABOL DERANGT	2,122	0.00092	0.01112	42.82075	0.00103	0.01112	41.90483
POSTOP PE OR DVT	2,272	0.00695	0.01225	16.20401	0.00696	0.01192	15.64592
POSTOP RESPIRATORY FAILURE	2,121	0.00268	0.00501	6.15831	0.00293	0.00627	9.27298
POSTOP SEPSIS	2,050	0.01000	0.02962	20.53298	0.01013	0.02882	21.75989
POSTOP WOUND DEHISCENCE	2,227	0.00243	0.00877	25.50940	0.00270	0.00945	22.07093
TECH DIFFICULTY W PROCEDURE	2,348	0.00242	0.00264	2.64406	0.00243	0.00258	2.65313
TRANSFUSION REACTION	2,349	0.00001	0.00006	19.53736			
BIRTH TRAUMA	1,784	0.00936	0.03144	11.85275	0.00922	0.03150	11.73605
OB TRAUMA - C-SECTION	1,756	0.00613	0.01612	19.02428	0.00628	0.01633	18.46638
OB TRAUMA - VAGINAL W INSTRUMENT	1,697	0.20359	0.14236	1.02616	0.14700	0.13526	1.46571
OB TRAUMA - VAGINAL WO INSTRUMENT	1,805	0.07558	0.05789	3.50258	0.06789	0.05818	3.64282

Table 3 shows the unadjusted and age-gender adjusted rates for the accepted indicators in the National SID in 1997. The second column shows the mean hospital level unadjusted rate, defined as the number of adverse events divided by the number of discharges in the population at risk. The third column shows the standard deviation in the hospital level rates, and the fourth column shows the skew statistic, which is defined as the third moment (where the variance is the second moment). The skew statistic is a measure of how symmetric the hospital level rates are relative to the mean hospital level rate. The more positive the skew statistic is, the longer the right-hand tail of the distribution. The closer to zero it is, the more symmetrical the distribution. Negative skew statistics indicate a longer the left-hand tail.

Table 4. Hospital Level Risk Adjusted Accepted Patient Safety Indicators, National SID, 1997

		DRG Adjusted*			Co-morbidity Adjusted**		
PSI Label	**N**	**Rate**	**SD**	**Skew**	**Rate**	**SD**	**Skew**
COMPLICATIONS OF ANESTHESIA	2,275	0.00087	0.00712	44.62686	0.00088	0.00711	44.61020
DEATH IN LOW MORTALITY DRGS	2,344	0.00114	0.01284	30.11021	0.00115	0.01287	30.10817
DECUBITUS ULCER	2,342	0.01668	0.01903	3.88522	0.01603	0.01802	3.92876
FAILURE TO RESCUE	2,327	0.09768	0.06615	2.17070	0.08461	0.06581	2.09463
FOREIGN BODY LEFT IN DURING PROC	2,349						
IATROGENIC PNEUMOTHORAX	2,349	0.00091	0.00127	5.76631	0.00090	0.00127	5.72549
INFECTION DUE TO MEDICAL CARE	2,349	0.00146	0.00152	6.63907	0.00150	0.00142	5.72947
POSTOP HEMORRHAGE OR HEMATOMA	2,272	0.00200	0.00363	15.71185	0.00201	0.00363	15.64393
POSTOP HIP FRACTURE	2,269	0.00129	0.00591	22.90517	0.00131	0.00590	23.06666
POSTOP PHYSIO METABOL DERANGT	2,122	0.00117	0.01103	41.81183	0.00122	0.01093	41.69619
POSTOP PE OR DVT	2,272	0.00681	0.01093	17.15800	0.00679	0.01082	17.17289
POSTOP RESPIRATORY FAILURE	2,121	0.00314	0.00583	9.04823	0.00301	0.00515	8.64106
POSTOP SEPSIS	2,050	0.01002	0.02759	23.83976	0.01004	0.02691	24.36537
POSTOP WOUND DEHISCENCE	2,227	0.00277	0.00943	22.05895	0.00286	0.00942	22.02311
TECH DIFFICULTY W PROCEDURE	2,348	0.00294	0.00207	2.87175	0.00293	0.00207	2.85770
TRANSFUSION REACTION	2,349						
BIRTH TRAUMA	1,784	0.00920	0.03150	11.67889	0.00922	0.03150	11.61115
OB TRAUMA - C-SECTION	1,756	0.00628	0.01633	18.46636	0.00668	0.01630	18.63379
OB TRAUMA - VAGINAL W INSTRUMENT	1,697	0.14700	0.13526	1.46571	0.14463	0.13378	1.49142
OB TRAUMA - VAGINAL WO INSTRUMENT	1,805	0.06786	0.05818	3.64127	0.06786	0.05764	3.70580

* Age, gender, DRG (except PSI 22, 24, 26, 27, 28, 29, 30); ** Age, gender, DRG, co-morbidity

Table 4 shows the mean hospital level risk-adjusted rates, standard deviations and skew statistic for the DRG and co-morbidity adjusted rates. The Obstetric measures are not adjusted for DRG. The Death in Low Mortality DRGs indicator is also not adjusted for DRG. Rather, the indicator is stratified by DRG group, namely medical (adult and pediatric), surgical (adult and pediatric), neonatal, obstetric and psychiatric [See supplemental Table 1].

Table 5. Hospital Level Reliability Adjusted Accepted Patient Safety Indicators, National SID, 1997

		Reliability* Adjusted			MSX Statistics		
PSI Label	**N**	**Rate**	**SD**	**Skew**	**Signal SD**	**Share**	**Signal Ratio**
COMPLICATIONS OF ANESTHESIA	2,248	0.00069	0.00147	13.36595	0.00187	0.00563	0.75680
DEATH IN LOW MORTALITY DRGS	2,338	0.00089	0.00531	24.87662	0.00439	0.04237	0.94157
DECUBITUS ULCER	2,338	0.02063	0.01802	3.37971	0.01457	0.01067	0.85568
FAILURE TO RESCUE	2,301	0.17498	0.04803	0.72576	0.04617	0.01450	0.66607
FOREIGN BODY LEFT IN DURING PROC							
IATROGENIC PNEUMOTHORAX	2,349	0.00093	0.00122	5.96158	0.00143	0.00183	0.79928
INFECTION DUE TO MEDICAL CARE	2,349	0.00154	0.00119	2.76077	0.00134	0.00095	0.70798
POSTOP HEMORRHAGE OR HEMATOMA	2,243	0.00264	0.00052	1.88841	0.00039	0.00006	0.08587
POSTOP HIP FRACTURE	2,241	0.00107	0.00211	11.61516	0.00184	0.00403	0.67135
POSTOP PHYSIO METABOL DERANGT	2,054	0.00084	0.00060	4.58555	0.00054	0.00033	0.20899
POSTOP PE OR DVT	2,243	0.00722	0.00521	5.60448	0.00633	0.00511	0.72594
POSTOP RESPIRATORY FAILURE	2,047	0.00301	0.00241	2.82516	0.00230	0.00187	0.46639
POSTOP WOUND DEHISCENCE	2,193	0.00217	0.00194	3.37005	0.00188	0.00171	0.35599
POSTOP SEPSIS	1,961	0.00976	0.00840	2.90175	0.00869	0.00790	0.53877
TECH DIFFICULTY W PROCEDURE	2,348	0.00259	0.00236	2.81472	0.00279	0.00241	0.82937
TRANSFUSION REACTION							
BIRTH TRAUMA	1,752	0.00967	0.03157	11.83738	0.04128	0.13603	0.97040
OB TRAUMA - C-SECTION	1,739	0.00618	0.00536	3.82585	0.00590	0.00576	0.45902
OB TRAUMA - VAGINAL W INSTRUMENT	1,625	0.21119	0.09963	0.58224	0.09794	0.05539	0.69985
OB TRAUMA - VAGINAL WO INSTRUMENT	1,758	0.07788	0.04634	1.50907	0.04314	0.02470	0.86416

* Age, gender, DRG, co-morbidity and reliability

Table 5 shows the effect of reliability adjustment, and provides statistics on the signal standard deviation, signal share and signal ratio. Hospitals with fewer than three patients in the denominator were not included in the reliability adjustment. Multi-variate methods (taking into account correlations among indicators in order to extract additional 'signal') were applied to most of the accepted indicators. The exceptions were Death in Low Mortality DRGs and Failure to Rescue. Only univariate smoothing methods were applied to these two indicators.

Table 6. Bias Measures*, Accepted Patient Safety Indicators, National SID, 1997

PSI Label	N	Rank Corr.	Abs. Value	Top 10%	Bot 10%	Two Declines
COMPLICATIONS OF ANESTHESIA	2,275	0.987	0.154	0.649	0.951	0.004
DEATH IN LOW MORTALITY DRGS	2,344	0.845	0.289	0.239	0.850	0.128
DECUBITUS ULCER	2,342	0.741	0.280	0.376	0.829	0.262
FAILURE TO RESCUE	2,327	0.417	0.508	0.192	0.419	0.437
FOREIGN BODY LEFT IN DURING PROC	2,349					
IATROGENIC PNEUMOTHORAX	2,349	0.873	0.173	0.528	0.885	0.138
INFECTION DUE TO MEDICAL CARE	2,349	0.900	0.170	0.579	0.847	0.103
POSTOP HIP FRACTURE	2,270	0.921	0.219	0.493	0.844	0.079
POSTOP HEMORRHAGE OR HEMATOMA	2,272	0.965	0.043	0.787	0.907	0.038
POSTOP PHYSIO METABOL DERANGT	2,122	0.934	0.249	0.619	0.839	0.054
POSTOP PE OR DVT	2,272	0.837	0.164	0.520	0.747	0.140
POSTOP RESPIRATORY FAILURE	2,121	0.888	0.198	0.635	0.826	0.112
POSTOP SEPSIS	2,050	0.879	0.228	0.648	0.774	0.114
POSTOP WOUND DEHISCENCE	2,227	0.963	0.174	0.768	0.855	0.035
TECH DIFFICULTY W PROCEDURE	2,348	0.796	0.307	0.379	0.826	0.237
TRANSFUSION REACTION	2,349					
BIRTH TRAUMA	1,784	0.998	0.032	0.979	0.958	0.000
OB TRAUMA - C-SECTION	1,756	0.972	0.107	0.828	0.828	0.024
OB TRAUMA - VAGINAL W INSTRUMENT	1,697	0.951	0.302	0.761	0.840	0.049
OB TRAUMA - VAGINAL WO INSTRUMENT	1,805	0.987	0.106	0.830	0.909	0.006

* Reliability adjusted to age, gender, DRG, co-morbidity and reliability adjusted

Table 6 shows the effect of age, gender, DRG and co-morbidity risk-adjustment on the relative ranking of hospitals, compared to no risk-adjustment, using five measures of impact. Both the unadjusted and risk-adjusted measures have been adjusted for reliability, in order to remove the impact of noise on the assessment of potential bias. Also, even if risk-adjustment reduces the apparent level of hospital level variation, the relative rank may not be affected if the distribution of the adjusters does not vary systematically across hospitals. A large impact on the relative ranking means that the measures are biased based on the patient characteristics we observe on the administrative data. A small or no impact means that the measures are not biased based on the characteristics we observe (although there might be characteristics that we do not observe that are related to the patient's risk of experiencing an adverse event).

The first measure is a relative rank correlation statistic (a measure of the impact of adjustment on the assessment of relative hospital performance). The second measure is the average absolute magnitude of the change in unadjusted – adjusted rate for each hospital (a measure of the relative importance of adjustment). The third and forth measures are the percentage of hospitals that remain in the top (or bottom) 10% of the distribution after adjustment (measures of the impact on the highest and lowest hospitals). The last measure is the percentage of hospitals that change more than two deciles in the distribution after adjustment (a measure of the impact throughout the distribution).

