

# The Seventh Annual HealthGrades Hospital Quality and Clinical Excellence Study

January 2009



HEALTHGRADES®  
**HealthGrades Seventh Annual  
Hospital Quality and Clinical Excellence Study  
January 2009**

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# HEALTHGRADES®

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### Executive Summary

Each year HealthGrades independently assesses the quality of care provided at the nation's nearly 5,000 non-federal hospitals across 26 procedures and diagnoses and makes specific hospital ratings available to consumers at [www.HealthGrades.com](http://www.HealthGrades.com). In this seventh annual study, HealthGrades objectively identifies hospitals that are performing among the best in the nation, designates each of these hospitals as a HealthGrades Distinguished Hospital for Clinical Excellence™, and compares them to all other hospitals.

Specifically, HealthGrades examines the differences in risk-adjusted mortality and complications between these top-performing hospitals and the rest of the nation's hospitals. This analysis highlights the vast differences in patient care between these top-performing hospitals and the rest. This study also summarizes the distribution of Distinguished Hospitals for Clinical Excellence by state.

HealthGrades' analysis is based on more than 41 million Medicare hospital discharges for the years 2005, 2006 and 2007. HealthGrades identifies the Distinguished Hospitals for Clinical Excellence based on overall performance of risk-adjusted outcomes associated with 26 common Medicare inpatient procedures and diagnoses. This analysis compared in-hospital risk-adjusted mortality rates for 17 inpatient procedures and diagnoses, and in-hospital risk-adjusted major complications rates for nine procedures.

Of the nation's approximate 5,000 short-term, non-federal, non-children's, acute care hospitals, only 270 hospitals (approximately 5%) are designated as HealthGrades' Distinguished Hospitals for Clinical Excellence™ (DH-CE). In this study, these 270 Distinguished Hospitals for Clinical Excellence are compared to all other U.S. hospitals to identify trends in outcomes, relative risk, and improvement for the years 2005, 2006 and 2007.

### Summary of Findings

HealthGrades' Distinguished Hospitals for Clinical Excellence have lower risk-adjusted mortality and lower in-hospital complications compared to all other hospitals. During 2005-2007, they had:

- Overall **27 percent lower risk-adjusted mortality** across 17 procedures and diagnoses where mortality was the end point of study.
- Risk-adjusted mortality was lower for Distinguished Hospitals for all 17 procedures and diagnoses. In fact, risk-adjusted mortality at Distinguished Hospitals was 18 to 40 percent lower than all other hospitals.
- Overall **eight percent lower risk-adjusted complications** across nine procedures where in-hospital complications were the end point of study.
- Risk-adjusted complications were lower across all nine procedures studied. In fact, risk-adjusted complications at Distinguished Hospitals were two to 14 percent lower than all other hospitals.

270 hospitals were designated as HealthGrades' Distinguished Hospitals for Clinical Excellence.

Patients have on average a 27% lower chance of dying at the nation's DH-CE hospitals compared to all other hospitals across 17 procedures and conditions.

If all hospitals performed at the level of DH-CE hospitals across the 17 procedures and conditions, 152,666 Medicare lives may have been saved.

From 2005 to 2007, if all hospitals performed at the level of Distinguished Hospitals:

- 152,666 deaths may have been prevented.
- 11,772 in-hospital complications may have been avoided.

Distinguished Hospitals showed greater improvement from 2005 to 2007 with an average:

- Reduction in risk-adjusted mortality by 18 percent, compared to 13 percent for all other hospitals.
- Reduction in risk-adjusted in-hospital complications by four percent, compared to 2.5 percent for all other hospitals.

Compared to last year's analysis, the number of states that have one or more Distinguished Hospitals for Clinical Excellence decreased by two.

- Thirty-five states have one or more Distinguished Hospitals for Clinical Excellence (compared to 37 last year).
- Maryland and Minnesota have the highest percentage of Distinguished Hospitals for Clinical Excellence at 44 percent of eligible hospitals followed by Ohio, Florida and Connecticut at 39 percent, 35 percent, and 33 percent respectively.

Thirty-five states have at least one Distinguished Hospital for Clinical Excellence.

## Introduction

HealthGrades, the nation's leading independent healthcare ratings organization, has been studying variations in care among the nation's hospitals for more than ten years. During this time, one fact remains constant: variation in care between hospitals contributes to potentially preventable morbidity and mortality. For this reason, many organizations (the federal government, state hospital associations, and publicly traded organizations) are making quality information available to consumers. What differentiates this healthcare quality study is that it evaluates hospitals across 26 of the most common diagnoses and procedures among Medicare beneficiaries and identifies those hospitals with the best overall clinical performances. In this analysis, 270 hospitals have been identified from the original list of the nation's almost 5,000 short-term, non-federal, non-children's, acute-care hospitals.

These elite 270 hospitals have the lowest overall risk-adjusted mortality and in-hospital complications compared to all other hospitals. Many hospitals strive for and achieve clinical excellence at the service line level (e.g., cardiac, stroke or orthopedics service lines). Distinguished Hospitals have achieved excellence across multiple service lines and have achieved hospital-wide clinical excellence.

Achieving outcomes that place a hospital in the top five percent of hospitals nationwide does not happen by chance. These hospitals have clearly found the means to systematically hard-wire clinical quality across the organization. The result is that, as a group, these hospitals have 27.1 percent lower risk-adjusted mortality across 17 diagnoses and procedures and 7.9 percent lower risk-adjusted in-hospital complications across nine commonly performed procedures.

These top-performing hospitals are designated by HealthGrades as the 2009 Distinguished Hospitals for Clinical Excellence™ (DH-CE). For the full list of the 270 recipients, see *Exhibit A* or visit [www.HealthGrades.com](http://www.HealthGrades.com).

DH-CE hospitals have 27% lower risk-adjusted mortality and 8% lower risk-adjusted complications compared to all other hospitals.

This study highlights the variation in patient outcomes between the best and all other hospitals by assessing, comparing, and studying the quality outcomes and trends of Distinguished Hospitals for Clinical Excellence to all other U.S. hospitals across the 26 procedures and diagnoses rated by HealthGrades for the years 2005 through 2007.

### Methodology

In order to evaluate overall hospital performance and to identify the best-performing hospitals in clinical excellence across the U.S., HealthGrades uses a two-step methodology:

- 1 Assign star ratings for 26 procedures and diagnoses using the *HealthGrades Hospital Report Cards™ Mortality and Complication Based Outcomes Methodology*.
- 2 Identify the overall best-performing hospitals using the *Distinguished Hospital Award for Clinical Excellence™ Methodology*.

The 26 procedures and diagnoses in this study are as follows.

Mortality-Based	Complication-Based
<ul style="list-style-type: none"> <li>• Bowel Obstruction</li> <li>• Chronic Obstructive Pulmonary Disease (COPD)</li> <li>• Coronary Bypass Surgery</li> <li>• Coronary Interventional Procedures (Angioplasty/Stent)</li> <li>• Diabetic Acidosis and Coma</li> <li>• Gastrointestinal Bleed</li> <li>• Gastrointestinal Surgeries and Procedures</li> <li>• Heart Attack</li> <li>• Heart Failure</li> <li>• Pancreatitis</li> <li>• Pneumonia</li> <li>• Pulmonary Embolism</li> <li>• Resection / Replacement of Abdominal Aorta</li> <li>• Respiratory Failure</li> <li>• Sepsis</li> <li>• Stroke</li> <li>• Valve Replacement Surgery</li> </ul>	<ul style="list-style-type: none"> <li>• Back and Neck Surgery (with Spinal Fusion)</li> <li>• Back and Neck Surgery (without Spinal Fusion)</li> <li>• Carotid Surgery</li> <li>• Cholecystectomy</li> <li>• Hip Fracture Repair</li> <li>• Peripheral Vascular Bypass</li> <li>• Prostatectomy</li> <li>• Total Hip Replacement</li> <li>• Total Knee Replacement</li> </ul>

### Mortality and Complication Based Outcomes 2009 Methodology

To help consumers evaluate and compare hospital performance, HealthGrades analyzes patient outcome data for virtually every hospital in the country (all hospitals with the exception of government/military hospitals). HealthGrades purchased the initial data from the Centers for Medicare and Medicaid Services (CMS). The Medicare data (MedPAR file) from CMS contains 41 million inpatient records for Medicare patients for hospitalizations from 2005 to 2007.

Using a logistic-regression based risk-adjusted model to compare performance among hospitals, hospitals are assigned one of three star ratings: one-star (poor), three-star (average), or five-star (best) for each of the above patient groups. The purpose of risk adjustment is to obtain fair statistical

comparisons among disparate populations or groups. Significant differences in demographic and clinical risk factors are found among patients treated in different hospitals and therefore, risk adjustment of the data is needed to make accurate and valid comparisons of clinical outcomes at different hospitals. To be eligible to receive a star rating, a hospital must have a minimum of 30 cases over the three years of study and at least five cases in the most recent year of analysis (2007).

More information regarding the risk-adjustment methodology for the 26 procedures and diagnoses above can be found in *Exhibit D*. Visit [www.HealthGrades.com](http://www.HealthGrades.com) to view hospital ratings and to read the complete methodology white paper *Hospital Report Card™ Mortality and Complication Based Outcomes 2009 Methodology*.

### Distinguished Hospital Award for Clinical Excellence™ 2009 Methodology

To be considered for the Distinguished Hospital Award for Clinical Excellence (DHA-CE), a hospital had to have received star ratings in at least 19 of the 26 HealthGrades procedures and diagnoses ratings using MedPAR data.

After creating a list of hospitals that met the above criteria, HealthGrades took the following steps to determine the DHA-CE recipients.

- 1 Calculated the average overall star rating for each hospital by averaging all of their MedPAR-based ratings.
- 2 Ranked hospitals in descending order by their average star rating.
- 3 Excluded hospitals whose average star was less than 3.42.
- 4 Designated the hospitals that remained on the list as recipients of the 2009 Distinguished Hospital Award-Clinical Excellence. These remaining hospitals represent approximately five percent of the nation's hospitals.

### Comparison of Distinguished Hospitals for Clinical Excellence to All Other Hospitals

To identify differences in performance between Distinguished Hospitals for Clinical Excellence (DH-CE) hospitals and all other hospitals, HealthGrades calculated the actual (observed) and predicted (expected) mortality rates for each of the 17 mortality-based procedures and diagnoses and the actual (observed) and predicted (expected) complication rates for the nine complication-based procedures for each hospital. Hospitals are divided into two groups, DH-CE and Non-DH-CE, and then overall observed and expected rates are calculated for both groups in each of the 26 procedures and diagnoses.

The purpose of comparing the predicted to actual is to make a fair comparison between hospitals with different populations. Sicker patients have higher associated observed mortality/complications so using the observed (O) to expected (E) ratio takes into consideration how sick the patient population is at a given hospital. Observed-to-expected ratios were calculated by procedure or diagnosis by year, for both groups of hospitals and were evaluated for differences.

- An O/E ratio of less than 1 means that the procedure or diagnosis measured had fewer deaths/complications than expected given the patient population.
- An O/E of greater than 1 means that the procedure or diagnosis measured had more deaths/complications than expected given the patient population.

Risk-adjustment methodology allows for fair statistical comparison between hospitals with different populations.

## Results

DH-CE hospitals improved at a faster rate in 19 procedures and diagnoses compared to all other hospitals.

Distinguished Hospitals for Clinical Excellence (DH-CE) consistently outperformed all other hospitals during the years 2005, 2006 and 2007. They exhibited lower risk-adjusted in-hospital mortality across all 17 mortality-based procedures and diagnoses in every year studied. DH-CE hospitals also had lower risk-adjusted in-hospital complications across the nine complication-based procedures. In addition, not only did DH-CE hospitals have better clinical quality outcomes but they improved at a faster rate from 2005 to 2007 than all other hospitals and across the majority of cohorts studied with the exception of heart attack, pancreatitis, valve replacement surgery, back and neck surgery (without spinal fusion), carotid surgery, total hip replacement, and hip fracture repair (see *Exhibits B and C*).

### On Average, DH-CE had 27 Percent Lower Risk-Adjusted In-hospital Mortality.

When compared to all other hospitals, DH-CE hospitals had lower risk-adjusted in-hospital mortality across all 17 procedures and diagnoses studied. The differences ranged from 17.54 percent lower risk-adjusted in-hospital mortality in coronary artery bypass surgery to 39.67 percent in the treatment of diabetic acidosis and coma (see *Exhibit B*).

When comparing DH-CE to all other hospitals, the largest differences in risk-adjusted in-hospital mortality were noted in the following areas.

Diabetic Acidosis and Coma	39.67%
Chronic Obstructive Pulmonary Disease	37.51%
Pulmonary Embolism	36.27%
Pneumonia	35.54%

DH-CE hospitals have lower risk-adjusted mortality and complications in the 26 procedures and diagnoses studied.

### On Average, DH-CE Performed 8 Percent Better in In-hospital Complications.

DH-CE hospitals demonstrated lower overall risk-adjusted in-hospital complications across all nine common Medicare procedures studied. During the three years studied, DH-CE hospitals performed, on average, 7.95 percent better than all other hospitals in in-hospital complications associated with orthopedic surgery, neurosurgery, vascular surgery, prostate surgery, and cholecystectomy. The differences ranged from 1.56 percent in back and neck surgery (with spinal fusion) to 14.14 percent in prostatectomy (see *Exhibit C*).

When comparing DH-CE to all other hospitals, the largest differences in risk-adjusted in-hospital complications were noted in the following areas.

Prostatectomy	14.14%
Hip Fracture Repair	12.60%
Total Hip Replacement	12.54%

### Distinguished Hospitals for Clinical Excellence Improved at Greater Rate.

While all hospitals showed improvements over the three years of study, DH-CE hospitals improved at a greater rate overall (see *Table 3*). Comparing 2007 data with 2005 data, DH-CE hospitals had an average reduction in risk-adjusted in-hospital mortality of 18.25 percent, versus 13.21 percent for all other hospitals. For risk-adjusted in-hospital complications, the corresponding reductions were 3.92 percent and 2.51 percent.

**Table 3.**  
**Overall Improvement from 2005 to 2007 DH-CE Hospitals**  
**Compared to All Other Hospitals**

	% Improvement Mortality-Based Procedures and Diagnoses	% Improvement Complication- Based Procedures
DH-CE Hospitals	18.25%	3.92%
All Other Hospitals	13.21%	2.51%

DH-CE hospitals outperformed all other hospitals in all areas except three mortality-based cohorts—heart attack, pancreatitis, and valve-replacement surgery (see *Exhibit B*). In the complication-based cohorts, DH-CE hospitals improved better overall compared to all other hospitals but improved at a faster rate in only four of the individual cohorts: back and neck surgery (with spinal fusion), peripheral vascular bypass, prostatectomy, and total knee replacement (see *Exhibit C*).

### Good News for Patients

All states had hospitals that met the criteria to be considered for DH-CE designation.

All states had hospitals that met the criteria to be considered for DH-CE designation. Thirty-five states have at least one hospital designated as a DH-CE (compared to 37 states last year). This year Arkansas joined the states that have at least one DH-CE hospital, and North Dakota, Alabama, and New Hampshire no longer have at least one hospital designated as a DH-CE.

Minnesota and Maryland lead the nation in percentage of DH-CE hospitals with 43.75 percent of eligible hospitals qualifying for the distinction. Ohio, Florida and Connecticut followed with 39.39 percent, 35.35 percent, and 33.33 percent of eligible hospitals meeting the criteria respectively.



States that have at least one Distinguished for Hospital for Clinical Excellence

Thirty-five states have at least one Distinguished for Hospital for Clinical Excellence.

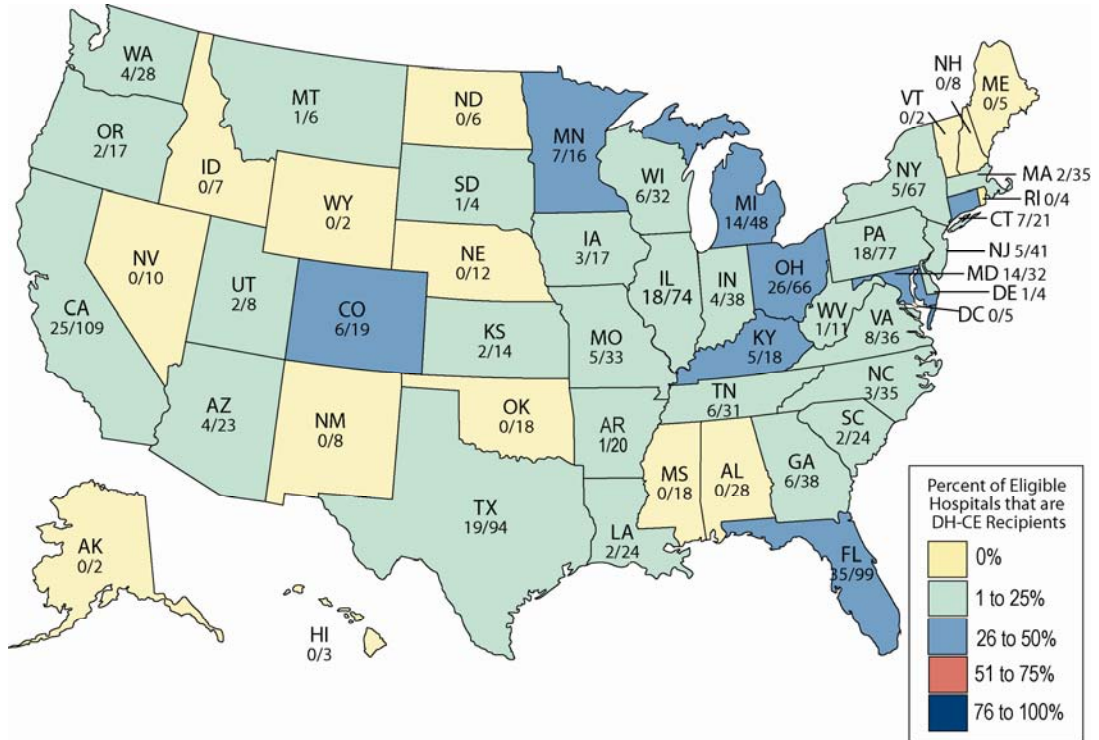


Table 4. Percentage of Distinguished Hospital Clinical Excellence Recipients by State

State / Abbreviation	Percent of Eligible	DH-CE Recipients	Eligible Hospitals	State / Abbreviation	Percent of Eligible	DH-CE Recipients	Eligible Hospitals
Alabama	0.00%	0	28	Montana	16.67%	1	6
Alaska	0.00%	0	2	Nebraska	0.00%	0	12
Arizona	17.39%	4	23	Nevada	0.00%	0	10
Arkansas	5.00%	1	20	New Hampshire	0.00%	0	8
California	22.94%	25	109	New Jersey	12.20%	5	41
Colorado	31.58%	6	19	New Mexico	0.00%	0	8
Connecticut	33.33%	7	21	New York	7.46%	5	67
Delaware	25.00%	1	4	North Carolina	8.57%	3	35
Dist. of Columbia	0.00%	0	5	North Dakota	0.00%	0	6
Florida	35.35%	35	99	Ohio	39.39%	26	66
Georgia	15.79%	6	38	Oklahoma	0.00%	0	18
Hawaii	0.00%	0	3	Oregon	11.76%	2	17
Idaho	0.00%	0	7	Pennsylvania	23.38%	18	77
Illinois	24.32%	18	74	Rhode Island	0.00%	0	4
Indiana	10.53%	4	38	South Carolina	8.33%	2	24
Iowa	17.65%	3	17	South Dakota	25.00%	1	4
Kansas	14.29%	2	14	Tennessee	19.35%	6	31
Kentucky	27.78%	5	18	Texas	20.21%	19	94
Louisiana	8.33%	2	24	Utah	25.00%	2	8
Maine	0.00%	0	5	Vermont	0.00%	0	2
Maryland	43.75%	14	32	Virginia	22.22%	8	36
Massachusetts	5.71%	2	35	Washington	14.29%	4	28
Michigan	29.17%	14	48	West Virginia	9.09%	1	11
Minnesota	43.75%	7	16	Wisconsin	18.75%	6	32
Mississippi	0.00%	0	18	Wyoming	0.00%	0	2
Missouri	15.15%	5	33				

## Interpretation of Results

Between 2005 and 2007, the best-performing hospitals had 27 percent lower risk-adjusted mortality and eight percent lower risk-adjusted in-hospital complications among Medicare beneficiaries compared to all other hospitals. If all hospitals performed at this level, **152,666 lives could have been saved and 11,722 in-hospital complications could have been avoided.**

Distinguished Hospitals for Clinical Excellence have set the bar for all other U.S. hospitals and represent the standard for clinical excellence that consumers and payers should demand. Regardless of service line or condition, patients can feel confident that they are receiving the right care, at the right time and by the right team when they are being treated at one of these nation's distinguished hospitals.