Table 7. Spearman Correlations, Accepted Patient Safety Indicators, National SID, 1997

PSI Label	**1**	**2**	**3**	**4**	**6**	**7**	**8**	**9**	**10**	**11**
COMPLICATIONS OF ANESTHESIA	1.000	0.033	0.061*	-0.024	0.063*	0.147*	0.054*	0.096*	-0.008	-0.011
DEATH IN LOW MORTALITY DRGS		1.000	0.013	0.151*	0.118*	0.126*	0.049*	0.002	0.011	0.039
DECUBITUS ULCER			1.000	0.240*	0.024	0.163*	0.153*	0.023	0.116*	0.224*
FAILURE TO RESCUE				1.000	0.099*	0.091*	0.129*	-0.026	-0.031	0.096*
IATROGENIC PNEUMOTHORAX					1.000	0.369*	0.074*	0.142*	-0.015	0.036
INFECTION DUE TO MEDICAL CARE						1.000	0.048*	0.182*	0.102*	0.130*
POSTOP HIP FRACTURE							1.000	0.044*	-0.006	0.088*
POSTOP HEMORRHAGE OR HEMATOMA								1.000	0.036	0.000
POSTOP PHYSIO METABOL DERANGT									1.000	0.239*
POSTOP RESPIRATORY FAILURE										1.000
POSTOP PE OR DVT										
POSTOP SEPSIS										
TECH DIFFICULTY W PROCEDURE										
WOUND DEHISCENCE										
BIRTH TRAUMA										
OB TRAUMA - VAGINAL W INSTRUMENT										
OB TRAUMA - VAGINAL WO INSTRUMENT										
OB TRAUMA - C-SECTION										

* Significant at $p < 0.05$

Table 7 (Continued). Spearman Correlations, Accepted Patient Safety Indicators, National SID, 1997

PSI Label	12	13	14	16	17	18	19	20	21	22
COMPLICATIONS OF ANESTHESIA	0.107*	0.043	0.157*	0.025	0.124*	0.111*	0.085*	0.065*	0.114*	0.064*
DEATH IN LOW MORTALITY DRGS	0.133*	0.004	0.019	0.024	0.006	0.009	0.038	0.020	0.032	0.054*
DECUBITUS ULCER	0.229*	0.219*	-0.104*	-0.028	0.093*	-0.090*	-0.039	-0.075*	-0.066*	0.043
FAILURE TO RESCUE	0.072*	0.057*	-0.047*	0.000	-0.012	-0.086*	-0.11*	-0.104*	-0.115*	0.028
IATROGENIC PNEUMOTHORAX	0.206*	-0.007	0.318*	0.026	0.205*	0.093*	0.115*	0.108*	0.131*	0.045
INFECTION DUE TO MEDICAL CARE	0.294*	0.167*	0.306*	0.018	0.290*	0.132*	0.158*	0.101*	0.189*	0.128*
POSTOP HIP FRACTURE	0.166*	0.020	-0.093*	0.016	-0.004	0.006	0.032	0.011	-0.018	0.010
POSTOP HEMORRHAGE OR HEMATOMA	0.102*	0.052*	0.176*	0.149*	0.092*	0.052*	0.045	0.123*	0.158*	0.129*
POSTOP PHYSIO METABOL DERANGT	0.065*	0.281*	-0.058*	0.025	-0.004	-0.039	-0.008	-0.022	0.014	0.002
POSTOP RESPIRATORY FAILURE	0.138*	0.322*	-0.134*	-0.003	0.023	-0.130*	-0.048	-0.045	-0.111*	-0.037
POSTOP PE OR DVT	1.000	0.122*	-0.003	0.056*	0.122*	0.045	0.114*	0.029	0.084*	0.064*
POSTOP SEPSIS		1.000	-0.066*	0.000	0.029	-0.094*	0.017	-0.053*	-0.057*	-0.003
TECH DIFFICULTY W PROCEDURE			1.000	-0.016	0.218*	0.289*	0.229*	0.175*	0.250*	-0.013
WOUND DEHISCENCE				1.000	-0.019	-0.03	-0.023	0.029	0.021	0.090*
BIRTH TRAUMA					1.000	0.113*	0.125*	0.116*	0.149*	0.139*
OB TRAUMA - VAGINAL W INSTRUMENT						1.000	0.545*	0.233*	0.221*	0.057*
OB TRAUMA - VAGINAL WO INSTRUMENT							1.000	0.217*	0.185*	0.071*
OB TRAUMA - C-SECTION								1.000	0.267*	0.129*

* Significant at $p < 0.05$

Table 8A. Factor Loadings, Accepted Patient Safety Indicators, National SID, 1997

		Factor 1				Factor 2	
PSI	**PSI Label**	**Loading**	**Var. Exp.**	**PSI**	**PSI Label**	**Loading**	**Var. Exp.**
7	INFECTION DUE TO MEDICAL CARE	0.6009	0.236	**11**	**POSTOP RESPIRATORY FAILURE**	**0.4641**	**0.085**
15	TECH DIFFICULTY W PROCEDURE	0.5194	0.195	**3**	**DECUBITUS ULCER**	**0.4634**	**0.088**
6	IATROGENIC PNEUMOTHORAX	0.4834	0.136	**14**	**POSTOPERATIVE SEPSIS**	**0.4221**	**0.072**
19	OB TRAUMA - VAGINAL WO INSTRUMENT	0.4552	0.161	12	POSTOPERATIVE PE OR DVT	0.3179	0.087
18	OB TRAUMA - VAGINAL W INSTRUMENT	0.4363	0.195	**4**	**FAILURE TO RESCUE**	**0.3120**	**0.039**
17	BIRTH TRAUMA	0.4045	0.093	**10**	**POSTOP PHYSIO METABOL DERANGMNT**	**0.2765**	**0.030**
12	POSTOPERATIVE PE OR DVT	0.3501	0.127	7	INFECTION DUE TO MEDICAL CARE	0.2351	0.163
20	OB TRAUMA - C-SECTION	0.2651	0.066	**8**	**POSTOPERATIVE HIP FRACTURE**	**0.1886**	**0.016**
9	POSTOP HEMORRHAGE OR HEMATOMA	0.2356	0.032	2	DEATH IN LOW MORTALITY DRGS	0.1210	0.016
1	COMPLICATIONS OF ANESTHESIA	0.2350	0.031	6	IATROGENIC PNEUMOTHORAX	0.0727	0.093
2	DEATH IN LOW MORTALITY DRGS	0.1592	0.023	17	BIRTH TRAUMA	0.0345	0.064
5	FOREIGN BODY LEFT IN DURING PROC	0.1206	0.012	**13**	**POSTOPERATIVE WOUND DEHISCENCE**	**0.0248**	**0.000**
3	**DECUBITUS ULCER**	**0.1033**	**0.128**	9	POSTOP HEMORRHAGE OR HEMATOMA	0.0236	0.022
14	**POSTOPERATIVE SEPSIS**	**0.0858**	**0.105**	1	COMPLICATIONS OF ANESTHESIA	-0.0021	0.022
8	**POSTOPERATIVE HIP FRACTURE**	**0.0743**	**0.023**	5	FOREIGN BODY LEFT IN DURING PROC	-0.0785	0.008
4	**FAILURE TO RESCUE**	**0.0472**	**0.056**	16	TRANSFUSION REACTION	-0.0982	0.074
11	**POSTOP RESPIRATORY FAILURE**	**0.0417**	**0.123**	20	OB TRAUMA - C-SECTION	-0.2158	0.046
13	**POSTOPERATIVE WOUND DEHISCENCE**	**0.0176**	**0.001**	15	TECH DIFFICULTY W PROCEDURE	-0.2706	0.134
10	**POSTOP PHYSIO METABOL DERANGMNT**	**0.0121**	**0.043**	19	OB TRAUMA - VAGINAL WO INSTRUMENT	-0.2764	0.111
16	TRANSFUSION REACTION	-0.4253	0.108	18	OB TRAUMA - VAGINAL W INSTRUMENT	-0.3914	0.134
	Share of Variance Explained	0.567			Share of Variance Explained	0.391	

Black – Highest loading on factor 1; **Bold** – Highest loading on factor 2

Table 8B. Factor Loadings, Non-OB Accepted Patient Safety Indicators, National SID, 1997

		Factor 1				Factor 2	
PSI	**PSI Label**	**Loading**	**Var. Exp.**	**PSI**	**PSI Label**	**Loading**	**Var. Exp.**
7	INFECTION DUE TO MEDICAL CARE	0.63096	0.272	**11**	**POSTOP RESPIRATORY FAILURE**	**0.4256**	**0.108**
6	IATROGENIC PNEUMOTHORAX	0.47137	0.193	**14**	**POSTOPERATIVE SEPSIS**	**0.3911**	**0.099**
12	POSTOPERATIVE PE OR DVT	0.46335	0.149	**3**	**DECUBITUS ULCER**	**0.3632**	**0.099**
3	**DECUBITUS ULCER**	**0.31242**	**0.152**	**10**	**POSTOP PHYSIO METABOL DERANGMNT**	**0.3308**	**0.056**
15	**TECH DIFFICULTY W PROCEDURE**	**0.30459**	**0.225**	16	TRANSFUSION REACTION	0.2037	0.090
14	**POSTOPERATIVE SEPSIS**	**0.27547**	**0.151**	8	POSTOPERATIVE HIP FRACTURE	0.1498	0.021
11	**POSTOP RESPIRATORY FAILURE**	**0.26393**	**0.166**	4	FAILURE TO RESCUE	0.1439	0.031
4	FAILURE TO RESCUE	0.22556	0.047	12	POSTOPERATIVE PE OR DVT	0.1069	0.098
9	POSTOP HEMORRHAGE OR HEMATOMA	0.22346	0.040	13	POSTOPERATIVE WOUND DEHISCENCE	-0.0071	0.001
2	DEATH IN LOW MORTALITY DRGS	0.21816	0.032	2	DEATH IN LOW MORTALITY DRGS	-0.0193	0.021
1	COMPLICATIONS OF ANESTHESIA	0.1923	0.030	1	COMPLICATIONS OF ANESTHESIA	-0.0887	0.019
8	POSTOPERATIVE HIP FRACTURE	0.15945	0.032	**5**	**FOREIGN BODY LEFT IN DURING PROC**	**-0.0894**	**0.005**
10	**POSTOP PHYSIO METABOL DERANGMNT**	**0.13815**	**0.085**	9	POSTOP HEMORRHAGE OR HEMATOMA	-0.1050	0.026
5	**FOREIGN BODY LEFT IN DURING PROC**	**0.06324**	**0.008**	7	INFECTION DUE TO MEDICAL CARE	-0.1187	0.178
13	POSTOPERATIVE WOUND DEHISCENCE	0.04133	0.001	6	IATROGENIC PNEUMOTHORAX	-0.2649	0.126
16	TRANSFUSION REACTION	-0.40846	0.138	**15**	**TECH DIFFICULTY W PROCEDURE**	**-0.4972**	**0.147**
	Share of Variance Explained	0.661			Share of Variance Explained	0.433	

Black – Highest loading on factor 1; **Bold** – Highest loading on factor 2

Table 9. Discharge Level Experimental Patient Safety Indicators, Florida and National SID, 1997

	Florida			National		
PSI Label	**Num.**	**Den.**	**Rate**	**Num.**	**Den.**	**Rate**
ASPIRATION PNEUMONIA	683	170,643	0.00400	3,864	1,331,866	0.00290
CABG POST PTCA	792	38,480	0.02058	6,267	281,771	0.02224
DECUBITUS ULCER IN HIGH RISK PATIENT	2,190	33,283	0.06580	28,753	421,801	0.06817
IN-HOSPITAL FRACTURES RELATED TO FALLS	967	398,488	0.00243	6,310	3,617,435	0.00174
INTRA-OPER NERVE COMP INJURY	7	461,526	0.00002	102	4,254,914	0.00002
MALIGNANT HYPERTHERMIA	0	478,400	0.00000	0	4,359,259	0.00000
POSTOPERATIVE AMI	643	223,770	0.00287	4,264	1,833,269	0.00233
POSTOP IATROGENIC COMPL - CARDIAC	9,109	478,400	0.01904	83,502	4,359,259	0.01916
POSTOP IATROGENIC COMPL - NERVOUS	1,965	478,400	0.00411	18,121	4,359,259	0.00416
REOPENING OF A SURGICAL SITE	3,244	533,311	0.00608	28,850	4,907,182	0.00588
SUTURE OF LACERATION	2,344	422,227	0.00555	22,097	3,801,214	0.00581
OTHER OBSTERIC COMPLICATION	703	179,018	0.00393	8,213	2,060,609	0.00399
OB WOUND COMP - C-SECTION DELIVERY	482	41,642	0.01157	5,517	427,558	0.01290
OB WOUND COMPLICATION OF VAGINAL DEL	124	137,376	0.00090	1,506	1,633,038	0.00092
POST-PARTUM UTI INFECTION	497	179,017	0.00278	5,296	2,060,547	0.00257
3RD OR 4TH DEGREE OB LACERATION	7,320	135,771	0.05391	99,383	1,620,823	0.06132
UTERINE RUPTURE	127	160,424	0.00079	1,324	1,878,381	0.00070

Table 9 shows the total number of adverse events (numerator), the total number of patients at risk (denominator), and the overall rate in Florida and the National SID for each experimental PSI. Florida was the state used for initial testing and development. The rates are shown to compare with the National SID rates.

Table 10. Hospital Level Experimental Patient Safety Indicators, Florida and National SID, 1997

	Florida				National			
PSI Label	**N**	**Rate**	**SD**	**Skew**	**N**	**Rate**	**SD**	**Skew**
ASPIRATION PNEUMONIA	178	0.00397	0.00514	4.36419	1,715	0.00256	0.00803	20.83495
CABG POST PTCA	69	0.01727	0.01193	0.09464	612	0.02049	0.01683	1.04254
DECUBITUS ULCER IN HIGH RISK PATIENT	194	0.07545	0.05976	2.28194	2,288	0.06173	0.06517	2.54328
IN-HOSPITAL FRAC RELATED TO FALLS	191	0.00347	0.00790	7.74260	2,269	0.00284	0.02330	36.57401
INTRA-OPER NERVE COMP INJURY	191	0.00001	0.00007	7.00068	2,274	0.00001	0.00011	10.74719
MALIGNANT HYPERTHERMIA								
POSTOPERATIVE AMI	179	0.00286	0.00300	2.15227	1,744	0.00199	0.00414	9.67318
POSTOP IATROGENIC COMPL - CARDIAC	191	0.01273	0.01497	2.53648	2,272	0.01179	0.01333	2.07341
POSTOP IATROGENIC COMPL - NERVOUS	191	0.00255	0.00308	2.02625	2,272	0.00239	0.00533	16.17496
REOPENING OF A SURGICAL SITE	191	0.00490	0.00390	0.87565	2,275	0.00399	0.00551	8.65050
SUTURE OF LACERATION	191	0.00543	0.00600	5.96016	2,267	0.00585	0.00840	7.40585
OB WOUND COMP - C-SECTION DELIVERY	121	0.00987	0.01182	2.49694	1,756	0.01100	0.01677	3.92826
OB WOUND COMP OF VAGINAL DELIVERY	126	0.00094	0.00160	2.72679	1,805	0.00097	0.00451	28.67962
OTHER OBSTERIC COMPLICATIONS	126	0.00317	0.00367	1.90949	1,812	0.00347	0.00596	6.30315
POST-PARTUM UTI INFECTION	126	0.00201	0.00247	1.46515	1,812	0.00349	0.03344	29.26669
3RD OR 4TH DEGREE OB LACERATION	129	0.04825	0.02861	0.66478	1,813	0.05827	0.04083	2.26357
UTERINE RUPTURE	126	0.00067	0.00104	2.56183	1,807	0.00071	0.00371	24.40042

Table 10 shows the hospital level rates for Florida and the National SID, for comparison.

Table 11. Hospital Level Unadjusted and Age-Gender Adjusted Experimental Patient Safety Indicators, National SID, 1997

		Unadjusted Rate			Age-Gender Adjusted		
PSI Label	**N**	**Rate**	**SD**	**Skew**	**Rate**	**SD**	**Skew**
ASPIRATION PNEUMONIA	1,715	0.00256	0.00803	20.83495	0.00281	0.00766	21.80080
CABG POST PTCA	612	0.02049	0.01683	1.04254	0.02054	0.01687	1.15669
DECUBITUS ULCER IN HIGH RISK PATIENT	2,288	0.06173	0.06517	2.54328	0.05755	0.06584	2.84363
IN-HOSPITAL FRAC RELATED TO FALLS	2,269	0.00284	0.02330	36.57401	0.00286	0.02313	36.66337
INTRA-OPER NERVE COMP INJURY	2,274	0.00001	0.00011	10.74719			
MALIGNANT HYPERTHERMIA POSTOPERATIVE AMI	1,744	0.00199	0.00414	9.67318	0.00214	0.00530	19.28620
POSTOP IATROGENIC COMPL - CARDIAC	2,272	0.01179	0.01333	2.07341	0.01189	0.01288	2.30382
POSTOP IATROGENIC COMPL - NERVOUS	2,272	0.00239	0.00533	16.17496	0.00248	0.00418	11.16202
REOPENING OF A SURGICAL SITE	2,275	0.00399	0.00551	8.65050	0.00431	0.00467	4.81263
SUTURE OF LACERATION	2,267	0.00585	0.00840	7.40585	0.00580	0.00879	9.51146
OB WOUND COMP - C-SECTION DELIVERY	1,756	0.01100	0.01677	3.92826	0.01127	0.01795	4.37926
OB WOUND COMP OF VAGINAL DELIVERY	1,805	0.00097	0.00451	28.67962	0.00100	0.00521	31.60748
OTHER OBSTERIC COMPLICATIONS	1,812	0.00347	0.00596	6.30315	0.00359	0.00585	6.70887
POST-PARTUM UTI INFECTION	1,812	0.00349	0.03344	29.26669	0.00351	0.03344	29.23084
3RD OR 4TH DEGREE OB LACERATION	1,813	0.05827	0.04083	2.26357	0.05462	0.04070	2.68744
UTERINE RUPTURE	1,807	0.00071	0.00371	24.40042	0.00074	0.00378	30.60857

Table 11 shows the unadjusted and age-gender adjusted rates for the experimental indicators in the National SID in 1997. The first column shows the number of hospitals with at least one patient in the at-risk denominator. The second column shows the mean hospital level unadjusted rate, defined as the number of adverse events divided by the number of discharges in the population at risk. The third column shows the standard deviation in the hospital level rates, and the fourth column shows the skew statistic, which is defined as the third moment (where the variance is the second moment). The skew statistic is a measure of how symmetric the hospital level rates are relative to the mean hospital level rate. The more positive the skew statistic is, the longer the right-hand tail of the distribution. The closer to zero it is, the more symmetrical the distribution. Negative skew statistics indicate a longer the left-hand tail.

Table 12. Hospital Level Risk Adjusted Experimental Patient Safety Indicators, National SID, 1997

		DRG Adjusted*			Co-morbidity Adjusted**		
PSI Label	**N**	**Rate**	**SD**	**Skew**	**Rate**	**SD**	**Skew**
ASPIRATION PNEUMONIA	1,715	0.00302	0.00746	22.17259	0.00301	0.00739	23.14628
CABG POST PTCA	612	0.02054	0.01687	1.15669	0.02112	0.01680	1.16310
DECUBITUS ULCER IN HIGH RISK PATIENT	2,288	0.05368	0.05879	3.16838	0.05101	0.05633	3.11981
IN-HOSPITAL FRAC RELATED TO FALLS	2,269	0.00288	0.02293	36.80870	0.00288	0.02266	36.73241
INTRA-OPER NERVE COMP INJURY							
MALIGNANT HYPERTHERMIA							
POSTOPERATIVE AMI	1,744	0.00233	0.00525	19.35160	0.00240	0.00524	19.95945
POSTOP IATROGENIC COMPL - CARDIAC	2,272	0.01607	0.01110	2.10968	0.01593	0.01100	2.12623
POSTOP IATROGENIC COMPL - NERVOUS	2,272	0.00357	0.00390	14.02002	0.00352	0.00388	14.09111
REOPENING OF A SURGICAL SITE	2,275	0.00511	0.00426	5.95044	0.00512	0.00419	6.09798
SUTURE OF LACERATION	2,267	0.00554	0.00851	10.03914	0.00556	0.00849	10.02887
OB WOUND COMP - C-SECTION DELIVERY	1,756	0.01127	0.01795	4.37917	0.01168	0.01763	4.42871
OB WOUND COMP OF VAGINAL DELIVERY	1,805	0.00100	0.00521	31.60748	0.00110	0.00520	31.85472
OTHER OBSTERIC COMPLICATIONS	1,812	0.00359	0.00585	6.70887	0.00369	0.00571	6.99412
POST-PARTUM UTI INFECTION	1,812	0.00351	0.03344	29.23084	0.00358	0.03334	29.25606
3RD OR 4TH DEGREE OB LACERATION	1,813	0.05462	0.04070	2.68744	0.05459	0.04006	2.79613
UTERINE RUPTURE	1,807	0.00074	0.00378	30.60857	0.00081	0.00378	30.64062

* Age, gender, DRG (except PSI 3, 4, 5, 6, 11); ** Age, gender, DRG, co-morbidity

Table 12 shows the mean hospital level risk-adjusted rates, standard deviations and skew statistic for the DRG and co-morbidity adjusted rates.

Table 13. Hospital Level Reliability Adjusted Experimental Patient Safety Indicators, National SID, 1997

		Reliability* Adjusted			MSX Statistics		
PSI Label	**N**	**Rate**	**SD**	**Skew**	**Signal SD**	**Share**	**Signal Ratio**
ASPIRATION PNEUMONIA							
CABG POST PTCA	612	0.02319	0.00485	1.04367	0.00544	0.00137	0.34171
DECUBITUS ULCER IN HIGH RISK PATIENT	2,288	0.05322	0.02164	1.73548	0.02696	0.01203	0.50482
IN-HOSPITAL FRAC RELATED TO FALLS	2,269	0.00199	0.00151	16.45952	0.00182	0.00192	0.56207
INTRA-OPER NERVE COMP INJURY							
MALIGNANT HYPERTHERMIA							
POSTOPERATIVE AMI							
POSTOP IATROGENIC COMPL - CARDIAC	2,272	0.01691	0.00878	1.63677	0.01154	0.00752	0.77177
POSTOP IATROGENIC COMPL - NERVOUS	2,272	0.00389	0.00130	2.62249	0.00193	0.00091	0.46311
REOPENING OF A SURGICAL SITE	2,275	0.00560	0.00179	2.66912	0.00249	0.00108	0.51588
SUTURE OF LACERATION	2,267	0.00570	0.00270	6.31452	0.00351	0.00215	0.57816
OB WOUND COMP - C-SECTION DELIVERY**	1,739	0.01206	0.01094	3.19456	0.01158	0.01056	0.57486
OB WOUND COMP OF VAGINAL DELIVERY	1,805	0.00104	0.00036	1.82693	0.00074	0.00060	0.29040
OTHER OBSTERIC COMPLICATIONS	1,812	0.00389	0.00385	9.98124	0.00427	0.00462	0.69885
POST-PARTUM UTI INFECTION**	1,761	0.00253	0.00326	3.92805	0.00328	0.00419	0.68333
3RD OR 4TH DEGREE OB LACERATION	1,813	0.05637	0.02551	0.88812	0.02627	0.01206	0.79732
UTERINE RUPTURE	1,807	0.00080	0.00015	2.28522	0.00038	0.00021	0.15962

* Age, gender, DRG, co-morbidity and reliability adjusted

** These two indicators were included in the Accepted indicator reliability adjustment, and then later demoted. The information reported here reflects that analysis.

Table 13 shows the effect of reliability adjustment, and provides statistics on the signal standard deviation, signal share and signal ratio. Hospitals with fewer than three patients in the denominator were not included in the reliability adjustment. Only univariate smoothing methods were applied to the experimental indicators, because there was less a priori reason to believe underlying processes or structural characteristics were common to these indicators.

Table 14. Bias Measures*, Experimental Patient Safety Indicators, National SID, 1997

PSI Label	N	Rank Corr.	Abs. Value	Top 10%	Bot 10%	Two Declines
ASPIRATION PNEUMONIA						
CABG POST PTCA	565	0.99201	0.02778	0.89474	0.89474	0.00000
DECUBITUS ULCER IN HIGH RISK PATIENT	2194	0.76883	0.23354	0.47273	0.66818	0.22470
IN-HOSPITAL FRAC RELATED TO FALLS	2240	0.89556	0.17110	0.62054	0.82143	0.10491
INTRA-OPER NERVE COMP INJURY						
MALIGNANT HYPERTHERMIA						
POSTOPERATIVE AMI						
POSTOP IATROGENIC COMPL - CARDIAC	2243	0.75712	0.42083	0.27111	0.73778	0.20285
POSTOP IATROGENIC COMPL - NERVOUS	2243	0.84357	0.28434	0.47556	0.75556	0.15292
REOPENING OF A SURGICAL SITE	2248	0.81376	0.20992	0.45333	0.76889	0.19440
SUTURE OF LACERATION	2240	0.94803	0.08606	0.75446	0.86161	0.05625
OB WOUND COMP - C-SECTION DELIVERY	1,756	0.972	0.090	0.828	0.868	0.025
OB WOUND COMP OF VAGINAL DELIVERY	1758	0.97279	0.10114	0.85795	0.89205	0.02162
OTHER OBSTERIC COMPLICATIONS	1761	0.96006	0.11163	0.68362	0.90960	0.03066
POST-PARTUM UTI INFECTION	1,812	0.982	0.093	0.802	0.910	0.012
3RD OR 4TH DEGREE OB LACERATION	1758	0.98284	0.07393	0.81818	0.89205	0.00967
UTERINE RUPTURE	1760	0.95904	0.13337	0.81818	0.84659	0.03125

* Reliability adjusted to age, gender, DRG, co-morbidity and reliability adjusted

Table 14 shows the effect of age, gender, DRG and co-morbidity risk-adjustment on the relative ranking of hospitals, compared to no risk-adjustment, using five measures of impact. Even if risk-adjustment reduces the apparent level of hospital level variation, the relative rank may not be affected if the distribution of the adjusters does not vary systematically across hospitals. A large impact on the relative ranking means that the measures are biased based on the patient characteristics we observe on the administrative data. A small or no impact means that the measures are not biased based on the characteristics we observe (although there might be characteristics that we do not observe that are related to the patients risk of experiencing an adverse event). The first measure is a relative rank correlation statistic. The second measure is the average absolute magnitude of the change in actual – predicted rate for each hospital. The third and forth measures are the percentage of hospitals that remain in the top (or bottom) 10% of the distribution after adjustment. The last measure is the percentage of hospitals that change more than two deciles in the distribution after adjustment.