Many hospitals focus and excel in a given service line. What differentiates these 270 hospitals is their commitment and ability to excel across a variety of service lines including cardiac, pulmonary, critical care, stroke, gastrointestinal, vascular and orthopedics, and their ability to obtain clinical outcomes that place them in the top five percent in the nation overall. These 270 elite hospitals have been recognized as recipients of the HealthGrades 2009 Distinguished Hospital Award for Clinical Excellence.

## Exhibit A: Distinguished Hospitals for Clinical Excellence™ 2009 List

\* Distinction cannot be used without a Licensing Agreement from Health Grades, Inc.

Distinguished Hospitals for Clinical Excellence™ 2009*	City
<b>Arizona</b>	
Mayo Clinic Hospital	Phoenix
Scottsdale Healthcare - Osborn	Scottsdale
Scottsdale Healthcare - Shea	Scottsdale
Sun Health Del E Webb Hospital	Sun City West
<b>Arkansas</b>	
Saint Vincent Infirmiry Medical Center	Little Rock
<i>including:</i> Saint Vincent Doctors Hospital	Little Rock
<b>California</b>	
Beverly Hospital	Montebello
California Pacific Med Ctr - Pacific	San Francisco
<i>including:</i> California Pacific Med Ctr - California	San Francisco
Cedars-Sinai Medical Center	Los Angeles
Eisenhower Medical Center	Rancho Mirage
El Camino Hospital	Mountain View
Fountain Valley Regional Hospital and Medical Center	Fountain Valley
Garfield Medical Center	Monterey Park
Glendale Adventist Medical Center	Glendale
Glendale Memorial Hospital & Health Center	Glendale
Good Samaritan Hospital	Los Angeles
Hoag Memorial Hospital Presbyterian	Newport Beach
Huntington Memorial Hospital	Pasadena
John Muir Medical Center - Concord Campus	Concord
John Muir Medical Center - Walnut Creek Campus	Walnut Creek
Marshall Medical Center	Placerville
Mills-Peninsula Health Services	Burlingame
<i>including:</i> Mills Health Center	San Mateo
Providence Holy Cross Medical Center	Mission Hills
Saint Johns Hospital Health Center	Santa Monica
Saint Vincent Medical Center	Los Angeles
Santa Monica - UCLA Medical Center	Santa Monica
Scripps Memorial Hospital Encinitas	Encinitas
Scripps Memorial Hospital La Jolla	La Jolla
Scripps Mercy Hospital	San Diego
<i>including:</i> Scripps Mercy Hospital - Chula Vista	Chula Vista
Sequoia Hospital	Redwood City
Sharp Chula Vista Medical Center	Chula Vista

Colorado	
Centura Health - Penrose Saint Francis Health Services	Colorado Springs
Littleton Adventist Hospital	Littleton
North Colorado Medical Center	Greeley
Poudre Valley Hospital	Fort Collins
Presbyterian/St. Luke's Medical Center	Denver
Rose Medical Center	Denver
Connecticut	
Danbury Hospital	Danbury
Griffin Hospital	Derby
Hartford Hospital	Hartford
Hospital of Saint Raphael	New Haven
Manchester Memorial Hospital	Manchester
Middlesex Hospital	Middletown
Yale-New Haven Hospital	New Haven
Delaware	
Christiana Care Health System - Christiana Hospital	Newark
Florida	
Baptist Hospital of Miami	Miami
Baptist Medical Center	Jacksonville
Bay Medical Center	Panama City
Boca Raton Community Hospital	Boca Raton
Brandon Regional Hospital	Brandon
Central Florida Regional Hospital	Sanford
Charlotte Regional Medical Center	Punta Gorda
Cleveland Clinic Hospital	Weston
Delray Medical Center	Delray Beach
Flagler Hospital	Saint Augustine
Florida Hospital Heartland Medical Center	Sebring
Florida Hospital Oceanside	Ormond Beach
<i>including:</i> Florida Hospital Ormond Beach	Ormond Beach
Florida Hospital Orlando	Orlando
<i>including:</i> Winter Park Memorial Hospital	Winter Park
Halifax Medical Center	Daytona Beach
Holmes Regional Medical Center	Melbourne
JFK Medical Center	Atlantis
Jupiter Medical Center	Jupiter
Kendall Regional Medical Center	Miami
Lawnwood Regional Medical Center and Heart Institute	Fort Pierce
Lee Memorial Hospital	Fort Myers
Martin Memorial Medical Center	Stuart

Memorial Hospital Jacksonville	Jacksonville
Mercy Hospital	Miami
Morton Plant Mease Healthcare Countryside	Safety Harbor
Munroe Regional Medical Center	Ocala
NCH Healthcare System	Naples
Oak Hill Hospital	Brooksville
Ocala Regional Medical Center/West Marion Hospital	Ocala
Palm Beach Gardens Medical Center	Palm Beach Gardens
Saint Vincent's Medical Center	Jacksonville
Sarasota Memorial Hospital	Sarasota
Sebastian River Medical Center	Sebastian
University of Miami Hospital	Miami
Westside Regional Medical Center	Plantation
Wuesthoff Medical Center Rockledge	Rockledge
<b>Georgia</b>	
Dekalb Medical	Decatur
Gwinnett Medical Center	Lawrenceville
Houston Medical Center	Warner Robins
Northeast Georgia Medical Center	Gainesville
<i>including:</i> Northeast Georgia Med Ctr - Lanier Park Campus	Gainesville
Piedmont Fayette Hospital	Fayetteville
Saint Joseph's Hospital of Atlanta	Atlanta
<b>Illinois</b>	
Advocate Good Samaritan Hospital	Downers Grove
Advocate Good Shepherd Hospital	Barrington
Alexian Brothers Medical Center	Elk Grove Village
Central Dupage Hospital	Winfield
Evanston Hospital	Evanston
<i>including:</i> Highland Park Hospital	Highland Park
Ingalls Memorial Hospital	Harvey
Lake Forest Hospital	Lake Forest
Mercy Hospital & Medical Center	Chicago
Metro South Medical Center	Blue Island
Northwest Community Hospital	Arlington Heights
Northwestern Memorial Hospital	Chicago
Our Lady of The Resurrection Medical Center	Chicago
Palos Community Hospital	Palos Heights
Provena Saint Joseph Medical Center	Joliet
Rush North Shore Medical Center	Skokie
Rush University Medical Center	Chicago
Saint Alexius Medical Center	Hoffman Estates

Swedish Covenant Hospital	Chicago
<b>Indiana</b>	
Clarian Health Partners <i>including:</i> Indiana University Medical Center	Indianapolis Indianapolis
The Community Hospital	Munster
Floyd Memorial Hospital and Health Services	New Albany
Saint Vincent Indianapolis Hospital	Indianapolis
<b>Iowa</b>	
Mercy Medical Center - Cedar Rapids	Cedar Rapids
Mercy Medical Center - Des Moines <i>including:</i> Metropolitan Medical Center	Des Moines Des Moines
Saint Lukes Hospital	Cedar Rapids
<b>Kansas</b>	
Saint Francis Health Center	Topeka
Via Christi Regional Medical Center <i>including:</i> Saint Joseph Medical Center	Wichita Wichita
<b>Kentucky</b>	
Baptist Hospital East	Louisville
Jewish Hospital <i>including:</i> Sts Mary & Elizabeth Hospital	Louisville Louisville
Norton Hospitals <i>including:</i> Norton Southwest Hospital Norton Audubon Hospital Norton Suburban Hospital	Louisville Louisville Louisville Louisville
Owensboro Medical Health System	Owensboro
St. Elizabeth Medical Center	Edgewood
<b>Louisiana</b>	
Glenwood Regional Medical Center	West Monroe
Willis Knighton Medical Center	Shreveport
<b>Maryland</b>	
Baltimore Washington Medical Center	Glen Burnie
Doctor's Community Hospital	Lanham
Franklin Square Hospital Center	Baltimore
Frederick Memorial Hospital	Frederick
Good Samaritan Hospital	Baltimore
Greater Baltimore Medical Center	Baltimore
Harbor Hospital	Baltimore
Howard County General Hospital	Columbia
Peninsula Regional Medical Center	Salisbury
Saint Joseph Medical Center	Towson
Sinai Hospital of Baltimore	Baltimore

Suburban Hospital	Bethesda
Upper Chesapeake Medical Center	Bel Air
Washington Adventist Hospital	Takoma Park
<b>Massachusetts</b>	
Berkshire Medical Center	Pittsfield
<i>including:</i> Hillcrest Hospital	Pittsfield
Massachusetts General Hospital	Boston
<b>Michigan</b>	
Bronson Methodist Hospital	Kalamazoo
Genesys Regional Medical Center	Grand Blanc
Hackley Hospital	Muskegon
Henry Ford Hospital	Detroit
Henry Ford Macomb Hospital	Clinton Township
<i>including:</i> Community Hospital Foundation	Almont
Huron Valley Sinai Hospital	Commerce Township
McLaren Regional Medical Center	Flint
Munson Medical Center	Traverse City
Providence Hospital	Southfield
Saint Mary Mercy Hospital	Livonia
Sinai-Grace Hospital	Detroit
Spectrum Health Hospitals	Grand Rapids
<i>including:</i> Ferguson/Blodgett Hospital	Grand Rapids
Spectrum Health - East Campus	Grand Rapids
William Beaumont Hospital	Royal Oak
William Beaumont Hospital - Troy	Troy
<b>Minnesota</b>	
Fairview Southdale Hospital	Edina
Mercy Hospital	Coon Rapids
Methodist Hospital	Minneapolis
North Memorial Health Care	Robbinsdale
Saint Cloud Hospital	Saint Cloud
Saint Lukes Hospital	Duluth
United Hospitals	Saint Paul
<b>Missouri</b>	
Missouri Baptist Medical Center	Saint Louis
Skaggs Community Health Center	Branson
SSM Saint Joseph Health Center	Saint Charles
<i>including:</i> SSM Saint Joseph Health Center - Wentzville	Wentzville
SSM Saint Marys Health Center	Saint Louis
St. Luke's Hospital	Chesterfield

Montana	
Kalispell Regional Hospital	Kalispell
New Jersey	
Clara Maass Medical Center	Belleville
Community Medical Center	Toms River
Hackensack University Medical Center	Hackensack
Ocean Medical Center	Brick
The Mountainside Hospital	Montclair
New York	
Ellis Hospital	Schenectady
New York-Presbyterian/Weill Cornell <i>including:</i> New York Presbyterian - Columbia	New York New York
Orange Regional Medical Center <i>including:</i> Horton Memorial Hospital	Goshen Middletown
University Hospital Stony Brook	Stony Brook
Winthrop-University Hospital	Mineola
North Carolina	
Haywood Regional Medical Center	Clyde
Nash General Hospital	Rocky Mount
Rex Hospital	Raleigh
Ohio	
Akron General Medical Center	Akron
Aultman Hospital	Canton
Barberton Citizens Hospital	Barberton
Bethesda North Hospital	Cincinnati
Christ Hospital	Cincinnati
EMH Regional Medical Center	Elyria
Good Samaritan Hospital	Dayton
Good Samaritan Hospital	Cincinnati
Grandview and Southview Medical Centers	Dayton
Hillcrest Hospital	Mayfield Heights
Jewish Hospital	Cincinnati
Kettering Medical Center	Kettering
Lakewood Hospital	Lakewood
Marymount Hospital	Garfield Heights
Meridia Euclid Hospital	Euclid
Miami Valley Hospital	Dayton
Parma Community General Hospital	Parma
Robinson Memorial Hospital	Ravenna
Saint Elizabeth Health Center	Youngstown
Saint John West Shore Hospital	Westlake



Saint Vincent Charity Hospital	Cleveland
South Pointe Hospital	Warrensville Heights
Southern Ohio Medical Center	Portsmouth
Southwest General Health Center	Middleburg Heights
Summa Health Systems Hospitals	Akron
The Toledo Hospital	Toledo
<b>Oregon</b>	
Mercy Medical Center	Roseburg
Saint Charles Medical Center - Bend	Bend
<b>Pennsylvania</b>	
Alle Kiski Medical Center	Natrona Heights
Community Medical Center	Scranton
Conemaugh Valley Memorial Hospital	Johnstown
Easton Hospital	Easton
Hamot Medical Center	Erie
Lancaster General Hospital	Lancaster
Lankenau Hospital - Main Line Health	Wynnewood
Lehigh Valley Hospital	Allentown
Lehigh Valley Hospital - Muhlenberg	Bethlehem
Mercy Hospital Scranton	Scranton
Pinnacle Health System	Harrisburg
Pocono Medical Center	East Stroudsburg
Saint Luke's Hospital	Bethlehem
<i>including:</i> Horton Saint Luke's Hospital-Allentown Campus	Allentown
The Reading Hospital and Medical Center	Reading
University of Pittsburgh Medical Center - Saint Margaret	Pittsburgh
University of Pittsburgh Medical Center - McKeesport	McKeesport
Western Pennsylvania Hospital Forbes Regional Campus	Monroeville
Williamsport Hospital & Medical Center	Williamsport
<b>South Carolina</b>	
AnMed Health	Anderson
Greenville Memorial Hospital	Greenville
Avera McKennan Hospital and University Health Center	Sioux Falls
<b>Tennessee</b>	
Baptist Memorial Hospital	Memphis
Baptist Riverside Hospital	Knoxville
Memorial Healthcare System	Chattanooga
Methodist Medical Center of Oak Ridge	Oak Ridge
Saint Mary's Medical Center	Knoxville
Saint Thomas Hospital	Nashville

Texas	
Baylor Regional Medical Center At Plano	Plano
CHRISTUS Santa Rosa Healthcare	San Antonio
CHRISTUS Spohn Hospital Corpus Christi - Memorial	Corpus Christi
<i>including:</i> CHRISTUS Spohn Hospital Corpus Christi – South	Corpus Christi
CHRISTUS Spohn Hospital Corpus Christi-Shoreline	Corpus Christi
Southside Health Center	Corpus Christi
Doctors Hospital at Renaissance	Edinburg
Good Shepherd Medical Center	Longview
Harlingen Medical Center	Harlingen
Harris Methodist Fort Worth	Fort Worth
McAllen Medical Center / Heart Hospital	McAllen
Memorial Hermann Healthcare System	Houston
Memorial Hermann Memorial City Hospital	Houston
<i>including:</i> Fort Bend Medical Center Hospital	Missouri City
The Methodist Hospital	Houston
<i>including:</i> Diagnostic Center Hospital	Houston
Mother Frances Hospital - Tyler	Tyler
Rio Grande Regional Hospital	McAllen
Saint Davids Hospital	Austin
Saint Lukes Episcopal Hospital	Houston
San Jacinto Methodist Hospital	Baytown
Seton Medical Center	Austin
Valley Baptist Medical Center	Harlingen
Woodland Heights Medical Center	Lufkin
Utah	
Intermountain Medical Center	Murray
St. Mark's Hospital	Salt Lake City
Virginia	
Augusta Medical Center	Fishersville
Bon Secours Memorial Regional Medical Center	Mechanicsville
Centra Health	Lynchburg
Henrico Doctors' Hospital - Forest	Richmond
<i>including:</i> Henrico Doctors' Hospital - Parham	Richmond
Inova Alexandria Hospital	Alexandria
Inova Fairfax Hospital	Falls Church
Rockingham Memorial Hospital	Harrisonburg
Winchester Medical Center	Winchester

Washington	
Central Washington Hospital	Wenatchee
Evergreen Hospital Medical Center	Kirkland
Providence Everett Medical Center - Colby Campus	Everett
Swedish Medical Center - First Hill	Seattle
<i>including:</i> Swedish Medical Center - Ballard Campus	Seattle
West Virginia	
Charleston Area Medical Center	Charleston
Wisconsin	
Aspirus Wausau Hospital	Wausau
Aurora Saint Lukes Medical Center	Milwaukee
<i>including:</i> Saint Lukes Medical Center	Cudahy
Bellin Memorial Hospital	Green Bay
Gundersen Lutheran Medical Center	La Crosse
Saint Josephs Hospital	Marshfield
West Allis Memorial Hospital	West Allis

\* Distinction cannot be used without a Licensing Agreement from Health Grades, Inc.