Area Indicators

Table 15. Unadjusted and Risk-Adjusted Area Patient Safety Indicators, National SID, 1997

		Unadjusted			Age-Gender Adjusted		
PSI Label	**N**	**Rate***	**SD**	**Skew**	**Rate***	**SD**	**Skew**
FOREIGN BODY LEFT IN DURING PROCEDURE	714	0.82	2.27	7.03015	0.83	2.41	9.62334
IATROGENIC PNEUMOTHORAX	714	8.80	16.62	9.73506	8.07	15.43	9.76828
INFECTION DUE TO MEDICAL CARE	714	12.98	25.24	10.40177	12.71	25.67	9.92958
TECHNICAL DIFFICULTY WITH PROCEDURE	714	22.03	45.26	14.23158	21.45	44.14	13.08738
TRANSFUSION REACTION	714	0.07	0.57	16.14953	0.07	0.51	14.95507
POSTOPERATIVE WOUND DEHISCENCE	673	1.55	3.43	4.64596	1.90	7.20	12.43435

* Rate per 100,000 (except PSI31, which uses the number of abortions as the denominator)

Table 15 shows the unadjusted and age-gender adjusted rates for the area indicators in the National SID in 1997. The unit of analysis is the MSA or county (in rural areas), except for the Therapeutic Abortion indicator, where the denominator is the number of abortions in the state. The other six indicators are accepted patient safety indicators that were modified into area indicators to assess the total incidence of the adverse event within geographic areas. The modification generally was to use principal rather than secondary diagnosis codes, and to use the area population as the denominator.

Supplemental Table 1. Death in Low Mortality DRGs by Category, National SID, 1997

Category	Num.	Den.	Rate
Death in Low Mortality DRG – Adult Medical	1,755	1,041,457	0.00169
Death in Low Mortality DRG – Pediatric Medical	318	543,195	0.00059
Death in Low Mortality DRG - Adult Surgical	375	685,286	0.00055
Death in Low Mortality DRG – Pediatric Surgical	30	29,725	0.00101
Death in Low Mortality DRG – Obstetric	201	2,310,440	0.00009
Death in Low Mortality DRG – Neonatal	0	1,928,936	0.00000
Death in Low Mortality DRG – Psychiatric	323	327,706	0.00099

Supplemental Table 2. Hospital Level Accepted Patient Safety Indicators, Florida, 1995-97

		Risk-adjusted Rate			Spearman Correlation		
PSI	**PSI Label**	**1995**	**1996**	**1997**	**'95-'96**	**'96-'97**	**'95-'97**
1	COMPLICATIONS OF ANESTHESIA	0.00069	0.00069	0.00081	0.379	0.410	0.320
2	DEATH IN LOW MORTALITY DRGS	0.00104	0.00111	0.00107	0.290	0.326	0.293
3	DECUBITUS ULCER	0.01639	0.01715	0.01782	0.702	0.728	0.636
4	FAILURE TO RESCUE	0.17851	0.17418	0.17144	0.480	0.497	0.463
5	FOREIGN BODY LEFT IN DURING PROC	0.00010	0.00009	0.00009	0.207	0.206	0.245
6	IATROGENIC PNEUMOTHORAX	0.00096	0.00099	0.00094	0.515	0.535	0.474
7	INFECTION DUE TO MEDICAL CARE	0.00147	0.00150	0.00155	0.613	0.614	0.519
8	IN-HOSPITAL HIP FRACTURE	0.00111	0.00122	0.00123	0.202	0.192	0.133
9	POSTOP HEMORRHAGE OR HEMATOMA*	0.00016	0.00068	0.00196	0.299	0.224	-0.105
10	POSTOP PHYSIO METABOL DERANGMNT	0.00098	0.00085	0.00091	0.223	0.272	0.257
11	POSTOP PULMONARY COMPROMISE	0.00345	0.00293	0.00293	0.423	0.409	0.385
12	POSTOPERATIVE PE OR DVT	0.00610	0.00732	0.00718	0.407	0.414	0.358
13	POSTOPERATIVE WOUND DEHISCENCE	0.00262	0.00245	0.00257	0.236	0.226	0.202
14	SEPTICEMIA	0.00799	0.00896	0.01002	0.308	0.309	0.291
15	TECH DIFFICULTY W PROCEDURE	0.00293	0.00309	0.00313	0.587	0.596	0.510
16	TRANSFUSION REACTION	.	.	.			
17	BIRTH TRAUMA	0.00896	0.00945	0.00955	0.593	0.583	0.518
18	OB TRAUMA - VAGINAL W INSTRUMENT	0.20459	0.20691	0.20660	0.654	0.669	0.629
19	OB TRAUMA - VAGINAL WO INSTRUMENT	0.07452	0.07652	0.07639	0.753	0.756	0.692
20	OB TRAUMA - C-SECTION	0.00577	0.00623	0.00611	0.285	0.242	0.223

*ICD-9 codes 998.11 (Hemorrhage complicating a procedure) and 998.12 (Hematoma complicating a procedure) were added in October, 1996.

Supplemental Table 3. Accepted Indicator Discharge Level Rates by Age Strata

	Age < 1			Age 1-14			Age 15-24			Age 25+		
Label	**Numer.**	**Denom.**	**Rate**	**Numer.**	**Denom.**	**Rate**	**Numer.**	**Denom.**	**Rate**	**Numer.**	**Denom.**	**Rate**
COMPLICATIONS OF ANESTHESIA	28	34,882	0.00080	100	141,690	0.000706	152	313,689	0.00048	2,766	4,416,119	0.00063
DEATH IN LOW MORTALITY DRGS	144	2,136,175	0.00007	214	427,301	0.000501	126	961,976	0.00013	2,518	3,341,293	0.00075
DECUBITUS ULCER	79	59,444	0.00133	308	132,028	0.002333	692	191,976	0.00360	106,963	4,935,024	0.02167
FAILURE TO RESCUE	1,247	16,422	0.07593	657	11,994	0.054777	973	13,007	0.07481	132,208	711,751	0.18575
FOREIGN BODY LEFT IN DURING PROC	11	275,937	0.00004	32	702,678	4.55E-05	95	1,394,663	0.00007	1,470	14,201,927	0.00010
IATROGENIC PNEUMOTHORAX	105	259,393	0.00040	274	598,051	0.000458	385	1,245,587	0.00031	15,810	12,596,672	0.00126
INFECTION DUE TO MEDICAL CARE	628	272,806	0.00230	662	654,920	0.001011	965	1,365,335	0.00071	24,805	12,118,478	0.00205
POSTOP HEMORRHAGE OR HEMATOMA	150	34,588	0.00434	207	140,869	0.001469	275	178,186	0.00154	11,406	4,004,850	0.00285
POSTOP HIP FRACTURE	0	31,190	0.00000	1	92,563	1.08E-05	14	236,426	0.00006	2,908	3,111,547	0.00093
POSTOP PHYSIO METABOL DERANGMNT	8	16,432	0.00049	35	63,991	0.000547	63	65,469	0.00096	2,004	2,164,826	0.00093
POSTOP PE OR DVT	63	34,572	0.00182	138	140,843	0.00098	528	177,749	0.00297	33,438	3,987,381	0.00839
POSTOP RESPIRATORY FAILURE	45	12,762	0.00353	120	55,410	0.002166	86	61,653	0.00139	5,098	1,754,130	0.00291
POSTOP SEPSIS	154	6,294	0.02447	150	17,519	0.008562	93	13,302	0.00699	6,238	651,491	0.00958
TECH DIFFICULTY W MED CARE	285	275,640	0.00103	515	696,745	0.000739	841	590,352	0.00142	44,485	12,668,347	0.00351
TRANSFUSION REACTION	2	275,937	0.00001	8	702,678	1.14E-05	8	1,394,663	0.00001	111	14,201,927	0.00001
WOUND DEHISCENCE	21	15,564	0.00135	29	44,908	0.000646	38	50,406	0.00075	2,119	955,922	0.00222
BIRTH TRAUMA	27,880	2,052,482	0.01358									
OB TRAUMA - VAGINAL W INSTRUMENT				120	518	0.23166	11,563	55,072	0.20996	25,223	107,072	0.23557
OB TRAUMA - VAGINAL WO INSTRUMENT				403	3,762	0.107124	48,750	532,041	0.09163	71,705	934,521	0.07673
OB TRAUMA - C-SECTION				3	669	0.004484	439	108,850	0.00403	2,162	318,039	0.00680

Supplemental Table 3 reports the rate of each indicator by four age strata. This analysis is intended to provide information regarding the applicability of these indicators to the pediatric population.

Supplemental Table 4. Percentage of Indicator Numerator or Denominator Represented by Age Strata

	Age < 1		Age 1-14		Age 15-24		Age 25+	
Label	**Numer.**	**Denom.**	**Numer.**	**Denom.**	**Numer.**	**Denom.**	**Numer.**	**Denom.**
COMPLICATIONS OF ANESTHESIA	0.9%	0.7%	3.28%	2.89%	5.0%	6.4%	90.8%	90.0%
DEATH IN LOW MORTALITY DRGS	4.8%	31.1%	7.13%	6.22%	4.2%	14.0%	83.9%	48.7%
DECUBITUS ULCER	0.1%	1.1%	0.29%	2.48%	0.6%	3.6%	99.0%	92.8%
FAILURE TO RESCUE	0.9%	2.2%	0.49%	1.59%	0.7%	1.7%	97.9%	94.5%
FOREIGN BODY LEFT IN DURING PROC	0.7%	1.7%	1.99%	4.24%	5.9%	8.4%	91.4%	85.7%
IATROGENIC PNEUMOTHORAX	0.6%	1.8%	1.65%	4.07%	2.3%	8.5%	95.4%	85.7%
INFECTION DUE TO MEDICAL CARE	2.3%	1.9%	2.45%	4.54%	3.6%	9.5%	91.7%	84.1%
POSTOP HEMORRHAGE OR HEMATOMA	1.2%	0.8%	1.72%	3.23%	2.3%	4.1%	94.7%	91.9%
POSTOP HIP FRACTURE	0.0%	0.9%	0.03%	2.67%	0.5%	6.8%	99.5%	89.6%
POSTOP PHYSIO METABOL DERANGMNT	0.4%	0.7%	1.66%	2.77%	3.0%	2.8%	95.0%	93.7%
POSTOP PE OR DVT	0.2%	0.8%	0.40%	3.24%	1.5%	4.1%	97.9%	91.9%
POSTOP RESPIRATORY FAILURE	0.8%	0.7%	2.24%	2.94%	1.6%	3.3%	95.3%	93.1%
POSTOP SEPSIS	2.3%	0.9%	2.26%	2.54%	1.4%	1.9%	94.0%	94.6%
POSTOP WOUND DEHISCENCE	1.0%	1.5%	1.31%	4.21%	1.7%	4.7%	96.0%	89.6%
TECH DIFFICULTY WITH PROCEDURE	0.6%	1.9%	1.12%	4.90%	1.8%	4.1%	96.4%	89.0%
TRANSFUSION REACTION	1.6%	1.7%	6.20%	4.24%	6.2%	8.4%	86.0%	85.7%
BIRTH TRAUMA	100.0%	100.0%						
OB TRAUMA - VAGINAL W INSTRUMENT			0.33%	0.32%	31.3%	33.9%	68.3%	65.8%
OB TRAUMA - VAGINAL WO INSTRUMENT			0.33%	0.26%	40.3%	36.2%	59.3%	63.6%
OB TRAUMA - C-SECTION			0.12%	0.16%	16.9%	25.5%	83.0%	74.4%

Supplemental Table 4 reports the percentage of the numerator and denominator consisting of patients in four age strata. This analysis provides further information regarding the applicability of these indicators to the pediatric population.