**Exhibit B: Inhospital Mortality Performance:  
 Distinguished Hospitals for Clinical Excellence (DH-CE) Compared to All Other U.S. Hospitals  
 (3-Year Aggregate Relative Risk-Adjusted Inhospital Mortality Performance: 2005-2007)**

Procedure or Diagnosis	Year	Total Number of U.S. Medicare Hospitalizations	DH-CE Hospitals Average Observed Inhospital Mortality to Expected Inhospital Mortality Ratio	% Improvement by DH-CE Hospitals <sup>1</sup>	All Other U.S. Hospitals Average Observed Inhospital Mortality to Expected Inhospital Mortality Ratio	% Improvement by All Other Hospitals <sup>2</sup>	Relative Risk Reduction Associated with DH-CE Hospitals Compared to All Other U.S. Hospitals <sup>3</sup>	Number of Lives That Could Have Been Saved If All Patients were Treated at DH-CE Hospitals (2005-2007) <sup>4</sup>	P-Value (DH-CE Hospital Mortality Compared to National Mortality Average)
Bowel Obstruction	2005	154,169	.85		1.16				<.001
	2006	151,326	.71		1.05				<.001
	2007	146,846	.63		.99				<.001
	2005-2007	452,341	.73	25.76%	1.06	15.25%	31.44%	4,974	<.001
Chronic Obstructive Pulmonary Disease (COPD)	2005	366,007	.80		1.19				<.001
	2006	327,117	.66		1.05				<.001
	2007	311,856	.54		.96				<.001
	2005-2007	1,004,980	.67	31.95%	1.07	18.83%	37.51%	6,943	<.001
Coronary Artery Bypass Surgery	2005	102,128	.96		1.14				.106
	2006	89,888	.86		1.04				<.001
	2007	81,569	.77		.97				<.001
	2005-2007	273,585	.87	19.35%	1.05	15.09%	17.54%	1,042	<.001
Coronary Interventional Procedures (Angioplasty/Stent)	2005	325,076	1.00		1.16				.446
	2006	321,696	.79		1.07				<.001
	2007	281,211	.76		.94				<.001
	2005-2007	927,983	.84	24.03%	1.05	18.67%	20.03%	1,661	<.001
Diabetic Acidosis and Coma	2005	54,678	.77		1.13				.001
	2006	53,749	.67		.99				<.001
	2007	52,867	.49		1.11				<.001
	2005-2007	161,294	.65	37.06%	1.08	1.95%	39.67%	939	<.001
Gastrointestinal Bleed	2005	279,210	.90		1.21				<.001
	2006	262,477	.76		1.04				<.001
	2007	250,642	.64		.93				<.001
	2005-2007	792,329	.76	28.41%	1.06	23.09%	28.03%	5,372	<.001

Procedure or Diagnosis	Year	Total Number of U.S. Medicare Hospitalizations	DH-CE Hospitals Average Observed Inhospital Mortality to Expected Inhospital Mortality Ratio	% Improvement by DH-CE Hospitals <sup>1</sup>	All Other U.S. Hospitals Average Observed Inhospital Mortality to Expected Inhospital Mortality Ratio	% Improvement by All Other Hospitals <sup>2</sup>	Relative Risk Reduction Associated with DH-CE Hospitals Compared to All Other U.S. Hospitals <sup>3</sup>	Number of Lives That Could Have Been Saved If All Patients were Treated at DH-CE Hospitals (2005-2007) <sup>4</sup>	P-Value (DH-CE Hospital Mortality Compared to National Mortality Average)
Gastrointestinal Surgeries and Procedures	2005	82,231	.85		1.10				<.001
	2006	81,044	.79		1.04				<.001
	2007	78,516	.76		1.01				<.001
	2005-2007	241,791	.80	10.48%	1.05	8.36%	23.80%	4,908	<.001
Heart Attack	2005	268,468	.88		1.09				<.001
	2006	244,010	.87		1.03				<.001
	2007	230,919	.80		.97				<.001
	2005-2007	743,397	.85	9.06%	1.04	11.12%	17.86%	11,625	<.001
Heart Failure	2005	642,583	.78		1.15				<.001
	2006	610,822	.73		1.07				<.001
	2007	563,945	.65		.98				<.001
	2005-2007	1,817,350	.72	16.61%	1.07	14.61%	32.25%	20,207	<.001
Pancreatitis	2005	51,921	.78		1.16				<.001
	2006	50,129	.72		1.01				<.001
	2007	47,687	.70		1.02				<.001
	2005-2007	149,737	.73	11.21%	1.07	12.27%	31.31%	1,112	<.001
Pneumonia	2005	596,658	.76		1.14				<.001
	2006	511,310	.67		1.05				<.001
	2007	478,659	.60		.97				<.001
	2005-2007	1,586,627	.68	20.62%	1.06	14.76%	35.54%	26,025	<.001
Pulmonary Embolism	2005	49,222	.76		1.22				<.001
	2006	50,402	.71		1.08				<.001
	2007	51,767	.61		.98				<.001
	2005-2007	151,391	.69	19.75%	1.09	19.70%	36.27%	2,241	<.001
Resection/Replacement of Abdominal Aorta	2005	21,403	.87		1.11				.015
	2006	21,460	.87		1.02				.022
	2007	21,142	.76		1.01				<.001
	2005-2007	64,005	.84	11.93%	1.05	9.47%	19.88%	514	<.001

Procedure or Diagnosis	Year	Total Number of U.S. Medicare Hospitalizations	DH-CE Hospitals Average Observed Inhospital Mortality to Expected Inhospital Mortality Ratio	% Improvement by DH-CE Hospitals <sup>1</sup>	All Other U.S. Hospitals Average Observed Inhospital Mortality to Expected Inhospital Mortality Ratio	% Improvement by All Other Hospitals <sup>2</sup>	Relative Risk Reduction Associated with DH-CE Hospitals Compared to All Other U.S. Hospitals <sup>3</sup>	Number of Lives That Could Have Been Saved If All Patients were Treated at DH-CE Hospitals (2005-2007) <sup>4</sup>	P-Value (DH-CE Hospital Mortality Compared to National Mortality Average)
Respiratory Failure	2005	129,321	.84		1.08				<.001
	2006	143,813	.82		1.06				<.001
	2007	141,262	.77		1.02				<.001
	2005-2007	414,396	.81	7.54%	1.05	6.40%	22.98%	18,049	<.001
Sepsis	2005	236,730	.89		1.14				<.001
	2006	256,164	.79		1.05				<.001
	2007	266,784	.76		1.00				<.001
	2005-2007	759,678	.81	14.30%	1.05	12.46%	23.47%	32,273	<.001
Stroke	2005	240,659	.88		1.11				<.001
	2006	227,270	.79		1.04				<.001
	2007	213,705	.75		.98				<.001
	2005-2007	681,634	.81	15.11%	1.05	11.14%	22.59%	13,542	<.001
Valve Replacement Surgery	2005	39,062	.85		1.12				<.001
	2006	38,289	.89		1.06				.001
	2007	36,847	.79		1.00				<.001
	2005-2007	114,198	.85	7.09%	1.06	11.31%	20.20%	1,239	<.001
<b>Totals</b>		<b>10,336,716</b>						<b>152,666</b>	
<b>3-Year Performance Averages</b>			<b>0.77</b>	<b>18.25%</b>	<b>1.06</b>	<b>13.21%</b>	<b>27.08%</b>		

<sup>1</sup> Percent improvement determines improvement over time (2005 to 2007) for aggregate DH-CE hospitals. Calculated as follows: (O/E for 2005 – O/E for 2007) / (O/E for 2005) where the O/E is for the DH-CE hospitals.

<sup>2</sup> Percent improvement determines improvement over time (2005 to 2007) for aggregate Non-DH-CE hospitals. Calculated as follows: (O/E for 2005 – O/E for 2007) / (O/E for 2005) where the O/E is for the Non-DH-CE hospitals.

<sup>3</sup> Relative Risk Reduction determines the difference in performance between DH-CE and All Other hospitals. Calculated as follows: (Non-DH-CE O/E – DH-CE O/E) / Non-DH-CE O/E.

<sup>4</sup> Lives saved were calculated: All Other hospitals' 3-year actual number of mortalities – (All Other hospitals' 3-year expected number of mortalities x DH-CE O/E ratio).

**Exhibit C: Inhospital Complications Performance:  
 Distinguished Hospitals for Clinical Excellence (DH-CE) Compared to All Other U.S. Hospitals  
 (3-Year Aggregate Relative Risk-Adjusted Inhospital Complications Performance: 2005-2007)**

Procedure or Diagnosis	Year	Total Number of U.S. Medicare Hospitalizations	DH-CE Hospitals Average Observed Inhospital Complications to Expected Inhospital Complications Ratio	% Improvement by DH-CE Hospitals <sup>1</sup>	All Other U.S. Hospitals Average Observed Inhospital Complications to Expected Inhospital Complications Ratio	% Improvement by All Other Hospitals <sup>2</sup>	Relative Risk Reduction Associated with DH-CE Hospitals Compared to All Other U.S. Hospitals <sup>3</sup>	Number of Patients That Could Have Avoided Developing >1 Post-Op Complications If All Patients were Treated at DH-CE Hospitals (2005-2007) <sup>4</sup>	P-Value (DH-CE Hospital Complications Compared to National Complication Average)
Back and Neck Surgery (Except Spinal Fusion)	2005	61,073	.98		1.03				.178
	2006	57,021	.93		.98				.003
	2007	53,004	1.00		1.04				.542
	2005-2007	171,098	.97	-2.48%	1.02	-1.47%	4.60%	666	.018
Back and Neck Surgery (Spinal Fusion)	2005	48,044	1.02		1.03				.827
	2006	50,495	1.00		1.02				.512
	2007	51,846	.98		1.00				.165
	2005-2007	150,385	1.00	4.08%	1.02	2.89%	1.56%	297	.491
Carotid Surgery	2005	72,921	.99		1.01				.296
	2006	71,390	.95		1.00				.035
	2007	67,848	.96		.98				.084
	2005-2007	212,159	.97	2.41%	1.00	2.96%	3.35%	376	.016
Cholecystectomy	2005	70,028	.95		1.04				.009
	2006	67,613	.96		1.01				.027
	2007	64,371	.97		1.02				.086
	2005-2007	202,012	.96	-2.02%	1.02	2.21%	5.98%	1,399	<.001
Hip Fracture Repair	2005	131,355	.92		1.05				<.001
	2006	129,823	.89		1.04				<.001
	2007	126,418	.87		.98				<.001
	2005-2007	387,596	.89	5.69%	1.02	6.81%	12.60%	4,050	<.001

Procedure or Diagnosis	Year	Total Number of U.S. Medicare Hospitalizations	DH-CE Hospitals Average Observed Inhospital Complications to Expected Inhospital Complications Ratio	% Improvement by DH-CE Hospitals <sup>1</sup>	All Other U.S. Hospitals Average Observed Inhospital Complications to Expected Inhospital Complications Ratio	% Improvement by All Other Hospitals <sup>2</sup>	Relative Risk Reduction Associated with DH-CE Hospitals Compared to All Other U.S. Hospitals <sup>3</sup>	Number of Patients That Could Have Avoided Developing >1 Post-Op Complications If All Patients were Treated at DH-CE Hospitals (2005-2007) <sup>4</sup>	P-Value (DH-CE Hospital Complications Compared to National Complication Average)
Peripheral Vascular Bypass	2005	23,392	.98		1.07				.326
	2006	20,485	.96		.99				.177
	2007	17,844	.85		1.05				.002
	2005-2007	61,721	.94	13.01%	1.04	1.15%	9.75%	403	.009
Prostatectomy	2005	59,906	.92		1.04				.012
	2006	56,522	.89		1.05				<.001
	2007	53,656	.80		.97				<.001
	2005-2007	170,084	.87	13.08%	1.02	6.88%	14.14%	1,069	<.001
Total Hip Replacement	2005	75,502	.89		1.02				<.001
	2006	72,168	.88		1.01				<.001
	2007	71,873	.92		1.04				<.001
	2005-2007	219,543	.90	-3.26%	1.02	-2.10%	12.54%	1,532	<.001
Total Knee Replacement	2005	181,310	.98		1.05				.075
	2006	181,029	.95		1.01				.001
	2007	177,318	.93		1.01				<.001
	2005-2007	539,657	.95	4.79%	1.02	3.28%	6.99%	1,980	<.001
<b>Totals</b>		<b>2,114,255</b>						<b>11,772</b>	
<b>3-Year Performance Average</b>			<b>0.94</b>	<b>3.92%</b>	<b>1.02</b>	<b>2.51%</b>	<b>7.95%</b>		

<sup>1</sup> Percent improvement determines improvement over time (2005 to 2007) for aggregate DH-CE hospitals. Calculated as follows: (O/E for 2005 – O/E for 2007) / (O/E for 2005) where the O/E is for the DH-CE hospitals.

<sup>2</sup> Percent improvement determines improvement over time (2005 to 2007) for aggregate Non-DH-CE hospitals. Calculated as follows: (O/E for 2005 – O/E for 2007) / (O/E for 2005) where the O/E is for the Non-DH-CE hospitals.

<sup>3</sup> Relative Risk Reduction determines the difference in performance between DH-CE and All Other hospitals. Calculated as follows: (Non-DH-CE O/E – DH-CE O/E) / Non-DH-CE O/E.

<sup>4</sup> Complications avoided were calculated: All Other hospitals' 3-year actual number of complications – (All Other hospitals' 3-year expected number of complications x DH-CE O/E ratio).



## Exhibit D: Hospital Report Card™ Mortality and Complication Based Outcomes 2009 Methodology

### Introduction

To help consumers evaluate and compare hospital performance, HealthGrades analyzed patient outcome data for virtually every hospital in the country. HealthGrades uses the following data source:

- Medicare inpatient data from the MedPAR database (purchased from the Centers for Medicare and Medicaid Services) for fiscal years 2005 through 2007.

Ratings were based upon HealthGrades' risk-adjustment methodology described below. The purpose of risk adjustment is to obtain fair statistical comparisons among disparate populations or groups. Significant differences in demographic and clinical risk factors are found among patients treated in different hospitals. Risk adjustment of the data is needed to make accurate and valid comparisons of clinical outcomes at different hospitals.

### Data Acquisition

The MedPAR data was selected for several reasons.

- First, it includes virtually every hospital in the country, with the exception of military and Veterans Administration hospitals.
- Second, hospitals are required by law to submit complete and accurate information with substantial penalties for those that report inaccurate or incomplete data.
- Third, the Medicare population represents a majority of the patients for virtually all of the clinical categories studied. For example, Medicare patients account for approximately 55 – 60 percent of all cardiac patients.

For Multivariate Logistic Regression-Based Ratings (see below), HealthGrades conducted a series of data quality checks to preserve the integrity of the ratings. Based on the results of these checks, we excluded a limited number of cases because they were inappropriate for inclusion in the database or miscoded.

Examples of excluded patient records were:

- Patients under the age of 65
- Patients who left the hospital against medical advice or who were transferred to another acute care hospital
- Patients discharged alive with a length of stay that is inconsistent with the reason for admission. (For example, a patient discharged alive with a one-day length of stay for valve replacement surgery would be excluded because this procedure requires several days for recovery.)
- Patients who were still in the hospital when the Medicare claim was filed
- Patients with an invalid gender

### Methodology for Ratings

HealthGrades' Multivariate Logistic Regression-Based Ratings methodology takes into account patient characteristics such as age, gender, and underlying medical conditions that could increase the patient's risk of mortality or complication.

## Multivariate Logistic Regression-Based Ratings

The in-hospital data for 26 procedures and diagnoses on the HealthGrades Web site represent three years of patient discharges from 2005 to 2007.

In the initial analysis of the data, a separate data set was created for each group of patients having a specific procedure or diagnosis based on ICD-9-CM coding (e.g., coronary bypass surgery, total hip replacement). Each group of patients was defined by using the information on diagnoses and procedures coded in the patient records. See *Appendix A* for a list of the diagnosis and procedure codes that define each patient cohort. The quality measure for some cohorts was mortality, whereas for other cohorts the quality measure was major complications.

For each patient cohort, we developed a list of specific procedures and diagnosis that define the cohort, a list of risk factors (see *Appendix C*), and a list of post-surgical complications. These latter two lists were developed in the following manner:

- 1 Potential risk factors were identified as all diagnoses occurring in more than 0.5 percent of the patient population, demographic characteristics, and clinically relevant procedures.
- 2 Post-surgical complications were identified using a team of clinical and coding experts.

In some cases an ICD-9 code can be either a risk or a complication. In these cases, a code is differentiated by the presence of a 900 post-operative complication code. For example in the case where a patient record contains 427.31 Atrial Fibrillation, that code is considered a risk if it occurs by itself and a complication if there is a corresponding 997.1 Cardiac Complications, NEC code also present in the patient record.

Some diagnosis codes were merged together (e.g., primary and secondary pulmonary hypertension) to minimize the impact of coding variations.

Outcomes were binary, with documented major/minor complications either present or not, and patients recorded as either alive or expired. In cohorts where the quality measure is major complications, mortality is considered a complication. See *Appendix B* for a list of complications included in the quality measure "Major Complications."

## Risk-Adjustment Methodology

Fair and valid comparisons between hospital providers can be made only to the extent that the risk-adjustment methodology considers important differences in patient demographic and clinical characteristics. The risk-adjustment methodology used by HealthGrades defines risk factors as those clinical and demographic variables that influence patient outcomes in significant and systematic ways. Risk factors may include age, gender, specific procedure performed, and comorbid conditions such as hypertension, chronic renal failure, heart failure, and diabetes. The methodology is disease-specific and outcome-specific. This means that individual risk models are constructed and tailored for each clinical condition or procedure, and also for each outcome.

Developing the HealthGrades ratings involved four steps for each cohort (e.g., coronary bypass surgery) and quality measure (e.g., in-hospital mortality or complications).

- 1 First, the predicted value (predicted number of deaths or complications at each hospital) was obtained using logistic regression models discussed in the next section *Statistical Models*.

- 2 Second, the predicted value was compared with the actual, or observed, value (actual number of deaths or complications at each hospital). Only hospitals with at least 30 cases across three years of data and at least five cases in the most current year were included.
- 3 Third, a test was conducted to determine whether the difference between the predicted and actual values was statistically significant. This test was performed to make sure that differences were unlikely to be caused by chance alone.
- 4 Fourth, a star rating was assigned based upon the outcome of the statistical test.

### Statistical Models

Unique statistical models were developed for each patient cohort and each outcome using logistic regression.

Comorbid diagnoses (e.g., hypertension, chronic renal failure, anemia, diabetes), demographic characteristics (e.g., age and gender), and specific procedures (where clinically relevant) were classified as potential risk factors. We used logistic regression to determine which of these were actually risk factors and to what extent they correlated with the quality measure (e.g., mortality). All risk factors that remained in the final model had to be highly significant ( $p < 0.05$ ) in predicting the outcome (mortality, in-hospital complications). In addition, risk factors are required to have an odds ratio greater than 1.0. There were occasional exceptions to this rule; for example, risk factors that have been documented in the medical literature to be protective and risk factors that are part of the cohort definition remain in the model even if the odds ratio was less than one (e.g., Streptococcal pneumoniae pneumonia is one type of pneumonia that makes up the Pneumonia cohort).

Complications were not counted as risk factors as they were considered a result of care received during the admission. See *Appendix C* for a list of the top five risk factors for each procedure or diagnosis.

The statistical models were checked for validity and finalized. All of the models were highly significant, with C-statistics ranging from ~ 0.6 to ~ 0.9. These cohort and outcome-specific models were then used to estimate the probability of the outcome for each patient in the cohort. Patients were then aggregated for each hospital to obtain the predicted outcome for each hospital.

Statistical significance tests were performed for each patient cohort to identify, by hospital, whether the actual and predicted rates were significantly different. We used a standardized score (z-score) to establish an approximate 90% confidence interval.

### Assignment of Star Ratings

The following rating system was applied to the data for all procedures and diagnoses:

- ★★★★★ Actual performance was better than predicted and the difference was statistically significant.
- ★★★ Actual performance was not significantly different from what was predicted.
- ★ Actual performance was worse than predicted and the difference was statistically significant.

In general, 70 percent to 80 percent of hospitals in each procedure/diagnosis are classified as three stars, with actual results statistically the same as predicted results. Approximately 10 percent to 15 percent were one-star hospitals and 10 percent to 15 percent were five-star hospitals.

### Limitations of the Data Models

It must be understood that while these models may be valuable in identifying hospitals that perform better than others, one should not use this information alone to determine the quality of care provided at each hospital. The models are limited by the following factors:

- Cases may have been coded incorrectly or incompletely by the hospital.
- The models can only account for risk factors that are coded into the billing data—if a particular risk factor was not coded into the billing data, such as a patient's socioeconomic status and health behavior, then it was not accounted for with these models.
- Although Health Grades, Inc. has taken steps to carefully compile these data using its methodology, no techniques are infallible, and therefore some information may be missing, outdated or incorrect.

Please note that a high ranking for a particular hospital is not a recommendation or endorsement by Health Grades, Inc. of a particular hospital; it means that the data associated with a particular hospital has met the foregoing qualifications. Only individual patients can decide whether a particular hospital is suited for their unique needs.

Also note that if more than one hospital reported to CMS under a single provider ID, HealthGrades analyzed patient outcome data for those hospitals as a single unit. (Throughout this document, therefore, "hospital" refers to one hospital or a group of hospitals reporting under a single provider ID.)

**Appendix A: Patient Cohorts and Related ICD-9-CM Codes**

Patient Cohort	ICD-9-CM Procedure/Diagnosis Codes and Criteria
<b>Back and Neck Surgery (Spinal Fusion)</b>	<b>Inclusions</b> Principal Procedure: 81.00, 81.01, 81.02, 81.03, 81.04, 81.05, 81.06, 81.07, 81.08, 81.61, 81.62, 81.63, 81.64 <b>Exclusions</b> Procedures (Primary or Secondary): 03.02, 37.51, 37.52, 37.53, 37.54, 37.5, 78.69, 81.3, 81.30, 81.31, 81.32, 81.33, 81.34, 81.35, 81.36, 81.37, 81.38, 81.39, 81.65, 81.66, 84.58, 84.59, 84.60, 84.61, 84.62, 84.63, 84.64, 84.65, 84.66, 84.67, 84.68, 84.69 Principal Diagnoses: 996.4, 996.40, 996.41, 996.42, 996.43, 996.44, 996.47, 996.49, 996.78 Diagnoses (Primary or Secondary): 198.5, 722.80, 722.81, 722.82, 722.83, 996.45, 996.46, V42.0, V42.1, V42.4, V42.6, V42.7, V42.81, V42.82, V42.83, V42.84, V42.89, V42.9, V45.4
<b>Back and Neck Surgery (except Spinal Fusion)</b>	<b>Inclusions</b> Principal Procedure: 03.09, 03.53, 80.50, 80.51, 80.59, 84.59, 84.60, 84.61, 84.62, 84.63, 84.64, 84.65 <b>Exclusions</b> Procedures (Primary or Secondary): 03.02, 37.5, 37.51, 37.52, 37.53, 37.54, 78.49, 78.69, 81.00, 81.01, 81.02, 81.03, 81.04, 81.05, 81.06, 81.07, 81.08, 81.09, 81.3, 81.30, 81.31, 81.32, 81.33, 81.34, 81.35, 81.36, 81.37, 81.38, 81.39, 81.61, 81.62, 81.63, 81.64, 81.65, 81.66, 84.66, 84.67, 84.68, 84.69 Principal Diagnoses: 996.4, 996.40, 996.41, 996.42, 996.43, 996.44, 996.47, 996.49, 996.78 Diagnoses (Primary or Secondary): 198.5, 722.80, 722.81, 722.82, 722.83, 996.45, 996.46, V42.0, V42.1, V42.4, V45.4, V42.6, V42.7, V42.81, V42.82, V42.83, V42.84, V42.89, V42.9, V54.0, V54.01, V54.09
<b>Bowel Obstruction</b>	<b>Inclusions</b> Principal Diagnosis: 532.01, 532.11, 532.21, 532.31, 532.41, 532.51, 532.61, 532.71, 532.91, 534.01, 534.11, 534.21, 534.31, 534.41, 534.51, 534.61, 534.71, 534.91, 537.2, 537.3, 550.10, 550.11, 550.12, 550.13, 552.00, 552.01, 552.02, 552.03, 552.1, 552.20, 552.21, 552.29, 552.8, 552.9, 560.0, 560.1, 560.2, 560.31, 560.39, 560.81, 560.89, 560.9, 936, 937 <b>Exclusions</b> Procedures (Primary or Secondary): 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63 Diagnoses (Primary or Secondary): 196.0, 196.1, 196.2, 196.3, 196.5, 196.6, 196.8, 196.9, 197.0, 197.1, 197.2, 197.3, 197.4, 197.5, 197.6, 197.7, 197.8, 198.0, 198.1, 198.2, 198.3, 198.4, 198.5, 198.6, 198.7, 198.8, 198.81, 198.82, 198.89, V42.0, V42.1, V42.4, V42.6, V42.7, V42.81, V42.82, V42.83, V42.84, V42.89, V42.9, V66.7
<b>Carotid Surgery</b>	<b>Inclusions</b> Principal Procedure: 00.61, 00.63, 38.12, 39.72, 39.74 <b>Exclusions</b> Procedures (Primary or Secondary): 36.1, 36.10, 36.11, 36.12, 36.13, 36.14, 36.15, 36.16, 36.17, 36.19, 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63, 38.08, 38.16, 38.18, 38.36, 39.24, 39.25, 39.29, 39.59, 39.90 Diagnoses (Primary or Secondary): 430, V42.0, V42.1, V42.4, V42.6, V42.7, V42.81, V42.82, V42.83, V42.84, V42.89, V42.9
<b>Cholecystectomy</b>	<b>Inclusions</b> Principal Procedure: 51.21, 51.22, 51.23, 51.24 <b>Exclusions</b> Procedures (Primary or Secondary): 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63 Diagnoses (Primary or Secondary): V42.0, V42.1, V42.4, V42.6, V42.7, V42.81, V42.82, V42.83, V42.84, V42.89, V42.9, V66.7
<b>Chronic Obstructive Pulmonary Disease (COPD)</b>	<b>Inclusions</b> Principal Diagnosis: 491.1, 491.20, 491.21, 491.22, 491.8, 491.9, 492.8, 493.20, 493.21, 493.22, 494, 494.0, 494.1, 496 <b>Exclusions</b> Procedures (Primary or Secondary): 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63 Diagnoses (Primary or Secondary): 196.0, 196.1, 196.2, 196.3, 196.5, 196.6, 196.8, 196.9, 197.0, 197.1, 197.2, 197.3, 197.4, 197.5, 197.6, 197.7, 197.8, 198.0, 198.1, 198.2, 198.3, 198.4, 198.5, 198.6, 198.7, 198.8, 198.81, 198.82, 198.89, 480.3, 480.8, V42.0, V42.1, V42.4, V42.6, V42.7, V42.81, V42.82, V42.83, V42.84, V42.89, V42.9, V66.7
<b>Coronary Bypass Surgery</b>	<b>Inclusions</b> Principal Procedure: 36.10, 36.11, 36.12, 36.13, 36.14, 36.15, 36.16, 36.19 <b>Exclusions</b> Procedures (Primary or Secondary): 35.1, 35.10, 35.11, 35.12, 35.13, 35.14, 35.2, 35.20, 35.21, 35.22, 35.23, 35.24, 35.25, 35.26, 35.27, 35.28, 35.55, 36.33, 36.34, 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63, 38.12, 38.34, 38.44, 38.64, 39.71, 44.12 Diagnoses (Primary or Secondary): 414.06, 414.07, 441.00, 441.01, 441.02, 441.03, V42.0, V42.1, V42.4, V42.6, V42.7, V42.81, V42.82, V42.83, V42.84, V42.89, V42.9

Coronary Interventional Procedures	Inclusions
	Principal Procedure: 00.66, 36.01, 36.02, 36.05, 36.06, 36.07, 36.09
	<b>Exclusions</b>
	Procedures (Primary or Secondary): 35.1, 35.10, 35.11, 35.12, 35.13, 35.14, 35.2, 35.20, 35.21, 35.22, 35.23, 35.24, 35.25, 35.26, 35.27, 35.28, 36.10, 36.11, 36.12, 36.13, 36.14, 36.15, 36.16, 36.19, 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63 Diagnoses (Primary or Secondary): 414.06, 414.07, V42.0, V42.1, V42.4, V42.6, V42.7, V42.81, V42.82, V42.83, V42.84, V42.89, V42.9
Diabetic Acidosis and Coma	Inclusions
	Principal Diagnosis: 250.10, 250.11, 250.12, 250.13, 250.20, 250.21, 250.22, 250.23, 250.30, 250.31, 250.32, 250.33, 250.80, 250.81, 250.82, 250.83
	<b>Exclusions</b>
	Procedures (Primary or Secondary): 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63 Diagnoses (Primary or Secondary): 196.0, 196.1, 196.2, 196.3, 196.5, 196.6, 196.8, 196.9, 197.0, 197.1, 197.2, 197.3, 197.4, 197.5, 197.6, 197.7, 197.8, 198.0, 198.1, 198.2, 198.3, 198.4, 198.5, 198.6, 198.7, 198.8, 198.81, 198.82, 198.89, V42.0, V42.1, V42.4, V42.6, V42.7, V42.81, V42.82, V42.83, V42.84, V42.89, V42.9, V66.7
Gastrointestinal Bleed	Inclusions
	Principal Diagnosis: 456.0, 456.20, 530.2, 530.21, 530.7, 530.82, 531.00, 531.01, 531.20, 531.21, 531.40, 531.41, 531.60, 531.61, 532.00, 532.01, 532.20, 532.21, 532.40, 532.41, 532.60, 532.61, 533.00, 533.01, 533.20, 533.21, 533.40, 533.41, 533.60, 533.61, 534.0, 534.00, 534.01, 534.20, 534.21, 534.40, 534.41, 534.60, 534.61, 535.01, 535.11, 535.21, 535.31, 535.41, 535.51, 535.61, 537.83, 537.84, 562.02, 562.03, 562.12, 562.13, 569.3, 569.82, 569.85, 569.86, 578, 578.0, 578.1, 578.9
	<b>Exclusions</b>
	Procedures (Primary or Secondary): 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63 Diagnoses (Primary or Secondary): 196.0, 196.1, 196.2, 196.3, 196.5, 196.6, 196.8, 196.9, 197.0, 197.1, 197.2, 197.3, 197.4, 197.5, 197.6, 197.7, 197.8, 198.0, 198.1, 198.2, 198.3, 198.4, 198.5, 198.6, 198.7, 198.8, 198.81, 198.82, 198.89, V42.0, V42.1, V42.4, V42.6, V42.7, V42.81, V42.82, V42.83, V42.84, V42.89, V42.9, V66.7
Gastrointestinal Surgeries and Procedures	Inclusions
	Principal Procedure: 43.5, 43.6, 43.7, 43.81, 43.89, 43.91, 43.99, 44.00, 44.01, 44.02, 44.03, 44.40, 44.41, 44.42, 44.63, 44.64, 44.65, 44.66, 44.69, 45.61, 45.62, 45.63, 45.71, 45.72, 45.73, 45.74, 45.75, 45.76, 45.79, 45.8, 45.90, 45.91, 45.92, 45.93, 45.94, 45.95
	<b>Exclusions</b>
	Diagnoses (Primary or Secondary): 151.0, 151.1, 151.2, 151.3, 151.4, 151.5, 151.6, 151.8, 151.9, 152.0, 152.1, 152.2, 152.3, 152.8, 152.9, 153.0, 153.1, 153.2, 153.3, 153.4, 153.5, 153.6, 153.7, 153.8, 153.9, 154.0, 154.1, 154.2, 154.3, 154.8, 155.0, 155.1, 155.2, 156.0, 156.1, 156.2, 156.8, 156.9, 157.0, 157.1, 157.2, 157.3, 157.4, 157.8, 157.9, 158.0, 158.8, 158.9, 159.0, 159.1, 159.8, 159.9, 196.0, 196.1, 196.2, 196.3, 196.5, 196.6, 196.8, 196.9, 197.0, 197.1, 197.2, 197.3, 197.4, 197.5, 197.6, 197.7, 197.8, 198.0, 198.1, 198.2, 198.3, 198.4, 198.5, 198.6, 198.7, 198.8, 198.81, 198.82, 198.89, V42.0, V42.1, V42.4, V42.6, V42.7, V42.81, V42.82, V42.83, V42.84, V42.89, V42.9
Heart Attack	Inclusions
	Principal Diagnosis: 410.01, 410.11, 410.21, 410.31, 410.41, 410.51, 410.61, 410.71, 410.81, 410.91
	<b>Exclusions</b>
	Procedures (Primary or Secondary): 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63 Diagnoses (Primary or Secondary): 196.0, 196.1, 196.2, 196.3, 196.5, 196.6, 196.8, 196.9, 197.0, 197.1, 197.2, 197.3, 197.4, 197.5, 197.6, 197.7, 197.8, 198.0, 198.1, 198.2, 198.3, 198.4, 198.5, 198.6, 198.7, 198.8, 198.81, 198.82, 198.89, 414.06, 414.07, V42.0, V42.1, V42.4, V42.6, V42.7, V42.81, V42.82, V42.83, V42.84, V42.89, V42.9, V66.7
Heart Failure	Inclusions
	Principal Diagnosis: 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428.2, 428.20, 428.21, 428.22, 428.23, 428.3, 428.30, 428.31, 428.32, 428.33, 428.4, 428.40, 428.41, 428.42, 428.43, 428.9
	<b>Exclusions</b>
	Procedures (Primary or Secondary): 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63, 39.95 Diagnoses (Primary or Secondary): 196.0, 196.1, 196.2, 196.3, 196.5, 196.6, 196.8, 196.9, 197.0, 197.1, 197.2, 197.3, 197.4, 197.5, 197.6, 197.7, 197.8, 198.0, 198.1, 198.2, 198.3, 198.4, 198.5, 198.6, 198.7, 198.8, 198.81, 198.82, 198.89, 414.06, 414.07, V42.0, V42.1, V42.4, V42.6, V42.7, V42.81, V42.82, V42.83, V42.84, V42.89, V42.9, V66.7

<b>Hip Fracture Repair</b>	<b>Inclusions</b>
	Principal Procedure: 79.05, 79.15, 79.25, 79.35, 81.52
	<b>Exclusions</b> Procedures (Primary or Secondary): 00.85, 37.51, 37.52, 37.53, 37.54, 37.5, 78.65, 78.66, 78.67, 80.05, 80.06, 81.51, 81.53, 81.54, 81.55 Principal Diagnoses: 996.4, 996.40, 996.41, 996.42, 996.43, 996.44, 996.47, 996.49, 996.78 Diagnoses (Primary or Secondary): 800.6, 820.9, 820.10, 820.11, 820.12, 820.13, 820.19, 820.20, 820.30, 820.31, 820.32, 821.00, 821.01, 821.10, 821.11, 821.20, 821.21, 821.22, 821.23, 821.29, 821.30, 821.31, 821.32, 821.33, 821.39, 996.45, 996.46, V42.0, V42.1, V42.4, V42.6, V42.7, V42.81, V42.82, V42.83, V42.84, V42.89, V42.9, V66.7 Diagnoses (Secondary when occurs with V1588, V424, V4364, V4365, V454, V5401, V5402, V5409): 996.4, 996.40, 996.41, 996.42, 996.43, 996.44, 996.47, 996.49
<b>Pancreatitis</b>	<b>Inclusions</b>
	Principal Diagnosis: 577.0, 577.1
	<b>Exclusions</b> Procedures (Primary or Secondary): 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63 Diagnoses (Primary or Secondary): 196.0, 196.1, 196.2, 196.3, 196.5, 196.6, 196.8, 196.9, 197.0, 197.1, 197.2, 197.3, 197.4, 197.5, 197.6, 197.7, 197.8, 198.0, 198.1, 198.2, 198.3, 198.4, 198.5, 198.6, 198.7, 198.8, 198.81, 198.82, 198.89, V42.0, V42.1, V42.4, V42.6, V42.7, V42.81, V42.82, V42.83, V42.84, V42.89, V42.9, V66.7
<b>Peripheral Vascular Bypass</b>	<b>Inclusions</b>
	Principal Procedure: 39.29 Principal Diagnosis: 250.60, 250.61, 250.62, 250.63, 250.70, 250.71, 250.72, 250.73, 250.80, 250.81, 250.82, 250.83, 440.20, 440.21, 440.22, 440.23, 440.24, 440.29, 440.30, 440.32, 442.2, 442.3, 443.89, 443.9, 444.22, 444.81, 445.02, 447.1, 681.10, 682.6, 682.7, 686.8, 707.10, 707.12, 707.13, 707.14, 707.15, 707.19, 707.8, 730.06, 730.07, 730.16, 730.17, 730.18, 730.26, 730.27, 785.4, 902.53, 904.41
	<b>Exclusions</b> Procedures (Primary or Secondary): 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63, 39.25, 39.49 Principal Diagnoses: 445.01, 996.74 Diagnoses (Primary or Secondary): 440.31, V42.0, V42.1, V42.4, V42.6, V42.7, V42.81, V42.82, V42.83, V42.84, V42.89, V42.9
<b>Pneumonia</b>	<b>Inclusions</b>
	Principal Diagnosis: 481, 482.0, 482.1, 482.2, 482.30, 482.31, 482.32, 482.39, 482.40, 482.41, 482.49, 482.81, 482.82, 482.83, 482.84, 482.89, 482.9, 483.0, 483.1, 483.8, 485, 486, 487.0
	<b>Exclusions</b> Procedures (Primary or Secondary): 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63 Diagnoses (Primary or Secondary): 196.0, 196.1, 196.2, 196.3, 196.5, 196.6, 196.8, 196.9, 197.0, 197.1, 197.2, 197.3, 197.4, 197.5, 197.6, 197.7, 197.8, 198.0, 198.1, 198.2, 198.3, 198.4, 198.5, 198.6, 198.7, 198.8, 198.81, 198.82, 198.89, 480.3, V42.0, V42.1, V42.4, V42.6, V42.7, V42.81, V42.82, V42.83, V42.84, V42.89, V42.9, V66.7
<b>Prostatectomy</b>	<b>Inclusions</b>
	Principal Procedure: 60.21, 60.29, 60.3, 60.4, 60.5, 60.61, 60.62, 60.69
	<b>Exclusions</b> Procedures (Primary or Secondary): 37.51, 37.52, 37.53, 37.54, 37.62, 37.63, 37.5, V42.0, V42.1, V42.4, V42.6, V42.7, V42.81, V42.82, V42.83, V42.84, V42.89, V42.9
<b>Pulmonary Embolism</b>	<b>Inclusions</b>
	Principal Diagnosis: 415.11, 415.19
	<b>Exclusions</b> Procedures (Primary or Secondary): 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63 Diagnoses (Primary or Secondary): 196.0, 196.1, 196.2, 196.3, 196.5, 196.6, 196.8, 196.9, 197.0, 197.1, 197.2, 197.3, 197.4, 197.5, 197.6, 197.7, 197.8, 198.0, 198.1, 198.2, 198.3, 198.4, 198.5, 198.6, 198.7, 198.8, 198.81, 198.82, 198.89, V42.0, V42.1, V42.4, V42.6, V42.7, V42.81, V42.82, V42.83, V42.84, V42.89, V42.9, V66.7
<b>Resection / Replacement of Abdominal Aorta</b>	<b>Inclusions</b>
	Principal Procedure: 38.34, 38.44, 38.64, 39.71
	<b>Exclusions</b> Procedures (Primary or Secondary): 00.61, 35.10, 35.11, 35.12, 35.13, 35.14, 35.20, 35.21, 35.22, 35.23, 35.24, 35.25, 35.26, 35.27, 35.28, 36.1, 36.10, 36.11, 36.12, 36.13, 36.14, 36.15, 36.16, 36.17, 36.19, 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63, 38.08, 38.16, 38.18, 38.36, 38.45, 39.24, 39.25, 39.29, 39.50, 39.59 Procedures (Secondary only): 38.34, 38.44, 38.64, 39.71 Diagnoses (Primary or Secondary): 441.00, 441.01, 441.02, 441.03, 441.1, 441.2, 441.6, 441.7, 441.9, V42.0, V42.1, V42.4, V42.6, V42.7, V42.81, V42.82, V42.83, V42.84, V42.89, V42.9