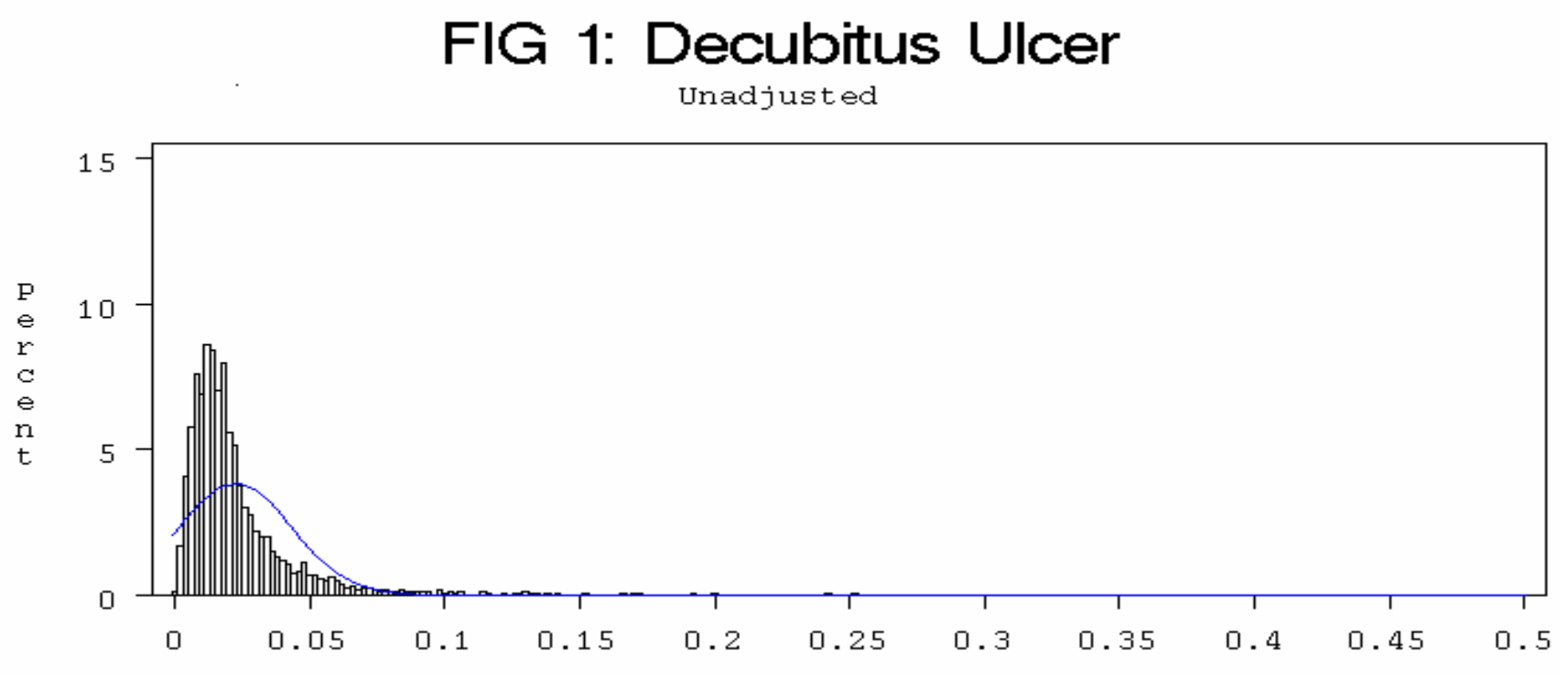

Figure 1. Distribution of non-zero hospital level Decubitus Ulcer rates in 1997 National SID (10% of the hospitals have a zero rate). Y-Axis is the percent of hospitals. X-axis is the hospital's Decubitus Ulcer rate, unadjusted. The blue line is the normal distribution superimposed on the actual distribution. Median rate is 1.6%, mean rate is 2.1% and skew statistic is 3.62.

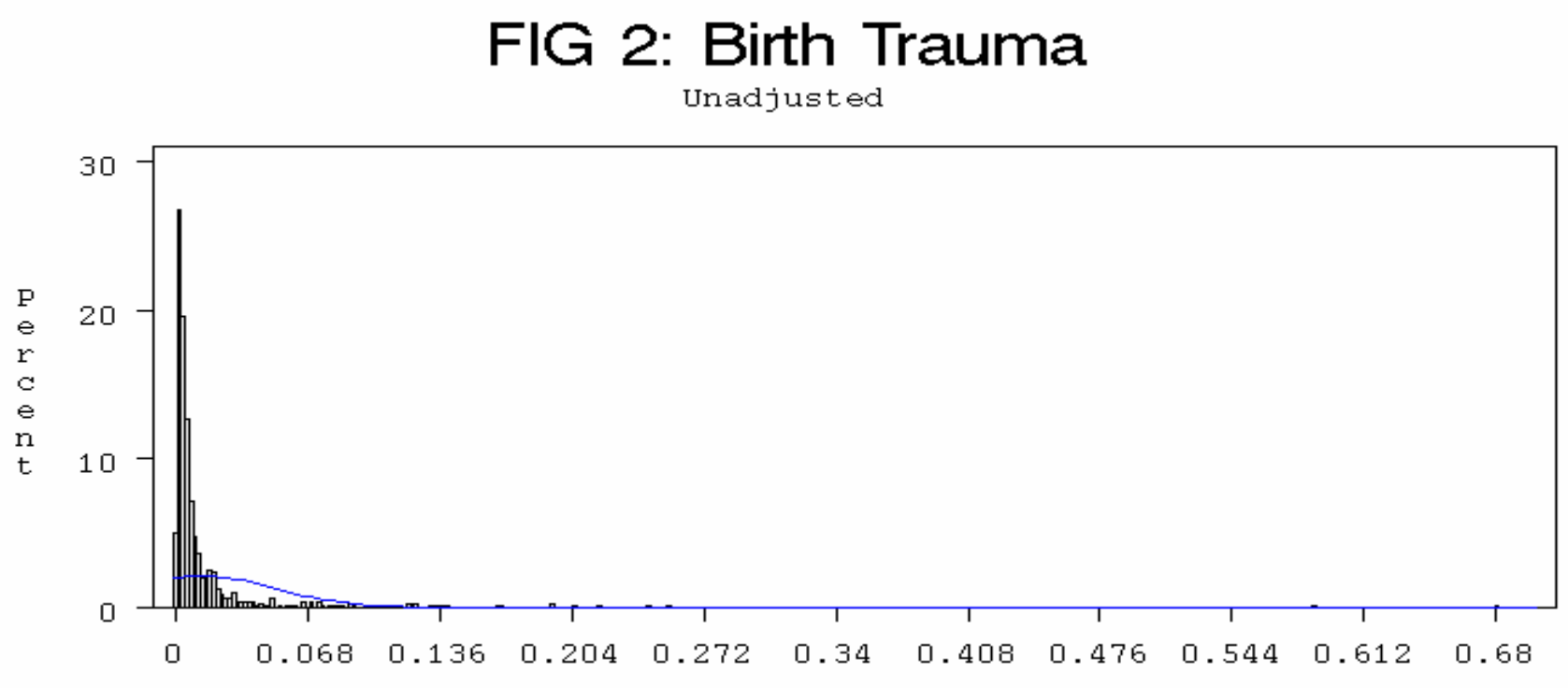

Figure 2. Distribution of non-zero hospital level Birth Trauma rates in 1997 National SID (25% of the hospitals have a zero rate). Y-Axis is the percent of hospitals. X-axis is the hospital's Birth Trauma rate, unadjusted. The blue line is the normal distribution superimposed on the actual distribution. Median rate is 0.25%, mean rate is 0.88% and skew statistic is 13.00.

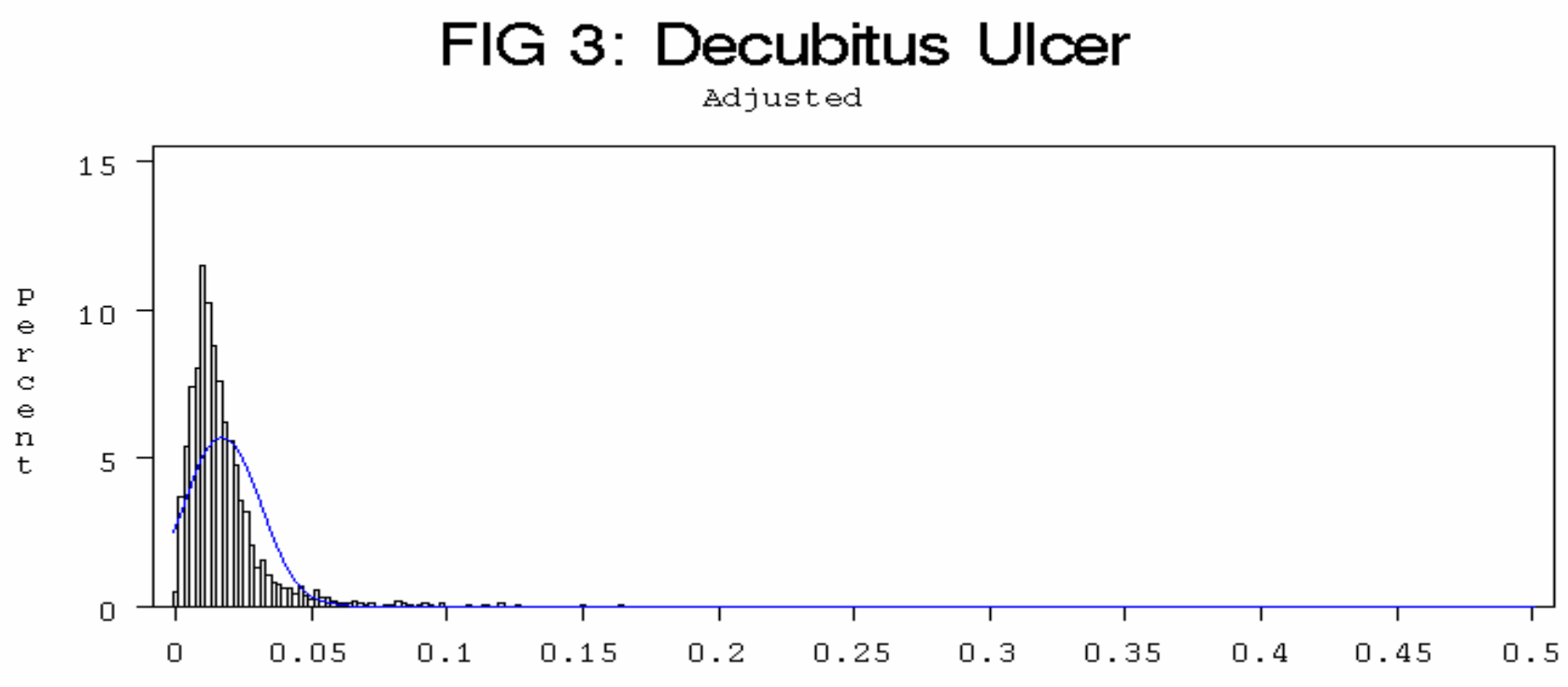

Figure 3. Distribution of non-zero hospital level Decubitus Ulcer rates in 1997 National SID (25% of the hospitals have a zero rate). Y-Axis is the percent of hospitals. X-axis is the hospital's Decubitus Ulcer rate, adjusted for risk and reliability. The blue line is the normal distribution superimposed on the actual distribution. Median rate is 1.4%, mean rate is 1.7% and skew statistic is 3.23.

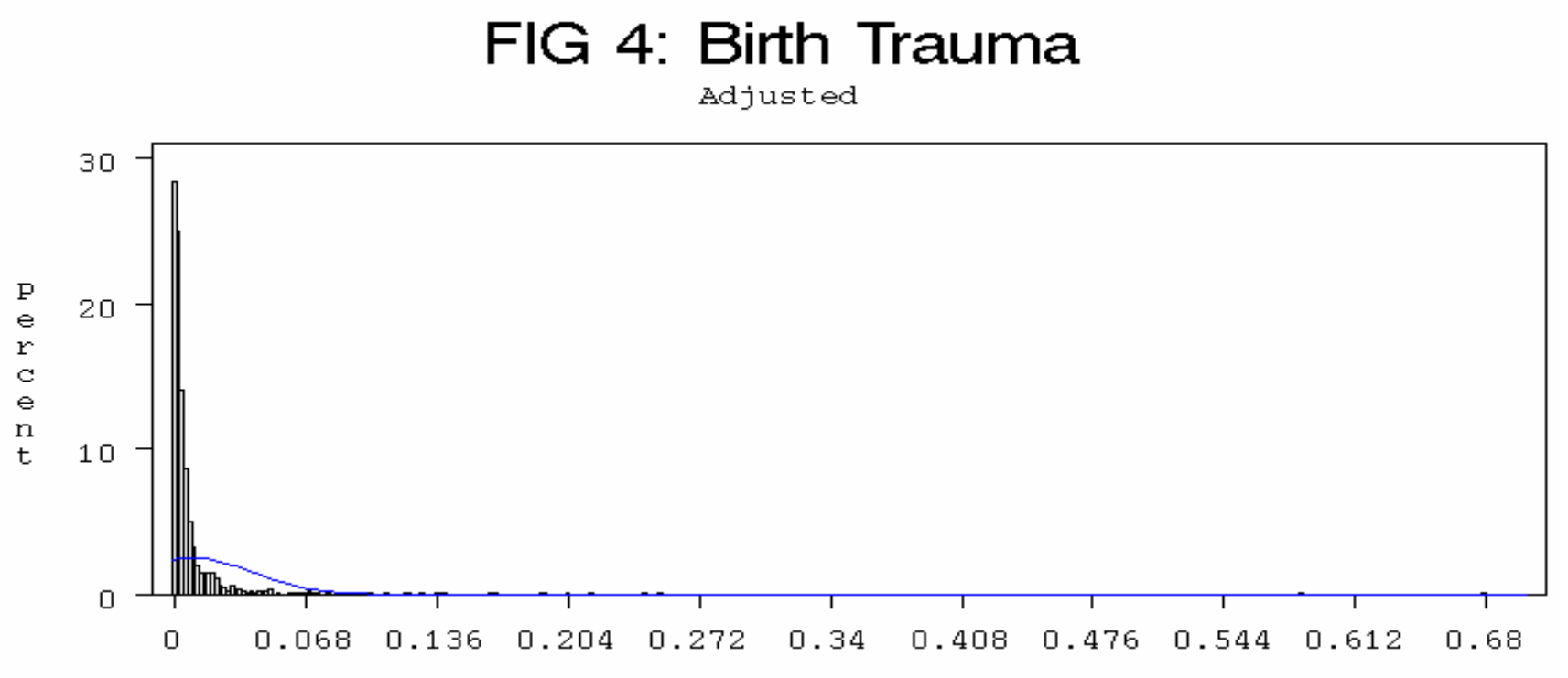

Figure 4. Distribution of non-zero hospital level Birth Trauma rates in 1997 National SID (25% of the hospitals have a zero rate). Y-Axis is the percent of hospitals. X-axis is the hospital's Birth Trauma rate, adjusted for risk and reliability. The blue line is the normal distribution superimposed on the actual distribution. Median rate is 0.26%, mean rate is 0.91% and skew statistic is 13.01.