<b>Respiratory Failure</b>	<b>Inclusions</b> Principal Diagnosis: 518.81, 518.84
	<b>Exclusions</b> Diagnoses (Primary or Secondary): 196.0, 196.1, 196.2, 196.3, 196.5, 196.6, 196.8, 196.9, 197.0, 197.1, 197.2, 197.3, 197.4, 197.5, 197.6, 197.7, 197.8, 198.0, 198.1, 198.2, 198.3, 198.4, 198.5, 198.6, 198.7, 198.8, 198.81, 198.82, 198.89, V42.0, V42.1, V42.4, V42.6, V42.7, V42.81, V42.82, V42.83, V42.84, V42.89, V42.9, V66.7
<b>Sepsis</b>	<b>Inclusions</b> Principal Diagnosis: 003.1, 027.0, 036.2, 036.3, 038.0, 038.10, 038.11, 038.19, 038.2, 038.3, 038.40, 038.41, 038.42, 038.43, 038.44, 038.49, 038.8, 038.9, 054.5, 785.52, 785.59
	<b>Exclusions</b> Procedures (Primary or Secondary): 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63 Diagnoses (Primary or Secondary): 196.0, 196.1, 196.2, 196.3, 196.5, 196.6, 196.8, 196.9, 197.0, 197.1, 197.2, 197.3, 197.4, 197.5, 197.6, 197.7, 197.8, 198.0, 198.1, 198.2, 198.3, 198.4, 198.5, 198.6, 198.7, 198.8, 198.81, 198.82, 198.89, V42.0, V42.1, V42.4, V42.6, V42.7, V42.81, V42.82, V42.83, V42.84, V42.89, V42.9, V66.7
<b>Stroke</b>	<b>Inclusions</b> Principal Diagnosis: 430, 431, 432.9, 433.01, 433.11, 433.21, 433.31, 433.81, 433.91, 434.01, 434.11, 434.91, 436
	<b>Exclusions</b> Procedures (Primary or Secondary): 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63 Diagnoses (Primary or Secondary): 196.0, 196.1, 196.2, 196.3, 196.5, 196.6, 196.8, 196.9, 197.0, 197.1, 197.2, 197.3, 197.4, 197.5, 197.6, 197.7, 197.8, 198.0, 198.1, 198.2, 198.3, 198.4, 198.5, 198.6, 198.7, 198.8, 198.81, 198.82, 198.89, V42.0, V42.1, V42.4, V42.6, V42.7, V42.81, V42.82, V42.83, V42.84, V42.89, V42.9, V66.7
<b>Total Hip Replacement</b>	<b>Inclusions</b> Principal Procedure: 00.85, 00.86, 00.87, 81.51
	<b>Exclusions</b> Procedures (Primary or Secondary): 00.70, 00.71, 00.72, 00.73, 00.80, 00.81, 00.82, 00.83, 00.84, 00.85, 00.86, 00.87, 37.5, 37.51, 37.52, 37.53, 37.54, 78.65, 78.67, 80.05, 80.06, 81.53, 81.54, 81.55 Diagnoses (Primary only): 820.09, 820.8, 996.4, 996.40, 996.41, 996.42, 996.43, 996.44, 996.45, 996.46, 996.47, 996.49, 996.78 Diagnoses (Primary or Secondary): E800, E800.0, E800.1, E800.2, E800.3, E800.8, E800.9, E801, E801.0, E801.1, E801.2, E801.3, E801.8, E801.9, E802, E802.0, E802.1, E802.2, E802.3, E802.8, E802.9, E803, E803.0, E803.1, E803.2, E803.3, E803.8, E803.9, E804, E804.0, E804.1, E804.2, E804.3, E804.8, E804.9, E805, E805.0, E805.1, E805.2, E805.3, E805.8, E805.9, E806, E806.0, E806.1, E806.2, E806.3, E806.8, E806.9, E807, E807.0, E807.1, E807.2, E807.3, E807.8, E807.9, E810, E810.0, E810.1, E810.2, E810.3, E810.4, E810.5, E810.6, E810.7, E810.8, E810.9, E811, E811.0, E811.1, E811.2, E811.3, E811.4, E811.5, E811.6, E811.7, E811.8, E811.9, E812, E812.0, E812.1, E812.2, E812.3, E812.4, E812.5, E812.6, E812.7, E812.8, E812.9, E813, E813.0, E813.1, E813.2, E813.3, E813.4, E813.5, E813.6, E813.7, E813.8, E813.9, E814, E814.0, E814.1, E814.2, E814.3, E814.4, E814.5, E814.6, E814.7, E814.8, E814.9, E815, E815.0, E815.1, E815.2, E815.3, E815.4, E815.5, E815.6, E815.7, E815.8, E815.9, E816, E816.0, E816.1, E816.2, E816.3, E816.4, E816.5, E816.6, E816.7, E816.8, E816.9, E817, E817.0, E817.1, E817.2, E817.3, E817.4, E817.5, E817.6, E817.7, E817.8, E817.9, E818, E818.0, E818.1, E818.2, E818.3, E818.4, E818.5, E818.6, E818.7, E818.8, E818.9, E819, E819.0, E819.1, E819.2, E819.3, E819.4, E819.5, E819.6, E819.7, E819.8, E819.9, E820, E820.0, E820.1, E820.2, E820.3, E820.4, E820.5, E820.6, E820.7, E820.8, E820.9, E821, E821.0, E821.1, E821.2, E821.3, E821.4, E821.5, E821.6, E821.7, E821.8, E821.9, E822, E822.0, E822.1, E822.2, E822.3, E822.4, E822.5, E822.6, E822.7, E822.8, E822.9, E823, E823.0, E823.1, E823.2, E823.3, E823.4, E823.5, E823.6, E823.7, E823.8, E823.9, E824, E824.0, E824.1, E824.2, E824.3, E824.4, E824.5, E824.6, E824.7, E824.8, E824.9, E825, E825.0, E825.1, E825.2, E825.3, E825.4, E825.5, E825.6, E825.7, E825.8, E825.9, E826, E826.0, E826.1, E826.2, E826.3, E826.4, E826.8, E826.9, E827, E827.0, E827.2, E827.3, E827.4, E827.8, E827.9, E828, E828.0, E828.2, E828.4, E828.8, E828.9, E829, E829.0, E829.4, E829.8, E829.9, E830, E830.0, E830.1, E830.2, E830.3, E830.4, E830.5, E830.6, E830.8, E830.9, E831, E831.0, E831.1, E831.2, E831.3, E831.4, E831.5, E831.6, E831.8, E831.9, E832, E832.0, E832.1, E832.2, E832.3, E832.4, E832.5, E832.6, E832.8, E832.9, E833, E833.0, E833.1, E833.2, E833.3, E833.4, E833.5, E833.6, E833.8, E833.9, E834, E834.0, E834.1, E834.2, E834.3, E834.4, E834.5, E834.6, E834.8, E834.9, E835, E835.0, E835.1, E835.2, E835.3, E835.4, E835.5, E835.6, E835.8, E835.9, E836, E836.0, E836.1, E836.2, E836.3, E836.4, E836.5, E836.6, E836.8, E836.9, E837, E837.0, E837.1, E837.2, E837.3, E837.4, E837.5, E837.6, E837.8, E837.9, E838, E838.0, E838.1, E838.2, E838.3, E838.4, E838.5, E838.6, E838.8, E838.9, E840, E840.0, E840.1, E840.2, E840.3, E840.4, E840.5, E840.6, E840.7, E840.8, E840.9, E841, E841.0, E841.1, E841.2, E841.3, E841.4, E841.5, E841.6, E841.7, E841.8, E841.9, E842, E842.6, E842.7, E842.8, E842.9, E843, E843.0, E843.1, E843.2, E843.3, E843.4, E843.5, E843.6, E843.7, E843.8, E843.9, E844, E844.0, E844.1, E844.2, E844.3, E844.4, E844.5, E844.6, E844.7, E844.8, E844.9, E845, E845.0, E845.8, E845.9, E846, E847, E848, E849, E849.0, E849.1, E849.2, E849.3, E849.4, E849.5, E849.6, E849.7, E849.8, E849.9, E880, E880.0, E880.1, E880.9, E881, E881.0, E881.1, E882, E883, E883.0, E883.1, E883.2, E883.9, E884,



Exhibit D: Hospital Report Cards™ Mortality and Complication Based Outcomes Methodology

	E884.0, E884.1, E884.2, E884.3, E884.4, E884.5, E884.6, E884.9, E885, E885.0, E885.1, E885.2, E885.3, E885.4, E885.9, E886, E886.0, E886.9, E887, E888, E888.0, E888.1, E888.8, E888.9, E890.0, E890.8, E891.0, E891.8, E916, E917.0, E917.1, E917.2, E917.3, E917.4, E917.5, E917.6, E917.7, E917.8, E917.9, E918, E919.0, E919.1, E919.2, E919.3, E919.4, E919.5, E919.6, E919.7, E919.8, E919.9, E920, E920.0, E920.1, E920.2, E920.3, E920.4, E920.5, E920.8, E920.9, E921, E921.0, E921.1, E921.8, E921.9, E922, E922.0, E922.1, E922.2, E922.3, E922.4, E922.5, E922.8, E922.9, E923, E923.0, E923.1, E923.2, E923.8, E923.9, E928.8, E928.9, E929, E929.0, E929.1, E929.2, E929.3, E929.4, E929.5, E929.8, E929.9, E955.0, E955.1, E955.2, E955.3, E955.4, E955.5, E955.6, E955.7, E955.9, E956, E957.0, E957.1, E957.2, E957.9, E958.0, E958.5, E958.6, E960.0, E965.0, E965.1, E965.2, E965.3, E965.4, E965.5, E965.6, E965.7, E965.8, E965.9, E966, E968.1, E968.2, E968.5, E968.6, E969, E970, E971, E973, E974, E977, E985, E985.0, E985.1, E985.2, E985.3, E985.4, E985.5, E985.6, E985.7, E986, E987, E987.0, E987.1, E987.2, E987.9, E988, E988.0, E988.5, E988.6, E989, V15.5, V42.0, V42.1, V42.4, V42.6, V42.7, V42.81, V42.82, V42.83, V42.84, V42.89, V42.9, V58.43, V58.49
<b>Total Knee Replacement</b>	<b>Inclusions</b>
	Principal Procedure: 81.54
	<b>Exclusions</b>
	Procedures (Primary or Secondary): 00.74, 00.75, 00.76, 00.80, 00.81, 00.82, 00.83, 00.84, 37.5, 37.51, 37.52, 37.53, 37.54, 78.65, 78.67, 80.05, 80.06, 81.51, 81.52, 81.53, 81.55 Principal Diagnoses: 996.4, 996.40, 996.41, 996.42, 996.43, 996.44, 996.47, 996.49, 996.78 Diagnoses (Primary or Secondary): 996.45, 996.46, V42.0, V42.1, V42.4, V42.6, V42.7, V42.81, V42.82, V42.83, V42.84, V42.89, V42.9
<b>Valve Replacement Surgery</b>	<b>Inclusions</b>
	Procedures (Primary or Secondary): 35.20, 35.21, 35.22, 35.23, 35.24, 35.25, 35.26, 35.27, 35.28
	<b>Exclusions</b>
	Procedures (Primary or Secondary): 35.1, 35.33, 35.55, 36.33, 36.34, 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63, 38.12, 38.34, 38.44, 38.64, 39.71, 44.12 Diagnoses (Primary or Secondary): 414.06, 414.07, 441.00, 441.01, 441.02, 441.03, 441.2, V42.0, V42.1, V42.4, V42.6, V42.7, V42.81, V42.82, V42.83, V42.84, V42.89, V42.9

## Appendix B: Major Complications

### Major Complications – Back and Neck Surgery (Spinal Fusion)

Major Complications – Back and Neck Surgery (Spinal Fusion)	
292.81	DRUG-INDUCED DELIRIUM
293.0	DELIRIUM D/T CCE
410.01	ANTEROLAT AMI-INITIAL
410.11	ANT AMI NEC-INITIAL
410.21	INFEROLAT AMI-INITIAL
410.31	INFEROPOST AMI-INITIAL
410.41	INF AMI NEC-INITIAL
410.51	LAT AMI NEC-INITIAL
410.61	POSTERIOR AMI-INITIAL
410.71	SUBEND INFARCT-INITIAL
410.81	AMI NEC-INITIAL EPISODE
410.91	AMI NOS-INITIAL EPISODE
415.11	IATRO PULM EMBOL/INFARCT
415.19	PULMON EMBOL/INFARCT NEC
480	VIRAL PNEUMONIA
480.0	ADENOVIRAL PNEUMONIA
480.1	RSV PNEUMONIA
480.2	PARINFLUENZA VIRAL PNEUM
480.3	SARS PNEUMONIA
480.8	VIRAL PNEUMONIA NEC
480.9	VIRAL PNEUMONIA NOS
481	PNEUMOCOCCAL PNEUMONIA
482	OTHER BACT PNEUMONIA
482.0	K. PNEUMONIAE PNEUMONIA
482.1	PSEUDOMONAE PNEUMONIA
482.2	H. INFLUENZAE PNEUMONIA
482.3	STREPTOCOCCAL PNEUMONIA
482.4	PNEUMONIA-STAPHYLOCOCCUS
482.30	STREP PNEUMONIA NOS
482.31	GROUP A STREP PNEUMONIA
482.32	GROUP B STREP PNEUMONIA
482.39	STREP PNEUMONIA NEC
482.4	STAPHYLOCOCCAL PNEUMONIA
482.40	STAPH PNEUMONIA NOS
482.41	STAPH AUREUS PNEUMONIA
482.49	STAPH PNEUMONIA NEC
482.8	OTH BACTERIAL PNEUMONIA
482.81	PNEUMONIA D/T ANAEROBES
482.82	E. COLI PNEUMONIA
482.83	GRAM-NEG PNEUMONIA NEC
482.84	LEGIONNAIRES' DISEASE
482.89	BACTERIAL PNEUMONIA NEC
482.9	BACTERIAL PNEUMONIA NOS
483	PNEUMONIA ORGANISM NEC
483.0	M. PNEUMONIAE PNEUMONIA
483.1	CHLAMYDIAL PNEUMONIA
483.8	PNEUMONIA D/T ORG NEC
484	PNEUM IN OTH INF DIS
484.1	PNEUMONIA IN CMV DISEASE
484.3	PNEUMONIA IN WHOOP COUGH
484.5	PNEUMONIA IN ANTHRAX
484.6	PNEUM IN ASPERGILLOSIS
484.7	PNEUM IN SYST MYCOSESNEC
484.8	PNEUM IN INFECT DIS NEC
485	BRONCHOPNEUMONIA ORG NOS
486	PNEUMONIA ORGANISM NOS
507.0	FOOD/VOMIT PNEUMONITIS
511.9	PLEURAL EFFUSION NOS
518.5	POSTTR PULMON INSUFF
518.7	TRALI
518.81	AC RESPIRATORY FAILURE
584.5	AC RF W TUBULAR NEPHR
584.8	ACUTE RENAL FAILURE NEC
584.9	ACUTE RENAL FAILURE NOS
995.91	SEPSIS
995.92	SEVERE SEPSIS
996.4	MECH COMP INT ORTH DEV
996.40	MECH COMP INT ORTH NOS
996.42	DISLOCATION JOINT PROSTH
996.41	MECH LOOSENING JT PROSTH
996.43	PROSTH JOINT FAILURE
996.44	PERI-PROSTHETIC FRACTURE
996.47	MECH COMP JT PROSTH NEC
996.49	MECH COMP INT ORTH NEC
996.77	COMP NEC D/T JT PROSTH
996.78	COMP NEC ORTH DEV NEC
997.02	IATROGEN CV INFARCT/HEM
997.09	NERV SYST SURG COMP NEC
997.1	SURG COMP-HEART
997.3	SURG COMP-RESP NEC
997.4	SURG COMP-DIGESTIVE
997.5	SURG COMP-URINARY NEC
998.0	POSTOPERATIVE SHOCK
998.11	HEMORRHAGE COMP PX
998.2	ACCIDENTAL OP LACERATION
998.3	POSTOP WOUND DISRUPTION
998.31	DISRUPT INTERNAL OP WND
998.32	DISRUPT EXTERNAL OP WND
998.59	POSTOP INFECTION NEC

### Dependent Complications – Back and Neck Surgery (Spinal Fusion)

Must occur with 997.1 Cardiac Complications	
427.0	PSVT
427.1	PVT
427.31	ATRIAL FIBRILLATION
427.32	ATRIAL FLUTTER
427.89	OTH CARDIAC DYSRHYTHMIAS
427.9	CARDIAC DYSRHYTHMIA NOS
428.0	CHF NOS
428.1	LEFT HEART FAILURE
428.2	SYSTOLIC HEART FAILURE
428.20	SYSTOLIC HF NOS
428.21	ACUTE SYSTOLIC HF
428.23	AC & CHR SYSTOLIC HF
428.3	DIASTOLIC HEART FAILURE
428.30	DIASTOLIC HF NOS
428.31	ACUTE DIASTOLIC HF
428.33	AC & CHR DIASTOLIC HF
428.4	SYSTOLIC & DIASTOLIC HF
428.40	SYS & DIASTOLIC HF NOS
428.41	AC SYS & DIASTOLIC HF
428.43	ACCHR SYS & DIASTOLIC HF
428.9	HEART FAILURE NOS

**Dependent Complications – Back and Neck Surgery (Spinal Fusion) (continued)**

Must occur with 997.4 Digestive System Complications			
560.1	PARALYTIC ILEUS		
Must occur with 997.5 Urinary Complications			
593.9	RENAL/URETER DISORD NOS	788.20	RETENTION OF URINE NOS
599.0	URINARY TRACT INF NOS	788.29	RETENTION OF URINE NEC

**Major Complications – Back and Neck Surgery (except Spinal Fusion)**

Major Complications – Back and Neck Surgery (except Spinal Fusion)			
292.81	DRUG-INDUCED DELIRIUM	483.1	CHLAMYDIAL PNEUMONIA
293.0	DELIRIUM D/T CCE	483.8	PNEUMONIA D/T ORG NEC
410.01	ANTEROLAT AMI-INITIAL	484	PNEUM IN OTH INF DIS
410.11	ANT AMI NEC-INITIAL	484.1	PNEUMONIA IN CMV DISEASE
410.21	INFEROLAT AMI-INITIAL	484.3	PNEUMONIA IN WHOOP COUGH
410.31	INFEROPOST AMI-INITIAL	484.5	PNEUMONIA IN ANTHRAX
410.41	INF AMI NEC-INITIAL	484.6	PNEUM IN ASPERGILLOSIS
410.51	LAT AMI NEC-INITIAL	484.7	PNEUM IN SYST MYCOSESNEC
410.61	POSTERIOR AMI-INITIAL	484.8	PNEUM IN INFECT DIS NEC
410.71	SUBEND INFARCT-INITIAL	485	BRONCHOPNEUMONIA ORG NOS
410.81	AMI NEC-INITIAL EPISODE	486	PNEUMONIA ORGANISM NOS
410.91	AMI NOS-INITIAL EPISODE	507.0	FOOD/VOMIT PNEUMONITIS
480	VIRAL PNEUMONIA	511.9	PLEURAL EFFUSION NOS
480.0	ADENOVIRAL PNEUMONIA	518.5	POSTTR PULMON INSUFF
480.1	RSV PNEUMONIA	518.7	TRALI
480.2	PARINFLUENZA VIRAL PNEUM	518.81	AC RESPIRATORY FAILURE
480.3	SARS PNEUMONIA	584.5	AC RF W TUBULAR NEPHR
480.8	VIRAL PNEUMONIA NEC	584.8	ACUTE RENAL FAILURE NEC
480.9	VIRAL PNEUMONIA NOS	584.9	ACUTE RENAL FAILURE NOS
481	PNEUMOCOCCAL PNEUMONIA	995.91	SEPSIS
482	OTHER BACT PNEUMONIA	995.92	SEVERE SEPSIS
482.0	K. PNEUMONIAE PNEUMONIA	996.4	MECH COMP INT ORTH DEV
482.1	PSEUDOMONAL PNEUMONIA	996.40	MECH COMP INT ORTH NOS
482.2	H. INFLUENZAE PNEUMONIA	996.41	MECH LOOSENING JT PROSTH
482.3	STREPTOCOCCAL PNEUMONIA	996.42	DISLOCATION JOINT PROSTH
482.30	STREP PNEUMONIA NOS	996.43	PROSTH JOINT FAILURE
482.31	GROUP A STREP PNEUMONIA	996.44	PERI-PROSTHETIC FRACTURE
482.32	GROUP B STREP PNEUMONIA	996.47	MECH COMP JT PROSTH NEC
482.39	STREP PNEUMONIA NEC	996.49	MECH COMP INT ORTH NEC
482.4	STAPHYLOCOCCAL PNEUMONIA	996.77	COMP NEC D/T JT PROSTH
482.40	STAPH PNEUMONIA NOS	996.78	COMP NEC ORTH DEV NEC
482.41	STAPH AUREUS PNEUMONIA	997.00	NERV SYST SURG COMP NOS
482.49	STAPH PNEUMONIA NEC	997.02	IATROGEN CV INFARCT/HEM
482.8	OTH BACTERIAL PNEUMONIA	997.09	NERV SYST SURG COMP NEC
482.81	PNEUMONIA D/T ANAEROBES	997.1	SURG COMP-HEART
482.82	E. COLI PNEUMONIA	997.3	SURG COMP-RESP NEC
482.83	GRAM-NEG PNEUMONIA NEC	997.4	SURG COMP-DIGESTIVE
482.84	LEGIONNAIRES' DISEASE	997.5	SURG COMP-URINARY NEC
482.89	BACTERIAL PNEUMONIA NEC	998.11	HEMORRHAGE COMP PX
482.9	BACTERIAL PNEUMONIA NOS	998.2	ACCIDENTAL OP LACERATION
483	PNEUMONIA ORGANISM NEC	998.59	POSTOP INFECTION NEC
483.0	M. PNEUMONIAE PNEUMONIA		

**Dependent Complications - Back and Neck Surgery (except Spinal Fusion)**

Must occur with 997.1 Cardiac Complications			
427.0	PSVT	428.23	AC & CHR SYSTOLIC HF
427.1	PVT	428.3	DIASTOLIC HEART FAILURE
427.31	ATRIAL FIBRILLATION	428.30	DIASTOLIC HF NOS
427.89	OTH CARDIAC DYSRHYTHMIAS	428.31	ACUTE DIASTOLIC HF
427.9	CARDIAC DYSRHYTHMIA NOS	428.33	AC & CHR DIASTOLIC HF
428.0	CHF NOS	428.4	SYSTOLIC & DIASTOLIC HF
428.1	LEFT HEART FAILURE	428.40	SYS & DIASTOLIC HF NOS
428.2	SYSTOLIC HEART FAILURE	428.41	AC SYS & DIASTOLIC HF
428.20	SYSTOLIC HF NOS	428.9	HEART FAILURE NOS
428.21	ACUTE SYSTOLIC HF		
Must occur with 997.4 Digestive System Complications			
560.1	PARALYTIC ILEUS		
Must occur with 997.5 Urinary Complications			
593.9	KIDNEY & URETER DIS, NOS	788.20	RETENTION OF URINE, NOS
599.0	URINARY TRACT INF NOS	788.29	RETENTION OF URINE, NEC

**Major Complications – Carotid Surgery**

Major Complications – Carotid Surgery			
410.01	ANTEROLAT AMI-INITIAL	482.89	BACTERIAL PNEUMONIA NEC
410.11	ANT AMI NEC-INITIAL	482.9	BACTERIAL PNEUMONIA NOS
410.21	INFEROLAT AMI-INITIAL	483	PNEUMONIA ORGANISM NEC
410.51	LAT AMI NEC-INITIAL	483.0	M. PNEUMONIAE PNEUMONIA
410.61	POSTERIOR AMI-INITIAL	483.1	CHLAMYDIAL PNEUMONIA
410.71	SUBEND INFARCT-INITIAL	483.8	PNEUMONIA D/T ORG NEC
410.81	AMI NEC-INITIAL EPISODE	484	PNEUM IN OTH INF DIS
410.91	AMI NOS-INITIAL EPISODE	484.1	PNEUMONIA IN CMV DISEASE
427.5	CARDIAC ARREST	484.3	PNEUMONIA IN WHOOP COUGH
480	VIRAL PNEUMONIA	484.5	PNEUMONIA IN ANTHRAX
480.0	ADENOVIRAL PNEUMONIA	484.6	PNEUM IN ASPERGILLOSIS
480.1	RSV PNEUMONIA	484.7	PNEUM IN SYST MYCOSESNEC
480.2	PARINFLUENZA VIRAL PNEUM	484.8	PNEUM IN INFECT DIS NEC
480.3	SARS PNEUMONIA	485	BRONCHOPNEUMONIA ORG NOS
480.8	VIRAL PNEUMONIA NEC	486	PNEUMONIA ORGANISM NOS
480.9	VIRAL PNEUMONIA NOS	507.0	FOOD/VOMIT PNEUMONITIS
481	PNEUMOCOCCAL PNEUMONIA	518.5	POSTTR PULMON INSUFF
482	OTHER BACT PNEUMONIA	518.7	TRALI
482.0	K. PNEUMONIAE PNEUMONIA	518.81	AC RESPIRATORY FAILURE
482.1	PSEUDOMONAL PNEUMONIA	780.01	COMA
482.2	H. INFLUENZAE PNEUMONIA	951.7	INJURY HYPOGLOSSAL NERVE
482.3	STREPTOCOCCAL PNEUMONIA	957.1	INJURY TO NERVE NEC
482.30	STREP PNEUMONIA NOS	997.00	NERV SYST SURG COMP NOS
482.31	GROUP A STREP PNEUMONIA	997.01	CNS SURG COMP
482.32	GROUP B STREP PNEUMONIA	997.02	IATROGEN CV INFARCT/HEM
482.39	STREP PNEUMONIA NEC	997.09	NERV SYST SURG COMP NEC
482.4	STAPHYLOCOCCAL PNEUMONIA	997.1	SURG COMP-HEART
482.40	STAPH PNEUMONIA NOS	997.3	SURG COMP-RESP NEC
482.41	STAPH AUREUS PNEUMONIA	997.4	SURG COMP-DIGESTIVE
482.49	STAPH PNEUMONIA NEC	997.5	SURG COMP-URINARY NEC
482.8	OTH BACTERIAL PNEUMONIA	997.91	SURG COMP-HYPERTENSION
482.81	PNEUMONIA D/T ANAEROBES	998.0	POSTOPERATIVE SHOCK
482.82	E. COLI PNEUMONIA	998.11	HEMORRHAGE COMP PX
482.83	GRAM-NEG PNEUMONIA NEC	998.2	ACCIDENTAL OP LACERATION
482.84	LEGIONNAIRES' DISEASE	998.59	POSTOP INFECTION NEC

### Dependent Complications - Carotid Surgery

<b>Must occur with 997.02 Nervous System Complications</b>			
434.11	CEREBRAL EMBOLISM-INFRACT	434.91	CEREBR ART OCCL-INFRACTN
<b>Must occur with 997.1 Cardiac Complications</b>			
427.1	PVT	428.3	DIASTOLIC HEART FAILURE
427.31	ATRIAL FIBRILLATION	428.30	DIASTOLIC HF NOS
427.89	OTH CARDIAC DYSRHYTHMIAS	428.31	ACUTE DIASTOLIC HF
428.0	CHF NOS	428.33	AC & CHR DIASTOLIC HF
428.1	LEFT HEART FAILURE	428.4	SYSTOLIC & DIASTOLIC HF
428.2	SYSTOLIC HEART FAILURE	428.40	SYS & DIASTOLIC HF NOS
428.20	SYSTOLIC HF NOS	428.41	AC SYS & DIASTOLIC HF
428.21	ACUTE SYSTOLIC HF	428.43	ACCHR SYS & DIASTOLIC HF
428.23	AC & CHR SYSTOLIC HF	428.9	HEART FAILURE NOS
<b>Must occur with 997.4 Digestive System Complications</b>			
560.1	PARALYTIC ILEUS		
<b>Must occur with 997.5 Urinary Complications</b>			
584.5	AC RF W TUBULAR NEPHR	593.9	RENAL/URETER DISORD NOS
584.8	ACUTE RENAL FAILURE NEC	599.0	URINARY TRACT INF NOS
584.9	ACUTE RENAL FAILURE NOS	788.20	RETENTION OF URINE NOS
<b>Must occur with 998.59 Postoperative Infection</b>			
038	SEPTICEMIA	038.40	GRAM-NEG SEPTICEMIA NOS
038.0	STREPTOCOCCAL SEPTICEMIA	038.41	H. INFLUENZAE SEPTICEMIA
038.1	STAPH SEPTICEMIA	038.42	E. COLI SEPTICEMIA
038.10	STAPH SEPTICEMIA NOS	038.43	PSEUDOMONAS SEPTICEMIA
038.11	STAPH AUREUS SEPTICEMIA	038.44	SERRATIA SEPTICEMIA
038.19	STAPH SEPTICEMIA NEC	038.49	GRAM-NEG SEPTICEMIA NEC
038.2	PNEUMOCOCCAL SEPTICEMIA	038.8	SEPTICEMIA NEC
038.3	ANAEROBIC SEPTICEMIA	038.9	SEPTICEMIA NOS
038.4	OTH GRAM-NEG SEPTICEMIA		

### Major Complications – Cholecystectomy

<b>Major Complications – Cholecystectomy</b>			
292.81	DRUG-INDUCED DELIRIUM	997.4	SURG COMP-DIGESTIVE
415.11	IATRO PULM EMBOL/INFARCT	997.5	SURG COMP-URINARY NEC
415.19	PULMON EMBOL/INFARCT NEC	998.0	POSTOPERATIVE SHOCK
512.1	IATROGENIC PNEUMOTHORAX	998.11	HEMORRHAGE COMP PX
518.5	POSTTR PULMON INSUFF	998.2	ACCIDENTAL OP LACERATION
518.7	TRALI	998.3	POSTOP WOUND DISRUPTION
518.81	AC RESPIRATORY FAILURE	998.31	DISRUPT INTERNAL OP WND
997.02	IATROGEN CV INFARCT/HEM	998.32	DISRUPT EXTERNAL OP WND
997.1	SURG COMP-HEART	998.59	POSTOP INFECTION NEC
997.3	SURG COMP-RESP NEC		

### Dependent Complications - Cholecystectomy

<b>Must occur with 997.1 Cardiac Complications</b>			
410.01	ANTEROLAT AMI-INITIAL	428.1	LEFT HEART FAILURE
410.11	ANT AMI NEC-INITIAL	428.2	SYSTOLIC HEART FAILURE
410.21	INFEROLAT AMI-INITIAL	428.20	SYSTOLIC HF NOS
410.51	LAT AMI NEC-INITIAL	428.21	ACUTE SYSTOLIC HF
410.61	POSTERIOR AMI-INITIAL	428.23	AC & CHR SYSTOLIC HF
410.71	SUBEND INFARCT-INITIAL	428.3	DIASTOLIC HEART FAILURE
410.81	AMI NEC-INITIAL EPISODE	428.30	DIASTOLIC HF NOS
410.91	AMI NOS-INITIAL EPISODE	428.31	ACUTE DIASTOLIC HF
427.0	PSVT	428.33	AC & CHR DIASTOLIC HF
427.1	PVT	428.4	SYSTOLIC & DIASTOLIC HF
427.31	ATRIAL FIBRILLATION	428.40	SYS & DIASTOLIC HF NOS
427.32	ATRIAL FLUTTER	428.41	AC SYS & DIASTOLIC HF
427.41	VENTRICULAR FIBRILLATION	428.43	ACCHR SYS & DIASTOLIC HF
427.89	OTH CARDIAC DYSRHYTHMIAS	428.9	HEART FAILURE NOS
428.0	CHF NOS		

**Dependent Complications – Cholecystectomy (continued)**

<b>Must occur with 997.3 Respiratory Complications</b>			
480	VIRAL PNEUMONIA	482.81	PNEUMONIA D/T ANAEROBES
480.0	ADENOVIRAL PNEUMONIA	482.82	E. COLI PNEUMONIA
480.1	RSV PNEUMONIA	482.83	GRAM-NEG PNEUMONIA NEC
480.2	PARINFLUENZA VIRAL PNEUM	482.84	LEGIONNAIRES' DISEASE
480.3	SARS PNEUMONIA	482.89	BACTERIAL PNEUMONIA NEC
480.8	VIRAL PNEUMONIA NEC	482.9	BACTERIAL PNEUMONIA NOS
480.9	VIRAL PNEUMONIA NOS	483	PNEUMONIA ORGANISM NEC
481	PNEUMOCOCCAL PNEUMONIA	483.0	M. PNEUMONIAE PNEUMONIA
482	OTHER BACT PNEUMONIA	483.1	CHLAMYDIAL PNEUMONIA
482.0	K. PNEUMONIAE PNEUMONIA	483.8	PNEUMONIA D/T ORG NEC
482.1	PSEUDOMONAL PNEUMONIA	484	PNEUM IN OTH INF DIS
482.2	H. INFLUENZAE PNEUMONIA	484.1	PNEUMONIA IN CMV DISEASE
482.3	STREPTOCOCCAL PNEUMONIA	484.3	PNEUMONIA IN WHOOP COUGH
482.30	STREP PNEUMONIA NOS	484.5	PNEUMONIA IN ANTHRAX
482.31	GROUP A STREP PNEUMONIA	484.6	PNEUM IN ASPERGILLOSIS
482.32	GROUP B STREP PNEUMONIA	484.7	PNEUM IN SYST MYCOSESNOC
482.39	STREP PNEUMONIA NEC	484.8	PNEUM IN INFECT DIS NEC
482.4	STAPHYLOCOCCAL PNEUMONIA	485	BRONCHOPNEUMONIA ORG NOS
482.40	STAPH PNEUMONIA NOS	486	PNEUMONIA ORGANISM NOS
482.41	STAPH AUREUS PNEUMONIA	507.0	FOOD/VOMIT PNEUMONITIS
482.49	STAPH PNEUMONIA NEC	799.02	HYPOXEMIA
482.8	OTH BACTERIAL PNEUMONIA		
<b>Must occur with 997.5 Urinary Complications</b>			
584.5	AC RF W TUBULAR NEPHR	599.0	URINARY TRACT INF NOS
584.8	ACUTE RENAL FAILURE NEC	788.20	RETENTION OF URINE NOS
584.9	ACUTE RENAL FAILURE NOS	788.29	RETENTION OF URINE NEC
<b>Must occur with 998.11 and 998.2 Hemorrhage Complicating a Procedure with Accidental Puncture or Laceration During a Procedure</b>			
568.81	HEMOPERITONEUM		
<b>Must occur with 997.4 and 998.2 Digestive System Complications with Accidental Puncture or Laceration During a Procedure</b>			
569.83	PERFORATION OF INTESTINE		
<b>Must occur with 998.59 Postoperative Infection</b>			
038	SEPTICEMIA	038.41	H. INFLUENZAE SEPTICEMIA
038.0	STREPTOCOCCAL SEPTICEMIA	038.42	E. COLI SEPTICEMIA
038.1	STAPH SEPTICEMIA	038.43	PSEUDOMONAS SEPTICEMIA
038.10	STAPH SEPTICEMIA NOS	038.44	SERRATIA SEPTICEMIA
038.11	STAPH AUREUS SEPTICEMIA	038.49	GRAM-NEG SEPTICEMIA NEC
038.19	STAPH SEPTICEMIA NEC	038.8	SEPTICEMIA NEC
038.2	PNEUMOCOCCAL SEPTICEMIA	038.9	SEPTICEMIA NOS
038.3	ANAEROBIC SEPTICEMIA	682.2	TRUNK CELLULITIS
038.4	OTH GRAM-NEG SEPTICEMIA	785.52	SEPTIC SHOCK
038.40	GRAM-NEG SEPTICEMIA NOS	995.91	SEPSIS

**Major Complications – Hip Fracture Repair**

<b>Major Complications – Hip Fracture Repair</b>			
292.81	DRUG-INDUCED DELIRIUM	996.78	COMP NEC ORTH DEV NEC
293.0	DELIRIUM D/T CCE	997.02	IATROGEN CV INFARCT/HEM
415.11	IATRO PULM EMBOL/INFARCT	997.1	SURG COMP-HEART
415.19	PULMON EMBOL/INFARCT NEC	997.3	SURG COMP-RESP NEC
512.1	IATROGENIC PNEUMOTHORAX	997.4	SURG COMP-DIGESTIVE
518.5	POSTTR PULMON INSUFF	997.5	SURG COMP-URINARY NEC
518.7	TRALI	998.0	POSTOPERATIVE SHOCK
785.59	SHOCK W/O TRAUMA NEC	998.11	HEMORRHAGE COMP PX
996.77	COMP NEC D/T JT PROSTH	998.59	POSTOP INFECTION NEC

**Dependent Complications – Hip Fracture Repair**

<b>Must occur with 997.1 Cardiac Complications</b>			
410.01	ANTEROLAT AMI-INITIAL	427.89	OTH CARDIAC DYSRHYTHMIAS
410.11	ANT AMI NEC-INITIAL	428.0	CHF NOS
410.21	INFEROLAT AMI-INITIAL	428.1	LEFT HEART FAILURE
410.31	INFEROPOST AMI-INITIAL	428.20	SYSTOLIC HF NOS
410.41	INF AMI NEC-INITIAL	428.21	ACUTE SYSTOLIC HF
410.51	LAT AMI NEC-INITIAL	428.23	AC & CHR SYSTOLIC HF
410.61	POSTERIOR AMI-INITIAL	428.30	DIASTOLIC HF NOS
410.71	SUBEND INFARCT-INITIAL	428.31	ACUTE DIASTOLIC HF
410.81	AMI NEC-INITIAL EPISODE	428.33	AC & CHR DIASTOLIC HF
410.91	AMI NOS-INITIAL EPISODE	428.40	SYS & DIASTOLIC HF NOS
427.0	PSVT	428.41	AC SYS & DIASTOLIC HF
427.1	PVT	428.43	ACCHR SYS & DIASTOLIC HF
427.31	ATRIAL FIBRILLATION	428.9	HEART FAILURE NOS
427.32	ATRIAL FLUTTER		
<b>Must occur with 997.3 Respiratory Complications</b>			
480.9	VIRAL PNEUMONIA NOS	482.84	LEGIONNAIRES' DISEASE
481	PNEUMOCOCCAL PNEUMONIA	482.89	BACTERIAL PNEUMONIA NEC
482	OTH BACTERIAL PNEUMONIA	482.9	BACTERIAL PNEUMONIA NOS
482.0	K. PNEUMONIAE PNEUMONIA	483	PNEUMONIA ORGANISM NEC
482.1	PSEUDOMONAL PNEUMONIA	483.0	M. PNEUMONIAE PNEUMONIA
482.2	H. INFLUENZAE PNEUMONIA	483.1	CHLAMYDIAL PNEUMONIA
482.3	STREPTOCOCCAL PNEUMONIA	483.8	PNEUMONIA D/T ORG NEC
482.30	STREP PNEUMONIA NOS	484	PNEUM IN OTH INF DIS
482.31	GROUP A STREP PNEUMONIA	484.1	PNEUM IN CMV DISEASE
482.32	GROUP B STREP PNEUMONIA	484.3	PNEUMONIA IN WHOOP COUGH
482.39	STREP PNEUMONIA NEC	484.5	PNEUMONIA IN ANTHRAX
482.4	STAPHYLOCOCCAL PNEUMONIA	484.6	PNEUM IN ASPERGILLOSIS
482.40	STAPH PNEUMONIA NOS	484.7	PNEUM IN SYST MYCOSESNEC
482.41	STAPH AUREUS PNEUMONIA	484.8	PNEUM IN INFECT DIS NEC
482.49	STAPH PNEUMONIA NEC	485	BRONCHOPNEUMONIA ORG NOS
482.8	BACTERIAL PNEUMONIA NEC	486	PNEUMONIA ORGANISM NOS
482.81	PNEUMONIA D/T ANAEROBES	507.0	FOOD/VOMIT PNEUMONITIS
482.82	E. COLI PNEUMONIA	518.82	OTHER PULMONARY INSUFF
482.83	GRAM-NEG PNEUMONIA NEC	518.84	AC & CHR RESP FAILURE
<b>Must occur with 997.4 Digestive System Complications with Accidental Puncture</b>			
560.1	PARALYTIC ILEUS		
<b>Must occur with 997.5 Urinary Complications</b>			
584.5	AC REN FAIL-LES TUBL, NEC	593.9	KIDNEY & URETER DIS, NOS
584.8	AC REN FAIL-PATH LES, NEC	599.0	URINARY TRACT INF NOS
584.9	ACUTE RENAL FAILURE, NOS	788.20	RETENTION OF URINE, NOS
<b>Must occur with 998.59 Postoperative Infection</b>			
038	SEPTICEMIA	038.42	E. COLI SEPTICEMIA
038.0	STREPTOCOCCAL SEPTICEMIA	038.43	PSEUDOMONAS SEPTICEMIA
038.1	STAPH SEPTICEMIA	038.44	SERRATIA SEPTICEMIA
038.10	STAPH SEPTICEMIA NOS	038.49	GRAM-NEG SEPTICEMIA NEC
038.11	STAPH AUREUS SEPTICEMIA	038.8	SEPTICEMIA NEC
038.19	STAPH SEPTICEMIA NEC	038.9	SEPTICEMIA NOS
038.2	PNEUMOCOCCAL SEPTICEMIA	041.4	E. COLI INFECT NOS
038.3	ANAEROBIC SEPTICEMIA	785.52	SEPTIC SHOCK
038.40	GRAM-NEG SEPTICEMIA NOS	995.91	SEPSIS
038.41	H. INFLUENZAE SEPTICEMIA		