Appendix H

Comparison of PSIs with CSP Indicators and Miller et al. PSIs

This appendix lists the differences between the final PSIs and the Complications Screening Program indicators and Miller et al. PSIs. These two sets of indicators were used as a starting point for this report. Also listed is the acceptance status of each indicator.

APPENDIX H. COMPARISON OF PSIs WITH CSP INDICATORS AND MILLER ET AL. PSIs

Table 1. Comparison of Miller et al. PSIs to PSIs evaluated in this report

Miller et al. PSIs	Relationship to PSI indicators
Procedure for suture of laceration	Experimental indicator ("Suture of laceration"). PSI adds 043, "suture of cranial and peripheral nerve," 3930 "suture of unspecified blood vessel," 3931, "suture of artery," 3932, "suture of vein," and 6761, "suture of laceration of cervix." PSI excludes obstetric admissions, and does not limit to elective surgery. PSI includes timing restriction of same day or after procedure.
Perforation diagnosis	Rejected pre-panels due to coding input.
Postoperative infection	Rejected pre-panel.
Transfusion reaction	Accepted indicator ("Transfusion reaction"). PSI does not include 999.8, "other transfusion reaction." PSI does not exclude trauma.
Foreign body left during procedure	Accepted indicator ("Foreign body left in during procedure"). PSI includes E871x, "foreign body left in body during procedure." PSI does not exclude trauma.
Infection due to procedure	Accepted indicator ("Infection due to medical care"). PSI adds 996.62.
Iatrogenic conditions	Indicator split prior to panel. "Iatrogenic hypotension" rejected by panel. "Iatrogenic PE/infarction" combined in "Postoperative PE or DVT." "Iatrogenic pneumothorax" retained as accepted indicator, with specified exclusions.
Wound disruption	Accepted indicator ("Wound dehiscence in abdominopelvic surgical patients"). PSI does not include 998.3, "Postoperative wound disruption." PSI limited to abdominoplevic surgical patients and excludes obstetric admissions.
Miscellaneous misadventure	Indicator split prior to panel. Shock due to anesthesia included in "Complications of anesthesia," rejected by panel. Postoperative shock due to procedure was rejected. Accidental puncture or laceration included in "Technical difficulty with procedure," accepted by panel. Air embolism was rejected by panel as part of "Technical difficulty with procedure."
Obstetric misadventure	Indicator split prior to panel. Most codes assigned to experimental indicator, "Other obstetric complications." "Wound complication - cesarean section" was accepted.
Birth trauma	Accepted indicator ("Birth trauma – injury to neonate"). PSI does not include 767.6 "Injury to brachial plexus." PSI excludes preterm infants with subdural or cerebral hemorrhage, and infants with osteogenic imperfecta.
E codes	E codes split prior to panels and assigned to indicators.

Table 2. Comparison of CSP Indicators to PSIs evaluated in this report

CSP Indicator	Relationship to PSI indicators
1. Post-operative cerebral infarction	Rejected pre-panel.
2. Aspiration pneumonia	Experimental ("Aspiration pneumonia"). PSI definition adds two E codes to numerator. PSI denominator is limited to elective surgery patients.
3. Post-operative pulmonary compromise	Accepted ("Postoperative pulmonary compromise"). PSI retains only acute respiratory failure (518.81), and limits to elective surgery. PSI excludes obstetric patients.
4. Post-operative gastrointestinal hemmorhage or ulceration following non-GI surgery	Rejected pre-panel
5. Post-operative complications relating to urinary tract anatomy	Rejected pre-panel
6. Cellulitis or decubitus ulcer	Accepted ("Decubitus ulcer"). PSI omits two cellulitis codes. PSI does not exclude IV drug users and patients 80 yrs and older. PSI does not limit to dxs after #5. PSI LOS is 4 days as opposed to 10. PSI definition excludes patients admitted from long term care facility.
7. Septicemia	Accepted ("Septicemia"). PSI doesn't include bacteraemia. PSI limits denominator to elective surgery patients, and does not limit to specified DRGs. PSI excludes obstetric admissions.
8. Post-or intra-operative shock due to anesthesia.	Code rejected as part of "Complications of anesthesia" indicator by panel.
9. Reopening of a Surgical Site	Experimental ("Reopening of surgical site"). PSI removed two codes, 5461 (moved to wound dehiscence) and 3595 (corrective procedure on heart). Other revision of vascular procedure (39.49) must occur withing 24 hours of principle procedure.
10. Mechanical complication due to device, implant or graft, except organ transplant.	Rejected pre-panel.
11. Miscellaneous complications	Rejected pre-panel, most codes reassigned to toher indicators. 999.1 "air embolism" rejected as part of "Technical difficulty with procedure." 999.3, "other infection" accepted as part of "Infection due to medical care." 999.8, "other transfusion reaction" rejected as part of "Transfusion reaction." E911 abd E912, "inhalation and ingestion of food causing obstruction of respiratory tract or suffocation" assigned to experimental set as part of "Aspiration pneumonia."

12. Shock or cardiopulmonary arrest in-hospital	Rejected pre-panel
13. Post-operative complications relating to central or peripheral nervous system.	Rejected pre-panel. Bracial plexus lesions (353.0) included as part of experimental indicator "Intaoperative nerve compression injuries."
14. Post-operative acute myocardial infarction	Experimental ("Postoperative AMI"). PSI definition limits denominator to elective non-cardiac surgery. PSI does not exclude MDC 5.
15. Post-operative cardiac abnormalities except AMI	Rejected pre-panel
16. Post-operative infections except pneumonia and wound	Rejected pre-panel, infection due to c. difficile included in own indicator.
17. Procedure related perforation or laceration	Experimental ("Suture of laceration"). PSI definition does not include perforation codes. PSI adds 043, "suture of cranial and peripheral nerve," 3782, "suture of laceration of diaphragm," 3930 "suture of unspecified blood vessel," 3931, "suture of artery," 3932, "suture of vein," 4673, "suture of laceration of small intestine," and 6761, "suture of laceration of cervix." PSI excludes obstetric admissions, and does not limit to elective surgery.
18. Post-operative coma or stupor	Rejected pre-panel
19. Post-operative pneumonia	Rejected by panel
20. Post-operative physiologic, metabolic derangements	Accepted ("Postoperative physiologic and metabolic derangements"). PSI omits oliguria and anuria, adds dialysis dependent acute renal failure, and other diabetic comas. PSI limits denominator to elective surgical patients, and excludes obstetric admissions.
21. Complications relating to anesthetic agents and other CNS depressents	Similar indicator proposed by panel ("Complications of anesthesia," Accepted indicator).
22. Venous thrombosis and pulmonary embolism	Accepted indicator ("Postoperative PE or DVT"). PSI definition adds 453.9 and 451.9 (unspecified sight), and procedure code 38.7. PSI excludes obstetric patients.
23. Wound infection	Rejected pre-panel
24. Post-procedural hemorrhage or hematoma	Accepted indicator ("Postoperative hemorrhage or hematoma"). PSI requires both a dx and procedure code, adds hematoma codes, and 38.8x. PSI eliminates seroma code.
25. In-hospital hip fracture	Accepted ("In-hospital hip fracture"). PSI ecludes patients with lymphoma or bone cancer, or self-inflicted injury and principal dx of delirium and other psychoses and anoxic brain injury. PSI only

	excludes patients with principal dx of trauma. PSI limits to surgical patients.
26. Iatrogenic complications	Experimental (nervous system and cardiac). Rejected (all others). PSI definition splits into 5 separate indicators.
27. Technical difficulty with medical care	Accepted ("Technical difficulty with procedure"). PSI only includes E8700-9 and adds 998.2. PSI excludes obstetric admissions.
28. Complications relating to drugs	Rejected pre-panel.
Sentinel events	999.6 and 999.7 are included in accepted indicator, transfusion reaction. E8710-9 and 998.4 accepted as part of "Foreign body left in during procedure." 998.2 accepted as part of "Technical difficulty with procedure." 54.92, "removal of foreign body from peritoneal cavity was rejected by panel, as was 998.3, "disruption of operation wound."

Appendix I

Definitions of Indicators Presented to Panelists

This appendix presents the definitions of each indicator as presented to panelists during the first round of ratings. Panelists then discussed these definitions during the conference call and suggested changes to the indicator. Short descriptions of the indicators are presented first followed by the ICD-9-CM level details for each indicator.

APPENDIX I. DEFINITIONS OF INDICATORS PRESENTED TO PANELISTS

Indicator	Numerator	Denominator
Aspiration pneumonia	Discharges with ICD-9-CM codes of 507.0, E911, or E912 in any secondary diagnosis field per 100 surgical discharges.	All surgical discharges. Exclude patients with a principal diagnosis of seizure, trauma, drug overdose, or poisoning.
CABG following PTCA	Discharges with ICD-9-CM codes for CABG (see below) in any procedure field per 100 discharges with PTCA (see below) in any procedure field. CABG must occur on the same day or after the PTCA.	All discharges with ICD-9-CM code for PTCA (see below) in any procedure code.
Complications of anesthesia	Discharges with ICD-9-CM codes of 995.4 (Shock due to anesthesia) or E876.3 (ETT misplacement) in any diagnosis field per 100 discharges.	Medical and surgical discharges. Exclude patients with any diagnosis of trauma.
Death in low mortality DRGs	All discharges with disposition of "deceased" per 100 population at risk.	Patients in DRGs with less than 0.5% mortality rate. Exclude patients with any diagnosis code of trauma, immunocompromised state, or cancer.
Decubitus ulcer	Discharges with ICD-9-CM code of 707.0 in any secondary diagnosis field per 100 discharges.	Medical and surgical discharges. Exclude patients greater than or equal to 80 years of age. Include only patients with a length of stay of more than 10 days. Exclude patients in MDC 9 or patients with any diagnosis of hemiplegia, paraplegia, quadriplegia, or IV drug abuse.
Dosage complications	Discharges with ICD-9-CM code denoting a dosage complication (see below) in any	Medical and surgical discharges.

	diagnosis field per 100 discharges.	
Foreign body left in during procedure	Discharges with ICD-9-CM codes of 998.4, 998.7, E871.x in any secondary diagnosis field per 100 surgical discharges.	Medical and surgical discharges.
Iatrogenic hypotension	Discharges with ICD-9-CM code of 458.2 in any diagnosis field per 100 discharges.	Medical and surgical patients. Exclude patients with any diagnosis of trauma.
Iatrogenic pneumothorax	Discharges with ICD-9-CM code of 512.1 in any diagnosis field per 100 discharges.	Medical and surgical patients. Exclude patients with any diagnosis of trauma.
Infection due to medical care	Discharges with ICD-9-CM code of 999.3 or E875.x in any diagnosis field per 100 discharges.	Medical or surgical patients. Excludes patients with any diagnosis code for trauma.
In-hospital hip fracture and fall (Renamed Postoperative hip fracture)	Discharges with ICD-9-CM code for hip fracture or fall (see below) in any secondary diagnosis field per 100 surgical discharges.	All surgical discharges. Excludes patients in MDC 8. Excludes patients with principal diagnosis codes for seizure, syncope, stroke, coma, cardiac arrest anoxic brain injury or poisoning or any diagnosis code of trauma or metastatic cancer.
Intestinal infection due to C. difficile	Discharges with ICD-9-CM code of 008.45 in any secondary diagnosis field per 100 discharges.	Medical and surgical patients.
Postoperative acute myocardial infarction	Discharges with ICD-9-CM codes for AMI (see below) in any secondary diagnosis field per 100 non-cardiac surgical discharges.	Non-cardiac surgical discharges. Exclude patients undergoing cardiac surgery (see below). Exclude patients in MDC 5.
Postoperative hemorrhage or hematoma	Discharges with ICD-9-CM codes for hemorrhage or hematoma (see below) in any secondary diagnosis or procedure code field per 100 surgical discharges. Procedure code for control of hemorrhage must	All surgical discharges.

	occur on the same day or after the principal procedure.	
Postoperative iatrogenic complications	Discharges with ICD-9-CM code for iatrogenic complications (see below) in any secondary procedure fields per 100 surgical discharges.	All surgical discharges.
Postoperative physiologic and metabolic derangements	Discharges with ICD-9-CM codes for physiologic and metabolic derangements (see below) in any secondary diagnosis field per 100 surgical discharges.	All surgical discharges. Exclude patients with a principal diagnosis of trauma. Exclude patients with both a diagnosis code of ketoacidosis and a principal diagnosis of diabetes. Exclude patients with both a secondary diagnosis code for oliguria or anuria or acute renal failure and a principal diagnosis of AMI, cardiac arrhythmia, cardiac arrest, or hemorrhage or in MDC 8.
Postoperative pneumonia	Discharges with ICD-9-CM codes for pneumonia (see below) in any secondary diagnosis field per 100 surgical discharges.	All surgical discharges. Exclude patients in MDC 4. Exclude patients with any diagnosis of AIDs, immunocompromised state or cancer.
Postoperative pulmonary compromise (Renamed Postoperative respiratory failure)	Discharges with ICD-9-CM codes for pulmonary compromise (see below) in any secondary diagnosis field per 100 surgical discharges.	All surgical discharges. Exclude patients in MDC 4 and MDC 5.
Postoperative pulmonary embolism or deep vein thrombosis	Discharges with ICD-9-CM codes for pulmonary embolism or deep vein thrombosis (see below) in any secondary diagnosis field per 100 surgical discharges.	All surgical discharges. Exclude patients with a principal diagnosis of deep vein thrombosis.
Postoperative septicemia	Discharges with ICD-9-CM code for septicemia (see below) in any secondary diagnosis field per 100 discharges in the population at risk.	Patients in DRG 5, 106, 107, 110, 111, 209 or MDC 11, 12, 13. Exclude patients with a principal diagnosis of infection, or any diagnosis of AIDS,

		immunocompromised state, or cancer. Include only patients with a length of stay of more than three days.
Postoperative wound dehiscence	Discharges with ICD-9-CM codes of 998.3 (postoperative wound disruption) in any diagnosis or 54.61or 11.52 in any procedure field per 100 discharges.	Medical or surgical discharges. Exclude patients with any diagnosis code for trauma, cancer, AIDs, transplant or immunocompromised state.
Reopening of a surgical site	Discharges with ICD-9-CM codes for reopening of a surgical site (see below) in any secondary procedure field per 100 surgical discharges. Reopening of surgical site must occur at least one day after the principal procedure.	All surgical discharges.
Suture of laceration	Discharges with ICD-9-CM codes for suture of laceration (see below) in any secondary procedure field per 100 surgical discharges. Suture of laceration must occur on the same day or after the principal procedure.	All surgical discharges. Exclude patients with any diagnosis code for foreign body or trauma.
Technical difficulty with procedure	Discharges with ICD-9-CM code denoting a condition arising from technical difficulty (see below) in any diagnosis field per 100 discharges.	Medical and surgical patients.
Transfusion reaction	Discharges with ICD-9-CM codes for transfusion reaction (see below) in any diagnosis field per 100 discharges.	Medical and surgical patients. Exclude patients with any diagnosis of trauma.
Obstetric indicators		
Birth trauma	Discharges with ICD-9-CM codes for birth trauma (see below) in any diagnosis field per 100 liveborn births.	All liveborn infants.
Obstetric complication of delivery - trauma	Discharges with ICD-9-CM codes for obstetric trauma (see below) in any diagnosis or procedure field per 100 deliveries.	All deliveries.
Obstetric thrombosis or embolism.	Discharges with ICD-9-CM codes for obstetric thrombosis or embolism (see below) in any diagnosis field per 100 deliveries.	All deliveries.

Obstetric complication of delivery - wound complications	Discharges with ICD-9-CM codes for obstetric wound complications (see below) in any diagnosis field per 100 deliveries.	All deliveries.
Obstetric complication of delivery - other	Discharges with ICD-9-CM codes for other obstetrical complications (see below) in any diagnosis field per 100 deliveries.	All deliveries.
Puerperal infection	Discharges with ICD-9-CM codes for major puerperal infection (see below) in any diagnosis field per 100 deliveries.	All deliveries. Exclude patients with a diagnosis code of antepartum infection of amniotic cavity [65840, 1, 3]

Acute myocardial infarction

ICD-9-CM diagnosis codes:

41000 AMI OF ANTEROLATERAL WALL – EPISODE OF CARE UNSPECIFIED
41001 AMI OF ANTEROLATERAL WALL - INITIAL EPISODE OF CARE
41010 AMI OF OTHER ANTERIOR WALL – EPISODE OF CARE UNSPECIFIED
41011 AMI OF OTHER ANTERIOR WALL – INITIAL EPISODE OF CARE
41020 AMI OF INFEROLATERAL WALL – EPISODE OF CARE UNSPECIFIED
41021 AMI OF INFEROLATERAL WALL – INITIAL EPISODE OF CARE
41030 AMI OF INFEROPOSTERIOR WALL – EPISODE OF CARE UNSPECIFIED
41031 AMI OF INFEROPOSTERIOR WALL — INITIAL EPISODE OF CARE
41040 AMI OF INFERIOR WALL - EPISODE OF CARE UNSPECIFIED
41041 AMI OF INFERIOR WALL - INITIAL EPISODE OF CARE
41050 AMI OF OTHER LATERAL WALL - EPISODE OF CARE UNSPECIFIED
41051 AMI OF OTHER LATERAL WALL - INITIAL EPISODE OF CARE
41060 AMI TRUE POSTERIOR WALL INFARCTION - EPISODE OF CARE UNSPECIFIED

41061 AMI TRUE POSTERIOR WALL INFARCTION - INITIAL EPISODE OF CARE
41070 AMI SUBENDOCARDIAL INFARCTION - EPISODE OF CARE UNSPECIFIED
41071 AMI SUBENDOCARDIAL INFARCTION - INITIAL EPISODE OF CARE
41080 AMI OF OTHER SPECIFIED SITES - EPISODE OF CARE UNSPECIFIED
41081 AMI OF OTHER SPECIFIED SITES - - INITIAL EPISODE OF CARE
41090 AMI UNSPECIFIED SITE - EPISODE OF CARE UNSPECIFIED
41091 AMI UNSPECIFIED SITE - INITIAL EPISODE OF CARE

Birth trauma

ICD-9-CM diagnosis codes:

7670 SUBDURAL AND CEREBRAL HEMORRHAGE (DUE TO TRAUMA OR TO INTRAPARTUM ANOXIA OR HYPOXIA)
7673 INJURIES TO SKELETON
7674 INJURY TO SPINE AND SPINAL CORD
7676 INJURY TO BRACHIAL PLEXUS
7677 OTHER CRANIAL AND PERIPHERAL NERVE INJURIES
7678 OTHER SPECIFIED BIRTH TRAUMA
7679 BIRTH TRAUMA, UNSPECIFIED

CABG

ICD-9-CM procedure code:s

3610 BYPASS ANASTOMOSIS FOR HEART REVASCULARIZATION
3611 OPEN HEART VALVULOPLASTY WITHOUT REPLACEMENT
3612 AORTOCORONARY BYPASS OF TWO CORONARY ARTERIES
3613 AORTOCORONARY BYPASS OF THREE CORONARY ARTERIES
3614 AORTOCORONARY BYPASS OF FOUR OR MORE CORONARY ARTERIES
3615 SINGLE INTERNAL MAMMARY-CORONARY ARTERY BYPASS
3616 BYPASS ANASTOMOSIS FOR HEART REVASCULARIZATION, DOUBLE INTERNAL MAMMARY-CORONARY ARTERY BYPASS
3617 ABDOMINAL-CORONARY ARTERY BYPASS
3619 OTHER BYPASS ANASTOMOSIS FOR HEART REVASCULARIZATION

Cardiac surgery

Diagnostic Related Groups (DRGs):

103 HEART TRANSPLANT
104 CARDIAC VALVE AND OTHER MAJOR CARDIOTHORACIC PROCEDURES WITH CARDIAC CATHETERIZATION
105 CARDIAC VALVE AND OTHER MAJOR CARDIOTHORACIC PROCEDURES WITHOUT CARDIAC CATHETERIZATION
106 CORONARY BYPASS WITH PTCA
107 CORONARY BYPASS WITH CARDIAC CATHETERIZATION
108 OTHER CARDIOTHORACIC PROCEDURES
110 MAJOR CARDIOVASCULAR PROCEDURES WITH CC
111 MAJOR CARDIOVASCULAR PROCEDURES WITHOUT CC
112 PERCUTANEOUS CARDIOVASCULAR PROCEDURES

Deep vein thrombosis

ICD-9-CM diagnosis codes:

45111 PHLEBITIS AND THROMBOSIS OF FEMORAL VEIN (DEEP) (SUPERFICIAL)
45119 PHLEBITIS AND THROMBOPHLEBITIS - OF DEEP VESSEL OF LOWER EXTREMITIES - OTHER
4512 PHLEBITIS AND THROMBOPHLEBITIS OF LOWER EXTREMITIES UNSPECIFIED
45181 PHLEBITIS AND THROMBOPHLEBITIS OF ILIAC VEIN
4519 PHLEBITIS AND THROMBOPHLEBITIS OF OTHER SITES - OF UNSPECIFIED SITE
4532 OTHER VENOUS EMBOLISM AND THROMBOSIS OF VENA CAVA
4538 OTHER VENOUS EMBOLISM AND THROMBOSIS OF OTHER SPECIFIED VEINS
4539 OTHER VENOUS EMBOLISM AND THROMBOSIS OF UNSPECIFIED SITE

Dosage Complications

ICD-9-CM diagnosis codes:

E8730 EXCESSIVE AMOUNT OF BLOOD OR OTHER FLUID DURING TRANSFUSION OR INFUSION.
E8731 INCORRECT DILUTION OF FLUID DURING INFUSION.
E8732 OVERDOSE OF RADIATION IN THERAPY
E8733 INADVERTENT EXPOSURE OF PATIENT TO RADIATION DURING MEDICAL CARE.
E8734 FAILURE IN DOSAGE IN ELECTROSHOCK OR INSULIN-SHOCK THERAPY.
E8735 INAPPROPRIATE (TOO HOT OR TOO COLD) TEMPERATURE IN LOCAL APPLICATION AND PACKING.
E8736 NON-ADMINSTRATION OF NECESSARY DRUG OR MEDICINAL SUBSTANCE.
E8738 OTHER SPECIFIED FAILURE IN DOSAGE
E8739 UNSPECIFIED FAILURE IN DOSAGE.
E8761 WRONG FLUID IN INFUSION

Hemorrhage or hematoma

ICD-9-CM diagnosis codes:

99811 HEMORRHAGE COMPLICATING A PROCEDURE
99812 HEMATOMA COMPLICATING A PROCEDURE
99813 SEROMA COMPLICATING A PROCEDURE

ICD-9-CM procedure codes:

287 CONTROL OF HEMORRHAGE AFTER TONSILLECTOMY AND ADENOIDECTOMY
3941 CONTROL OF HEMORRHAGE AFTER TONSILLECTOMY AND ADENOIDECTOMY
3998 CONTROL OF HEMORRHAGE NOS
4995 CONTROL OF (POSTOPERATIVE) HEMORRHAGE OF ANUS
5793 CONTROL OF (POSTOPERATIVE) HEMORRHAGE OF BLADDER

Hip fracture or fall

ICD-9-CM diagnosis codes: (includes all 5th digits)

8200 FRACTURE OF NECK OF FEMUR-TRANSCERVICAL FRACTURE, CLOSED
8201 FRACTURE OF NECK OF FEMUR-TRANSCERVICAL FRACTURE, OPEN
8202 FRACTURE OF NECK OF FEMUR-PERTROCHANTERIC FRACTURE, CLOSED
8203 FRACTURE OF NECK OF FEMUR-PERTROCHANTERIC FRACTURE, OPEN
8208 UNSPECIFIED PART OF NECK OF FEMUR, CLOSED
8209 UNSPECIFIED PART OF NECK OF FEMUR, OPEN
E8842 FALL FROM CHAIR OR BED
E8849 FALL FROM ONE LEVEL TO ANOTHER
E885 FALL ON SAME LEVEL FROM SLIPPING, TRIPPING OR STUMBLING
E887 FRACTURE, CAUSE UNSPECIFIED
E888 OTHER AND UNSPECIFIED FALL

Iatrogenic complications

ICD-9-CM diagnosis codes:

9970X NERVOUS SYSTEM COMPLICATIONS
9971 CARDIAC COMPLICATIONS
9972 PERIPHERAL VASCULAR COMPLICATIONS
9973 RESPIRATORY COMPLICATIONS
9974 DIGESTIVE SYSTEM COMPLICATIONS
9975 URINARY COMPLICATIONS

Obstetric thrombosis or embolism

ICD-9-CM diagnosis codes:

671.40 DEEP VEIN THROMBOSIS – POSTPARTUM UNSPECIFIED
671.42 DEEP VEIN THROMBOSIS – DELIVERED WITH MENTION OF POSTPARTUM COMPLICATION
671.44 DEEP VEIN THROMBOSIS – POSTPARTUM CONDITION OR COMPLICATION
673.20-4 OBSTETRIC PULMONARY EMBOLISM