### Major Complications – Peripheral Vascular Bypass

Major Complications – Peripheral Vascular Bypass			
518.5	POSTTR PULMON INSUFF	997.5	SURG COMP-URINARY NEC
518.7	TRALI	998.0	POSTOPERATIVE SHOCK
997.1	SURG COMP-HEART	998.11	HEMORRHAGE COMP PX
997.3	SURG COMP-RESP NEC	998.2	ACCIDENTAL OP LACERATION
997.4	SURG COMP-DIGESTIVE	998.59	POSTOP INFECTION NEC
Must occur with 997.1 Cardiac Complications			
410.01	ANTEROLAT AMI-INITIAL	428.2	SYSTOLIC HEART FAILURE
410.11	ANT AMI NEC-INITIAL	428.20	SYSTOLIC HF NOS
410.21	INFEROLAT AMI-INITIAL	428.21	ACUTE SYSTOLIC HF
410.51	LAT AMI NEC-INITIAL	428.23	AC & CHR SYSTOLIC HF
410.61	POSTERIOR AMI-INITIAL	428.3	DIASTOLIC HEART FAILURE
410.71	SUBEND INFARCT-INITIAL	428.30	DIASTOLIC HF NOS
410.81	AMI NEC-INITIAL EPISODE	428.31	ACUTE DIASTOLIC HF
410.91	AMI NOS-INITIAL EPISODE	428.33	AC & CHR DIASTOLIC HF
427.1	PVT	428.4	SYSTOLIC & DIASTOLIC HF
427.31	ATRIAL FIBRILLATION	428.40	SYS & DIASTOLIC HF NOS
427.32	ATRIAL FLUTTER	428.41	AC SYS & DIASTOLIC HF
427.89	OTH CARDIAC DYSRHYTHMIAS	428.43	ACCHR SYS & DIASTOLIC HF
428.0	CHF NOS	428.9	HEART FAILURE NOS
428.1	LEFT HEART FAILURE		

### Dependent Complications – Peripheral Vascular Bypass

Must occur with 997.3 Respiratory Complications			
480	VIRAL PNEUMONIA	482.81	PNEUMONIA D/T ANAEROBES
480.0	ADENOVIRAL PNEUMONIA	482.82	E. COLI PNEUMONIA
480.1	RSV PNEUMONIA	482.83	GRAM-NEG PNEUMONIA NEC
480.2	PARINFLUENZA VIRAL PNEUM	482.84	LEGIONNAIRES' DISEASE
480.3	SARS PNEUMONIA	482.89	BACTERIAL PNEUMONIA NEC
480.8	VIRAL PNEUMONIA NEC	482.9	BACTERIAL PNEUMONIA NOS
480.9	VIRAL PNEUMONIA NOS	483	PNEUMONIA ORGANISM NEC
481	PNEUMOCOCCAL PNEUMONIA	483.0	M. PNEUMONIAE PNEUMONIA
482	OTHER BACT PNEUMONIA	483.1	CHLAMYDIAL PNEUMONIA
482.0	K. PNEUMONIAE PNEUMONIA	483.8	PNEUMONIA D/T ORG NEC
482.1	PSEUDOMONAL PNEUMONIA	484	PNEUM IN OTH INF DIS
482.2	H. INFLUENZAE PNEUMONIA	484.1	PNEUMONIA IN CMV DISEASE
482.3	STREPTOCOCCAL PNEUMONIA	484.3	PNEUMONIA IN WHOOP COUGH
482.30	STREP PNEUMONIA NOS	484.5	PNEUMONIA IN ANTHRAX
482.31	GROUP A STREP PNEUMONIA	484.6	PNEUM IN ASPERGILLOSIS
482.32	GROUP B STREP PNEUMONIA	484.7	PNEUM IN SYST MYCOSESNEC
482.39	STREP PNEUMONIA NEC	484.8	PNEUM IN INFECT DIS NEC
482.4	STAPHYLOCOCCAL PNEUMONIA	485	BRONCHOPNEUMONIA ORG NOS
482.40	STAPH PNEUMONIA NOS	486	PNEUMONIA ORGANISM NOS
482.41	STAPH AUREUS PNEUMONIA	507.0	FOOD/VOMIT PNEUMONITIS
482.49	STAPH PNEUMONIA NEC	518.81	AC RESPIRATORY FAILURE
482.8	OTH BACTERIAL PNEUMONIA		
Must occur with 997.4 Digestive System Complications			
560.1	PARALYTIC ILEUS		
Must occur with 997.5 Urinary Complications			
584.5	AC RF W TUBULAR NEPHR	593.9	RENAL/URETER DISORD NOS
584.8	ACUTE RENAL FAILURE NEC	599.0	URINARY TRACT INF NOS
584.9	ACUTE RENAL FAILURE NOS	788.20	RETENTION OF URINE NOS
Must occur with 998.59 and 998.51 Postoperative Infection with Infected Postoperative Seroma			
041.04	BACTR INF DT GRP D STREP	041.7	PSEUDOMONAS IN OTHER DIS
041.11	BACTERL INF DT S. AUREUS		
Must occur with 998.59 Postoperative Infection			
038	SEPTICEMIA	038.40	GRAM-NEG SEPTICEMIA NOS
038.0	STREPTOCOCCAL SEPTICEMIA	038.41	H. INFLUENZAE SEPTICEMIA
038.1	STAPH SEPTICEMIA	038.42	E. COLI SEPTICEMIA
038.10	STAPH SEPTICEMIA NOS	038.43	PSEUDOMONAS SEPTICEMIA
038.11	STAPH AUREUS SEPTICEMIA	038.44	SERRATIA SEPTICEMIA
038.19	STAPH SEPTICEMIA NEC	038.49	GRAM-NEG SEPTICEMIA NEC
038.2	PNEUMOCOCCAL SEPTICEMIA	038.8	SEPTICEMIA NEC
038.3	ANAEROBIC SEPTICEMIA	038.9	SEPTICEMIA NOS
038.4	OTH GRAM-NEG SEPTICEMIA	995.92	SEVERE SEPSIS



### Major Complications – Prostatectomy

Major Complications – Prostatectomy			
410.01	ANTEROLAT AMI-INITIAL	507.0	FOOD/VOMIT PNEUMONITIS
410.11	ANT AMI NEC-INITIAL	518.5	POSTTR PULMON INSUFF
410.21	INFEROLAT AMI-INITIAL	518.7	TRALI
410.31	INFEROPOST AMI-INITIAL	518.81	AC RESPIRATORY FAILURE
410.41	INF AMI NEC-INITIAL	996.76	COMP NEC D/T GU DEVICE
410.51	LAT AMI NEC-INITIAL	997.1	SURG COMP-HEART
410.61	POSTERIOR AMI-INITIAL	997.3	SURG COMP-RESP NEC
410.71	SUBEND INFARCT-INITIAL	997.4	SURG COMP-DIGESTIVE
410.81	AMI NEC-INITIAL EPISODE	997.5	SURG COMP-URINARY NEC
410.91	AMI NOS-INITIAL EPISODE	998.11	HEMORRHAGE COMP PX
427.5	CARDIAC ARREST	998.2	ACCIDENTAL OP LACERATION

### Dependent Complications – Prostatectomy

Must occur with 997.1 Cardiac Complications			
427.1	PVT	428.3	DIASTOLIC HEART FAILURE
427.31	ATRIAL FIBRILLATION	428.30	DIASTOLIC HF NOS
427.89	OTH CARDIAC DYSRHYTHMIAS	428.31	ACUTE DIASTOLIC HF
428.0	CHF NOS	428.33	AC & CHR DIASTOLIC HF
428.1	LEFT HEART FAILURE	428.4	SYSTOLIC & DIASTOLIC HF
428.2	SYSTOLIC HEART FAILURE	428.40	SYS & DIASTOLIC HF NOS
428.20	SYSTOLIC HF NOS	428.41	AC SYS & DIASTOLIC HF
428.21	ACUTE SYSTOLIC HF	428.43	ACCHR SYS & DIASTOLIC HF
428.23	AC & CHR SYSTOLIC HF	428.9	HEART FAILURE NOS
Must occur with 997.3 Respiratory Complications			
480	VIRAL PNEUMONIA	482.8	OTH BACTERIAL PNEUMONIA
480.0	ADENOVIRAL PNEUMONIA	482.81	PNEUMONIA D/T ANAEROBES
480.1	RSV PNEUMONIA	482.82	E. COLI PNEUMONIA
480.2	PARINFLUENZA VIRAL PNEUM	482.83	GRAM-NEG PNEUMONIA NEC
480.3	SARS PNEUMONIA	482.84	LEGIONNAIRES' DISEASE
480.8	VIRAL PNEUMONIA NEC	482.89	BACTERIAL PNEUMONIA NEC
480.9	VIRAL PNEUMONIA NOS	482.9	BACTERIAL PNEUMONIA NOS
481	PNEUMOCOCCAL PNEUMONIA	483	PNEUMONIA ORGANISM NEC
482	OTHER BACT PNEUMONIA	483.0	M. PNEUMONIAE PNEUMONIA
482.0	K. PNEUMONIAE PNEUMONIA	483.1	CHLAMYDIAL PNEUMONIA
482.1	PSEUDOMONAL PNEUMONIA	483.8	PNEUMONIA D/T ORG NEC
482.2	H. INFLUENZAE PNEUMONIA	484	PNEUM IN OTH INF DIS
482.3	STREPTOCOCCAL PNEUMONIA	484.1	PNEUMONIA IN CMV DISEASE
482.30	STREP PNEUMONIA NOS	484.3	PNEUMONIA IN WHOOP COUGH
482.31	GROUP A STREP PNEUMONIA	484.5	PNEUMONIA IN ANTHRAX
482.32	GROUP B STREP PNEUMONIA	484.6	PNEUM IN ASPERGILLOSIS
482.39	STREP PNEUMONIA NEC	484.7	PNEUM IN SYST MYCOSESNEC
482.4	STAPHYLOCOCCAL PNEUMONIA	484.8	PNEUM IN INFECT DIS NEC
482.40	STAPH PNEUMONIA NOS	485	BRONCHOPNEUMONIA ORG NOS
482.41	STAPH AUREUS PNEUMONIA	486	PNEUMONIA ORGANISM NOS
482.49	STAPH PNEUMONIA NEC		

### Dependent Complications – Prostatectomy (continued)

Must occur with 997.4 Digestive Complications			
560.1	PARALYTIC ILEUS		
Must occur with 997.5 Urinary Complications			
584.5	AC REN FAIL-LES TUBL, NEC	584.9	ACUTE RENAL FAILURE, NOS
584.8	AC REN FAIL-PATH LES, NEC		
Must occur with 998.59 Postoperative Infection			
038	SEPTICEMIA	038.40	GRAM-NEG SEPTICEMIA NOS
038.0	STREPTOCOCCAL SEPTICEMIA	038.41	H. INFLUENZAE SEPTICEMIA
038.1	STAPH SEPTICEMIA	038.42	E. COLI SEPTICEMIA
038.10	STAPH SEPTICEMIA NOS	038.43	PSEUDOMONAS SEPTICEMIA
038.11	STAPH AUREUS SEPTICEMIA	038.44	SERRATIA SEPTICEMIA
038.19	STAPH SEPTICEMIA NEC	038.49	GRAM-NEG SEPTICEMIA NEC
038.2	PNEUMOCOCCAL SEPTICEMIA	038.8	SEPTICEMIA NEC
038.3	ANAEROBIC SEPTICEMIA	038.9	SEPTICEMIA NOS
038.4	OTH GRAM-NEG SEPTICEMIA		

### Major Complications – Total Hip Replacement

Major Complications – Total Hip Replacement			
292.81	DRUG-INDUCED DELIRIUM	484.1	PNEUMONIA IN CMV DISEASE
410.01	ANTEROLAT AMI-INITIAL	484.3	PNEUMONIA IN WHOOP COUGH
410.11	ANT AMI NEC-INITIAL	484.5	PNEUMONIA IN ANTHRAX
410.21	INFEROLAT AMI-INITIAL	484.6	PNEUM IN ASPERGILLOSIS
410.31	INFEROPOST AMI-INITIAL	484.7	PNEUM IN SYST MYCOSESNEC
410.41	INF AMI NEC-INITIAL	484.8	PNEUM IN INFECT DIS NEC
410.51	LAT AMI NEC-INITIAL	485	BRONCHOPNEUMONIA ORG NOS
410.61	POSTERIOR AMI-INITIAL	486	PNEUMONIA ORGANISM NOS
410.71	SUBEND INFARCT-INITIAL	507.0	FOOD/VOMIT PNEUMONITIS
410.81	AMI NEC-INITIAL EPISODE	518.5	POSTTR PULMON INSUFF
410.91	AMI NOS-INITIAL EPISODE	518.7	TRALI
415.11	IATRO PULM EMBOL/INFARCT	518.81	AC RESPIRATORY FAILURE
415.19	PULMON EMBOL/INFARCT NEC	584.5	AC RF W TUBULAR NEPHR
480	VIRAL PNEUMONIA	584.8	ACUTE RENAL FAILURE NEC
480.0	ADENOVIRAL PNEUMONIA	584.9	ACUTE RENAL FAILURE NOS
480.1	RSV PNEUMONIA	707.0	DECUBITUS ULCER
480.2	PARINFLUENZA VIRAL PNEUM	707.00	DECUBITUS ULCER-SITE NOS
480.3	SARS PNEUMONIA	707.01	DECUBITUS ULCER-ELBOW
480.8	VIRAL PNEUMONIA NEC	707.02	DECUBITUS ULCER-UP BACK
480.9	VIRAL PNEUMONIA NOS	707.03	DECUBITUS ULCER-LOW BACK
481	PNEUMOCOCCAL PNEUMONIA	707.04	DECUBITUS ULCER-HIP
482	OTHER BACT PNEUMONIA	707.05	DECUBITUS ULCER-BUTTOCK
482.0	K. PNEUMONIAE PNEUMONIA	707.06	DECUBITUS ULCER-ANKLE
482.1	PSEUDOMONAL PNEUMONIA	707.07	DECUBITUS ULCER-HEEL
482.2	H. INFLUENZAE PNEUMONIA	707.09	DECUBITUS ULCER-SITE NEC
482.3	STREPTOCOCCAL PNEUMONIA	799.1	RESPIRATORY ARREST
482.30	STREP PNEUMONIA NOS	995.92	SEVERE SEPSIS
482.31	GROUP A STREP PNEUMONIA	996.4	MECH COMP INT ORTH DEV
482.32	GROUP B STREP PNEUMONIA	996.40	MECH COMP INT ORTH NOS
482.39	STREP PNEUMONIA NEC	996.41	MECH LOOSENING JT PROSTH
482.4	STAPHYLOCOCCAL PNEUMONIA	996.42	DISLOCATION JOINT PROSTH
482.40	STAPH PNEUMONIA NOS	996.43	PROSTH JOINT FAILURE
482.41	STAPH AUREUS PNEUMONIA	996.44	PERI-PROSTHETIC FRACTURE
482.49	STAPH PNEUMONIA NEC	996.47	MECH COMP JT PROSTH NEC
482.8	OTH BACTERIAL PNEUMONIA	996.77	COMP NEC D/T JT PROSTH
482.81	PNEUMONIA D/T ANAEROBES	996.78	COMP NEC ORTH DEV NEC
482.82	E. COLI PNEUMONIA	997.02	IATROGEN CV INFARCT/HEM
482.83	GRAM-NEG PNEUMONIA NEC	997.1	SURG COMP-HEART
482.84	LEGIONNAIRES' DISEASE	997.3	SURG COMP-RESP NEC
482.89	BACTERIAL PNEUMONIA NEC	997.4	SURG COMP-DIGESTIVE
482.9	BACTERIAL PNEUMONIA NOS	997.5	SURG COMP-URINARY NEC
483	PNEUMONIA ORGANISM NEC	998.0	POSTOPERATIVE SHOCK
483.0	M. PNEUMONIAE PNEUMONIA	998.11	HEMORRHAGE COMP PX
483.1	CHLAMYDIAL PNEUMONIA	998.59	POSTOP INFECTION NEC
483.8	PNEUMONIA D/T ORG NEC	999.8	TRANSFUSION REACTION NEC
484	PNEUM IN OTH INF DIS		

### Dependent Complications – Total Hip Replacement

<b>Must occur with 997.1 Cardiac Complications</b>			
427.0	PSVT	428.23	AC & CHR SYSTOLIC HF
427.1	PVT	428.3	DIASTOLIC HEART FAILURE
427.31	ATRIAL FIBRILLATION	428.30	DIASTOLIC HF NOS
427.89	OTH CARDIAC DYSRHYTHMIAS	428.31	ACUTE DIASTOLIC HF
427.9	CARDIAC DYSRHYTHMIA NOS	428.33	AC & CHR DIASTOLIC HF
428.0	CHF NOS	428.4	SYSTOLIC & DIASTOLIC HF
428.1	LEFT HEART FAILURE	428.40	SYS & DIASTOLIC HF NOS
428.2	SYSTOLIC HEART FAILURE	428.41	AC SYS & DIASTOLIC HF
428.20	SYSTOLIC HF NOS	428.43	ACCHR SYS & DIASTOLIC HF
428.21	ACUTE SYSTOLIC HF	428.9	HEART FAILURE NOS
<b>Must occur with 997.4 Digestive Complications</b>			
560.1	PARALYTIC ILEUS		
<b>Must occur with 997.5 Urinary Complications</b>			
593.9	KIDNEY & URETER DIS, NOS	788.20	RETENTION OF URINE, NOS
599.0	URINARY TRACT INFECT, NOS	788.29	RETENTION OF URINE, NEC