Obstetric trauma

ICD-9-CM diagnosis codes:

66420, 1,4 THRID-DEGREE PERINEAL LACERATION
66430, 1,4 FOURTH-DEGREE PERINEAL LACERATION
66530, 1, 4 LACERATION OF CERVIX
66540, 1, 4 HIGH VAGINAL LACERATIONS
66550, 1, 4 OTHER INJURY TO PELVIC ORGANS

ICD-9-CM procedure codes:

7550 REPAIR OF CURRENT OBSTETRIC LACERATIONS UTERUS
7551 REPAIR OF CURRENT OBSTETRIC LACERATIONS OF CERVIX
7552 REPAIR OF CURRENT OBSTETRIC LACERATIONS OF CORPUS UTERI
7561 REPAIR OF CURRENT OBSTETRIC LACERATION OF BLADDER AND URETHRA
7562 REPAIR OF CURRENT OBSTETRIC LACERATION OF RECTUM AND SPHINCTER ANI

Obstetric wound complications

ICD-9-CM diagnosis codes:

67410,2,4 DISRUPTION OF CESAREAN WOUND
67420,2,4 DISRUPTION OF PERINEAL WOUND
67430 OTHER COMPLICATIONS OF OBSTETRICAL SURGICAL WOUNDS

Other obstetrical complications

ICD-9-CM diagnosis codes:

(includes 5th digits):
6651 RUPTURE OF UTERUS DURING OR AFTER LABOR
6680 PULMONARY COMPLICATIONS
6681 CARDIAC COMPLICATIONS
6682 CENTRAL NERVOUS SYSTEM COMPLICATIONS
6688 OTHER COMPLICATIONS OF ANESTHESIA OR OTHER SEDATION IN LABOR AND DELIVERY
6689 UNSPECIFIED COMPLICATION OF ANESTHESIA AND OTHER SEDATION
6691 SHOCK DURING OR FOLLOWING LABOR AND DELIVERY
6694 OTHER COMPLICATIONS OF OBSTETRICAL SURGERY AND PROCEDURES
66930, 2, 4 ACUTE RENAL FAILURE FOLLOWING LABOR AND DELIVERY

Physiologic and metabolic derangements

ICD-9-CM diagnosis codes:

DIABETES WITH KETOACIDOSIS:
25010 TYPE 2, OR UNSPECIFIED TYPE, NOT STATED AS UNCONTROLLED
25011 TYPE 1 NOT STATED AS UNCONTROLLED
25012 TYPE 2 OR UNSPECIFIED TYPE, UNCONTROLLED
25013 TYPE 1 UNCONTROLLED

ACUTE RENAL FAILURE:
5845 WITH LESION OF TUBULAR NECROSIS

5846 WITH LESION OF RENAL CORTICAL NECROSIS
5847 WITH LESION OF RENAL MEDULLARY [PAPILLARY] NECROSIS
5848 WITH OTHER SPECIFIED PATHOLOGICAL LESION IN KIDNEY
5849 ACUTE RENAL FAILURE, UNSPECIFIED

DIABETES WITH HYPEROSMOLARITY:
25020 TYPE 2, OR UNSPECIFIED TYPE, NOT STATED AS UNCONTROLLED
25021 TYPE 1 NOT STATED AS UNCONTROLLED
25022 TYPE 2 OR UNSPECIFIED TYPE, UNCONTROLLED
25023 TYPE 1 UNCONTROLLED

DIABETES WITH OTHER COMA:
25030 TYPE 2, OR UNSPECIFIED TYPE, NOT STATED AS UNCONTROLLED
25031 TYPE 1 NOT STATED AS UNCONTROLLED
25032 TYPE 2 OR UNSPECIFIED TYPE, UNCONTROLLED
25033 TYPE 1 UNCONTROLLED

Pneumonia

ICD-9-CM diagnosis codes:

481 PNEUMOCOCCAL PNEUMONIA
4821 KLEBSIELLA PNEUMONIAE
4822 PNEUMONIA DUE TO PSEUDOMONAS
4823 HEMOPHILIS PNEUMONIAE
4824 PNEUMONIA DUE TO STREPTOCOCCUS
4825 PNEUMONIA DUE TO STAPHYLOCOCCUS
4826 PNEUMONIA DUE TO ANAEROBES
4827 PNEUMONIA DUE TO E. COLI
4828 PNEUMONIA DUE TO OTHER GRAM NEGATIVE
4829 PNEUMONIA DUE TO LEGIONNAIRES DISEASE
4830-8 PNEUMONIA DUE TO OTHER SPECIFIED ORGANISM (MYCOPLASMA PNEUMONIA, CHLAMYDIA, OTHER SPECIFIED)
485 BRONCHOPNEUMONIA, ORGANISM UNSPECIFIED
486 PNEUMONIA, ORGANISM UNSPECIFIED (EXCLUDES HYPOSTATIC OR PASSIVE PNUEMONIA, ASPIRATION PNEUMONIA)

Puerperal infection

ICD-9-CM diagnosis code:

67000 MAJOR PUERPERAL INFECTION, UNSPECIFIED AS TO EPISODE OF CARE
67002 MAJOR PUERPERAL INFECTION, DELIVERED WITH MENTION OF POST-PARTUM COMPLICATION
67004 MAJOR PUERPERAL INFECTION, POST-PARTUM CONDITION OR COMPLICATION

PTCA

ICD-9-CM procedure codes:

3601 SINGLE VESSEL PERCUTANEOUS TRANSLUMINAL CORONARY ANGIOPLASTY [PTCA] OR CORONARY ATHERECTOMY WITHOUT MENTION OF THROMBOLYTIC AGENT
3602 SINGLE VESSEL PERCUTANEOUS TRANSLUMINAL CORONARY ANGIOPLASTY [PTCA] OR CORONARY ATHERECTOMY WITH MENTION OF THROMBOLYTIC AGENT
3605 MULTIPLE VESSEL PERCUTANEOUS TRANSLUMINAL CORONARY ANGIOPLSTY [PTCA] OR CORONARY ATHERECTOMY PERFORMED DURING THE SAME OPERATION, WITH OR WITHOUT MENTION OF THROMBOLYTIC AGENT
3606 INSERTION OF CORONARY ARTERY STENTS

Pulmonary compromise

ICD-9-CM diagnosis codes:

51881 ACUTE RESPIRATORY FAILURE
51882 OTHER PULMONARY INSUFFICIENCY NOT ELSEWHERE CLASSIFIED
514 PULMONARY CONGESTION AND HYPOSTASIS
518.5 PULMONARY INSUFFICIENCY FOLLOWING TRAUMA AND SURGERY
518.4 ACUTE EDEMA OF LUNG, UNSPECIFIED

Pulmonary embolism

ICD-9-CM diagnosis codes:

41511 IAGTROGENIC PULMONARY EMBOLISM AND INFARCTION
41519 OTHER

Reopening of a surgical site

ICD-9-CM procedure codes:

123 REOPENING OF CRANIOTOMY SITE
302 REOPENING OF LAMINECTOMY SITE
602 REOPENING OF WOUND OF THYROID FIELD
3403 REOPENING OF RECENT THORACOTOMY SITE
3595 REVISION OF CORRECTIVE PROCEDURE ON HEART
3949 OTHER REVISION OF VASCULAR PROCEDURE
5412 REOPENING OF RECENT LAPAROTOMY SITE

Septicemia

ICD-9-CM diagnosis codes:

0380 STREPTOCOCCAL SEPTICEMIA
03810 STAPHYLOCOCCAL SEPTICEMIA, UNSPECIFIED
03811 STAPHYLOCOCCUS AUREUS SEPTICEMIA
03819 OTHER STAPHYLOCOCCAL SEPTICEMIA

0382 PNEUMOCOCCAL SEPTICEMIA (STREPTOCOCCUS PNEUMONIAE SEPTICEMIA)
0383 SEPTICEMIA DUE TO ANAEROBES
SEPTICEMIA DUE TO
03840 GRAM-NEGATIVE ORGANISM, UNSPECIFIED
03841 HEMOPHILUS INFLUENZAE
03842 ESCHERICHIA COLI
03843 PSEUDOMONAS
03844 SERRATIA
03849 SEPTICEMIA DUE TO OTHER GRAM-NEGATIVE ORGANISMS
0388 OTHER SPECIFIED SEPTICEMIAS
0389 UNSPECIFIED SEPTICEMIA

Suture of laceration

ICD-9-CM procedure codes:

2951 SUTURE OF LACERATION OF PHARYNX
3161 SUTURE OF LACERATION OF LARYNX
3341 SUTURE OF LACERATION OF BRONCHUS
3343 CLOSURE OF LACERATION OF LUNG
3482 SUTURE OF LACERATION OF DIAPHRAGM
3930 SUTURE OF UNSPECIFIED BLOOD VESSEL
3931 SUTURE OF ARTERY
3932 SUTURE OF VEIN
4282 SUTURE OF LACERATION OF ESOPHAGUS
4461 SUTURE OF LACERATION OF STOMACH
4671 SUTURE OF LACERATION OF DUODENUM
4673 SUTURE OF LACERATION OF SMALL INTESTINE, EXCEPT DUODENUM
4675 SUTURE OF LACERATION OF LARGE INTESTINE
4871 SUTURE OF LACERATION OF RECTUM
4971 SUTURE OF LACERATION OF ANUS
5581 SUTURE OF LACERATION OF KIDNEY
5682 SUTURE OF LACERATION OF URETER
5781 SUTURE OF LACERATION OF BLADDER
5841 SUTURE OF LACERATION OF URETHRA
5061 CLOSURE OF LACERATION OF LIVER
5191 REPAIR OF LACERATION OF GALLBLADDER
6941 SUTURE OF LACERATION OF UTERUS

Technical difficulty with medical care (procedure)

ICD-9-CM Diagnosis Codes

E870X ACCIDENTAL CUT, PUNCTURE, PERFORATION, OR HEMORRHAGE DURING MEDICAL CARE
E872X FAILURE OF STERILE PRECAUTIONS DURING PROCEDURE
E8765 PERFORMANCE OF INAPPROPRIATE OPERATION
9982 ACCIDENTAL PUNCTURE OR LACERATION DURING A PROCEDURE
99881 EMPHYSEMA (SUBCUTANEOUS) (SURGICAL) RESULTING FROM A PROCEDURE
99882 CATARACT FRAGMENTS IN EYE FOLLOWING CATARACT SURGERY
99889 OTHER SPECIFIED COMPLICATIONS OF PROCEDURES, NOT ELSEWHERE CLASSIFIED
9991 AIR EMBOLISM

Transfusion reaction

ICD-9-CM diagnosis codes:

9996 ABO INCOMPATIBILITY REACTION
9997 RH INCOMPATIBILITY REACTION
9998 OTHER TRANSFUSION REACTION
E8760 MISMATCHED BLOOD IN TRANSFUSION

Appendix J

Peer Reviewers

This appendix lists the peer reviewers who who provided comments on the report draft.

APPENDIX J. PEER REVIEWERS

The EPC acknowledges the contribution of the following individuals, who provided comments on the report draft. This review was used to improve the final report.

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Acronyms Used in This Report

AHIMA	American Health Information Management Association
AHRQ	Agency for Healthcare Research and Quality
AIDS	Acquired Immune Deficiency Syndrome
AMI	Acute Myocardial Infarction
APR-DRG	All-Patient Refined-Diagnostic Related Group
CABG	Coronary Artery Bypass Graft
CC	Comorbidities or complications
CHF	Congestive Heart Failure
CMA	California Medical Association
CMS	Centers for Medicare and Medicaid Services
CNS	Central Nervous System
COPD	Chronic Obstruction Pulmonary Disease
CSP	Complications Screening Program
DNR	Do Not Resuscitate
DRG	Diagnostic Related Groups
DVT	Deep Vein Thrombosis
E-Codes	External cause-of-injury codes
EPC	Evidence-based Practice Center
HCUP	Healthcare Cost and Utilization Project
HIV	Human Immunodeficiency Virus
ICD-9-CM	*International Classification of Diseases 9th Revision Clinical Modification*
IV	Intravenous (catheter)
IVC	Intra Vena Cava
JCAHO	Joint Commission for the Accreditation of Healthcare Organizations
MDC	Major Diagnostic Categories
MSA	Metropolitan Statistical Area
MSX	Multivariate Signal Extraction
NCHS	National Center for Health Statistics
NIS	Nationwide Inpatient Sample
NQF	National Quality Forum
NQR	National Quality Report
NSQIP	National Surgical Quality Improvement Program (VA)
OB	Obstetric
OR	Operating Room
PE	Pulmonary Embolism
PO	Postoperative
PICC	Peripherally Inserted Central Catheter
PSI	Patient Safety Indicator
PTCA	Percutaneous Transluminal Coronary Angioplasty
QI	Quality Indicator
SID	State Inpatient Databases
VA	(Department of) Veterans Affairs
VBAC	Vaginal Birth After Cesarean
UCSF	University of California at San Francisco
UTI	Urinary Tract Infection