### Major Complications – Total Knee Replacement

Major Complications – Total Knee Replacement	
292.81	DRUG-INDUCED DELIRIUM
410.01	ANTEROLAT AMI-INITIAL
410.11	ANT AMI NEC-INITIAL
410.21	INFEROLAT AMI-INITIAL
410.31	INFEROPOST AMI-INITIAL
410.41	INF AMI NEC-INITIAL
410.51	LAT AMI NEC-INITIAL
410.61	POSTERIOR AMI-INITIAL
410.71	SUBEND INFARCT-INITIAL
410.81	AMI NEC-INITIAL EPISODE
410.91	AMI NOS-INITIAL EPISODE
415.11	IATRO PULM EMBOL/INFARCT
415.19	PULMON EMBOL/INFARCT NEC
480	VIRAL PNEUMONIA
480.0	ADENOVIRAL PNEUMONIA
480.1	RSV PNEUMONIA
480.2	PARINFLUENZA VIRAL PNEUM
480.3	SARS PNEUMONIA
480.8	VIRAL PNEUMONIA NEC
480.9	VIRAL PNEUMONIA NOS
481	PNEUMOCOCCAL PNEUMONIA
482	OTHER BACT PNEUMONIA
482.0	K. PNEUMONIAE PNEUMONIA
482.1	PSEUDOMONAL PNEUMONIA
482.2	H. INFLUENZAE PNEUMONIA
482.3	STREPTOCOCCAL PNEUMONIA
482.30	STREP PNEUMONIA NOS
482.31	GROUP A STREP PNEUMONIA
482.32	GROUP B STREP PNEUMONIA
482.39	STREP PNEUMONIA NEC
482.4	STAPHYLOCOCCAL PNEUMONIA
482.40	STAPH PNEUMONIA NOS
482.41	STAPH AUREUS PNEUMONIA
482.49	STAPH PNEUMONIA NEC
482.8	OTH BACTERIAL PNEUMONIA
482.81	PNEUMONIA D/T ANAEROBES
482.82	E. COLI PNEUMONIA
482.83	GRAM-NEG PNEUMONIA NEC
482.84	LEGIONNAIRES' DISEASE
482.89	BACTERIAL PNEUMONIA NEC
482.9	BACTERIAL PNEUMONIA NOS
483	PNEUMONIA ORGANISM NEC
483.0	M. PNEUMONIAE PNEUMONIA
483.1	CHLAMYDIAL PNEUMONIA
483.8	PNEUMONIA D/T ORG NEC
484	PNEUM IN OTH INF DIS
484.1	PNEUMONIA IN CMV DISEASE
484.3	PNEUMONIA IN WHOOP COUGH
484.5	PNEUMONIA IN ANTHRAX
484.6	PNEUM IN ASPERGILLOSIS
484.7	PNEUM IN SYST MYCOSESNEC
484.8	PNEUM IN INFECT DIS NEC
485	BRONCHOPNEUMONIA ORG NOS
486	PNEUMONIA ORGANISM NOS
507.0	FOOD/VOMIT PNEUMONITIS
518.5	POSTTR PULMON INSUFF
518.7	TRALI
518.81	AC RESPIRATORY FAILURE
584.5	AC RF W TUBULAR NEPHR
584.8	ACUTE RENAL FAILURE NEC
584.9	ACUTE RENAL FAILURE NOS
707.0	DECUBITUS ULCER
707.00	DECUBITUS ULCER-SITE NOS
707.01	DECUBITUS ULCER-ELBOW
707.02	DECUBITUS ULCER-UP BACK
707.03	DECUBITUS ULCER-LOW BACK
707.04	DECUBITUS ULCER-HIP
707.05	DECUBITUS ULCER-BUTTOCK
707.06	DECUBITUS ULCER-ANKLE
707.07	DECUBITUS ULCER-HEEL
707.09	DECUBITUS ULCER-SITE NEC
799.1	RESPIRATORY ARREST
995.92	SEVERE SEPSIS
996.4	MECH COMP INT ORTH NOS
996.40	MECH COMP INT ORTH NOS
996.41	MECH LOOSENING JT PROSTH
996.42	DISLOCATION JOINT PROSTH
996.43	PROSTH JOINT FAILURE
996.44	PERI-PROSTHETIC FRACTURE
996.47	MECH COMP JT PROSTH NEC
996.49	MECH COMP INT ORTH NEC
996.77	COMP NEC D/T JT PROSTH
996.78	COMP NEC ORTH DEV NEC
997.02	IATROGEN CV INFARCT/HEM
997.1	SURG COMP-HEART
997.3	SURG COMP-RESP NEC
997.4	SURG COMP-DIGESTIVE
997.5	SURG COMP-URINARY NEC
998.0	POSTOPERATIVE SHOCK
998.11	HEMORRHAGE COMP PX
998.59	POSTOP INFECTION NEC
999.8	TRANSFUSION REACTION NEC

### Dependent Complications – Total Knee Replacement

<b>Must occur with 997.1 Cardiac Complications</b>			
427.0	PSVT	428.23	AC & CHR SYSTOLIC HF
427.1	PVT	428.3	DIASTOLIC HEART FAILURE
427.31	ATRIAL FIBRILLATION	428.30	DIASTOLIC HF NOS
427.89	OTH CARDIAC DYSRHYTHMIAS	428.31	ACUTE DIASTOLIC HF
427.9	CARDIAC DYSRHYTHMIA NOS	428.33	AC & CHR DIASTOLIC HF
428.0	CHF NOS	428.4	SYSTOLIC & DIASTOLIC HF
428.1	LEFT HEART FAILURE	428.40	SYS & DIASTOLIC HF NOS
428.2	SYSTOLIC HEART FAILURE	428.41	AC SYS & DIASTOLIC HF
428.20	SYSTOLIC HF NOS	428.43	ACCHR SYS & DIASTOLIC HF
428.21	ACUTE SYSTOLIC HF	428.9	HEART FAILURE NOS
<b>Must occur with 997.4 Digestive System Complications</b>			
560.1	PARALYTIC ILEUS		
<b>Must occur with 997.5 Urinary Complications</b>			
593.9	KIDNEY & URETER DIS, NOS	788.20	RETENTION OF URINE, NOS
599.0	URINARY TRACT INFECT, NOS	788.29	RETENTION OF URINE, NEC

## Appendix C: Top Five Risk Factors by Procedure or Diagnosis

Proc = Procedure Code      Diag = Diagnosis Code

<b>Back and Neck Surgery (Spinal Fusion)</b>	
Diag 260, 261, 262, 263.0, 263.1, 263.2, 263.8, 263.9	MALNUTRITION
Proc 81.04	DORSAL AND DORSOLUMBAR FUSION, ANTERIOR TECHNIQUE
Diag 403.11, 403.91	NON-MALIGNANT RENAL DISEASE W/ FAILURE
Diag 787.2	DYSPHAGIA
Proc 81.05	DORSAL AND DORSOLUMBAR FUSION, POSTERIOR TECHNIQUE
<b>Back and Neck Surgery (Except Spinal Fusion)</b>	
Diag 403.11, 403.91	NON-MALIGNANT RENAL DISEASE W/ FAILURE
Diag 276.1	HYPOSMOLALITY AND/OR HYPONATREMIA
Diag 349.2	DISORDERS OF MENINGES, NOT ELSEWHERE CLASSIFIED
Proc 03.53	REPAIR OF VERTEBRAL FRACTURE
Diag 428.0	CONGESTIVE HEART FAILURE, UNSPECIFIED
<b>Bowel Obstruction</b>	
Diag 518.81	ACUTE RESPIRATORY FAILURE
Diag 995.91	SEPSIS
Diag 458.8, 458.9	HYPOTENSION, UNSPECIFIED OR NEC
Diag 569.83	PERFORATION OF INTESTINE
Diag 276.2	ACIDOSIS
<b>Carotid Surgery</b>	
Proc 39.72	ENDOVASCULAR REMOVAL OF OBSTRUCTION FROM HEAD AND NECK VESSEL(S)
Diag 584.5, 584.8, 584.9 <i>not with 997.5 Urinary Complications</i>	ACUTE RENAL FAILURE
Diag 342.90	UNSPECIFIED HEMIPLEGIA AND HEMIPARESIS AFFECTING UNSPECIFIED SIDE
Diag 491.0, 491.1, 491.20, 491.21, 491.8, 491.9	CHRONIC BRONCHITIS
Diag 787.2	DYSPHAGIA
<b>Cholecystectomy</b>	
Diag 276.2	ACIDOSIS
Diag 51.21	OTHER PARTIAL CHOLECYSTECTOMY
Diag 511.9	UNSPECIFIED PLEURAL EFFUSION
Diag 995.92	SEVERE SEPSIS
Proc 51.22	CHOLECYSTECTOMY
<b>Chronic Obstructive Pulmonary Disease (COPD)</b>	
Diag 518.81	ACUTE RESPIRATORY FAILURE
Diag 518.84	ACUTE AND CHRONIC RESPIRATORY FAILURE
Diag 584.5, 584.8, 584.9	ACUTE RENAL FAILURE
Diag 162.9	MALIGNANT NEOPLASM OF BRONCHUS AND LUNG, UNSPECIFIED
Diag 458.8, 458.9	HYPOTENSION, UNSP OR NEC
<b>Coronary Bypass Surgery</b>	
Diag 584.5, 584.8, 584.9 <i>not with 997.5 Urinary Complications</i>	ACUTE RENAL FAILURE
Proc 37.61	IMPLANT OF PULSATION BALLOON
Diag V45.1	POSTSURGICAL RENAL DIALYSIS STATUS
Diag 585.6	END STAGE RENAL DISEASE
Diag 410.01, 410.11, 410.21, 410.51, 410.61, 410.81, 410.91	ANTERIOR/LATERAL WALL AMI

<b>Coronary Interventional Procedures</b>	
Diag 410.01, 410.11, 410.21, 410.51, 410.61, 410.81, 410.91	ANTERIOR/LATERAL WALL AMI
Diag 410.31, 410.41	INFERIOR WALL AMI
Diag 584.5, 584.8, 584.9 <i>not with 997.5 Urinary Complications</i>	ACUTE RENAL FAILURE
Diag 426.0	ATRIOVENTRICULAR BLOCK, COMPLETE
Diag 410.71	ACUTE MYOCARDIAL INFARCTION, SUBENDOCARDIAL INFARCTION, INITIAL EPISODE OF CARE
<b>Diabetic Acidosis and Coma</b>	
Diag 518.81	ACUTE RESPIRATORY FAILURE
Diag 038, 038.0, 038.1, 038.10, 038.11, 038.19, 038.2, 038.3, 038.4, 038.40, 038.41, 038.42, 038.43, 038.44, 038.49, 038.8, 038.9	SEPSIS
Diag 250.31	DIABETES WITH OTHER COMA, TYPE I [JUVENILE TYPE], NOT STATED AS UNCONTROLLED
Diag 250.30	DIABETES WITH OTHER COMA, TYPE II OR UNSPECIFIED TYPE, NOT STATED AS UNCONTROLLED
Diag 578.9	HEMORRHAGE OF GASTROINTESTINAL TRACT, UNSPECIFIED
<b>Gastrointestinal Bleed</b>	
Diag 518.81	ACUTE RESPIRATORY FAILURE
Diag 785.59	OTHER SHOCK W/O MENTION OF TRAUMA
Diag 532.60	CHRONIC OR UNSPECIFIED DUODENAL ULCER W/ HEMORRHAGE AND PERFORATION, W/O MENTION OF OBSTRUCTION
Diag 276.2	ACIDOSIS
Diag 507.0	PNEUMONITIS DUE TO INHALATION OF FOOD OR VOMITUS
<b>Gastrointestinal Surgeries and Procedures</b>	
Proc 43.99	OTHER TOTAL GASTRECTOMY
Proc 43.7	PARTIAL GASTRECTOMY WITH ANASTOMOSIS TO JEJUNUM
Diag 038, 038.0, 038.1, 038.10, 038.11, 038.19, 038.2, 038.3, 038.4, 038.40, 038.41, 038.42, 038.43, 038.44, 038.49, 038.8, 038.9	SEPSIS
Proc 45.63	TOTAL REMOVAL OF SMALL INTESTINE
Proc 44.69	OTHER REPAIR OF STOMACH
<b>Heart Attack</b>	
Diag 518.81	ACUTE RESPIRATORY FAILURE
Proc 37.61	IMPLANT OF PULSATION BALLOON
Diag 410.01, 410.11, 410.21, 410.51, 410.61, 410.81, 410.91	ANTERIOR/LATERAL WALL AMI
Diag 276.2	ACIDOSIS
Diag 410.31, 410.41	INFERIOR WALL AMI
<b>Heart Failure</b>	
Diag 410.01, 410.11, 410.21, 410.51, 410.61, 410.81, 410.91	ANTERIOR/LATERAL WALL AMI
Diag 518.81	ACUTE RESPIRATORY FAILURE
Diag 507.0	PNEUMONITIS DUE TO INHALATION OF FOOD OR VOMITUS
Diag 458.8, 458.9	HYPOTENSION, UNSP OR NEC
Diag 585.6	END STAGE RENAL DISEASE

<b>Hip Fracture Repair</b>	
Diag 038, 038.0, 038.1, 038.10, 038.11, 038.19, 038.2, 038.3, 038.4, 038.40, 038.41, 038.42, 038.43, 038.44, 038.49, 038.8, 038.9	SEPSIS
Diag 507.0	PNEUMONITIS DUE TO INHALATION OF FOOD OR VOMITUS
Diag 276.2	ACIDOSIS
Diag 511.9	UNSPECIFIED PLEURAL EFFUSION
Diag 799.02	HYPOXEMIA
<b>Pancreatitis</b>	
Diag 458.8, 458.9	HYPOTENSION, UNSP OR NEC
Diag 507.0	PNEUMONITIS DUE TO INHALATION OF FOOD OR VOMITUS
Diag 038, 038.0, 038.1, 038.10, 038.11, 038.19, 038.2, 038.3, 038.4, 038.40, 038.41, 038.42, 038.43, 038.44, 038.49, 038.8, 038.9	SEPSIS
Diag 584.5, 584.8, 584.9 <i>not with 997.5 Urinary Complications</i>	ACUTE RENAL FAILURE
Diag 995.92	SEVERE SEPSIS
<b>Peripheral Vascular Bypass</b>	
Diag 682.6	CELLULITIS AND ABSCESS OF LEG, EXCEPT FOOT
Diag 480, 480.0, 480.1, 480.2, 480.3, 480.8, 480.9, 481, 482, 482.0, 482.1, 482.2, 482.3, 482.30, 482.31, 482.32, 482.39, 482.4, 482.40, 482.41, 482.49, 482.8, 482.81, 482.82, 482.83, 482.84, 482.89, 482.9, 483, 483.0, 483.1, 483.8, 484, 484.1, 484.3, 484.5, 484.6, 484.7, 484.8, 485, 486 <i>not with 997.3 Respiratory Complications</i>	PNEUMONIA
Diag 584.5, 584.8, 584.9 <i>not with 997.5 Urinary Complications</i>	ACUTE RENAL FAILURE
Diag 287.5	THROMBOCYTOPENIA, UNSPECIFIED
Diag 250.81	DIABETES WITH OTHER SPECIFIED MANIFESTATIONS, TYPE I [JUVENILE TYPE], NOT STATED AS UNCONTROLLED
<b>Pneumonia</b>	
Diag 518.81	ACUTE RESPIRATORY FAILURE
Diag 518.82	OTHER PULMONARY INSUFFICIENCY, NOT ELSEWHERE CLASSIFIED
Diag 162.9	MALIGNANT NEOPLASM OF BRONCHUS AND LUNG, UNSPECIFIED
Diag 038, 038.0, 038.1, 038.10, 038.11, 038.19, 038.2, 038.3, 038.4, 038.40, 038.41, 038.42, 038.43, 038.44, 038.49, 038.8, 038.9	SEPSIS
Diag 162.9	MALIGNANT NEOPLASM OF BRONCHUS AND LUNG, UNSPECIFIED
<b>Prostatectomy</b>	
Proc 60.3	SUPRAPUBIC PROSTATECTOMY
Diag 276.1	HYPOSMOLALITY AND/OR HYPONATREMIA
Proc 60.4	RETROPUBIC PROSTATECTOMY
Diag 287.5	THROMBOCYTOPENIA, UNSPECIFIED
Proc 60.5	RADICAL PROSTATECTOMY
<b>Pulmonary Embolism</b>	
Diag 518.81	ACUTE RESPIRATORY FAILURE
Diag 276.2	ACIDOSIS
Diag 458.8, 458.9	HYPOTENSION, UNSP OR NEC
Diag 162.9	MALIGNANT NEOPLASM OF BRONCHUS AND LUNG, UNSPECIFIED
Diag 585.6	END STAGE RENAL DISEASE

<b>Resection / Replacement of Abdominal Aorta</b>	
Proc 38.64	OTHER EXCISION OF AORTA
Diag 441.3	ABDOMINAL ANEURYSM, RUPTURED
Diag 557.0	ACUTE VASCULAR INSUFFICIENCY OF INTESTINE
Proc 38.34	RESECTION OF AORTA WITH ANASTOMOSIS
Diag 286.9	OTHER AND UNSPECIFIED COAGULATION DEFECTS
<b>Respiratory Failure</b>	
Diag 785.51	CARDIOGENIC SHOCK
Diag 785.50	SHOCK, UNSPECIFIED
Diag 162.9	MALIGNANT NEOPLASM OF BRONCHUS AND LUNG, UNSPECIFIED
Diag 410.01, 410.11, 410.21, 410.51, 410.61, 410.81, 410.91	ANTERIOR/LATERAL WALL AMI
Diag 434.91	UNSPECIFIED CEREBRAL ARTERY OCCLUSION WITH CEREBRAL INFARCTION
<b>Sepsis</b>	
Diag 410.01, 410.11, 410.21, 410.51, 410.61, 410.81, 410.91	ANTERIOR/LATERAL WALL AMI
Diag 557.0	ACUTE VASCULAR INSUFFICIENCY OF INTESTINE
Diag 518.81	ACUTE RESPIRATORY FAILURE
Diag 286.6	DEFIBRINATION SYNDROME
Diag 560.9	UNSPECIFIED INTESTINAL OBSTRUCTION
<b>Stroke</b>	
Diag 780.01	COMA
Diag 518.81	ACUTE RESPIRATORY FAILURE
Diag 432.9	UNSPECIFIED INTRACRANIAL HEMORRHAGE
Diag 410.01, 410.11, 410.21, 410.51, 410.61, 410.81, 410.91	ANTERIOR/LATERAL WALL AMI
Diag 431	INTRACEREBRAL HEMORRHAGE
<b>Total Hip Replacement</b>	
Diag 403.11, 403.91	NON-MALIGNANT RENAL DISEASE WITH FAILURE
Diag 287.5	THROMBOCYTOPENIA, UNSPECIFIED
Diag 428.0	CONGESTIVE HEART FAILURE, UNSPECIFIED
Diag 397.0	DISEASES OF TRICUSPID VALVE
Diag 496	CHRONIC AIRWAY OBSTRUCTION, NOT ELSEWHERE CLASSIFIED
<b>Total Knee Replacement</b>	
Diag 403.11, 403.91	NON-MALIGNANT RENAL DISEASE WITH FAILURE
Diag 585.9	CHRONIC KIDNEY DISEASE, UNSPECIFIED
Diag 250.02	DIABETES MELLITUS WITHOUT MENTION OF COMPLICATION, TYPE II OR UNSPECIFIED TYPE, UNCONTROLLED
Diag 428.0	CONGESTIVE HEART FAILURE, UNSPECIFIED
Proc 81.54	BILATERAL KNEE REPLACEMENT
<b>Valve Replacement Surgery</b>	
Proc 37.61	IMPLANT OF PULSATION BALLOON
Diag 584.5, 584.8, 584.9 <i>not with 997.5 Urinary Complications</i>	ACUTE RENAL FAILURE
Proc 35.27, 35.28	TRICUSPID VALVE REPLACEMENT
Diag V45.1	POSTSURGICAL RENAL DIALYSIS STATUS
Diag 996.61	INFECTION AND INFLAMMATORY REACTION DUE TO CARDIAC DEVICE, IMPLANT, AND GRAFT



## Appendix D: Methodology Enhancements for 2009 Ratings Models

The following changes were determined and implemented after input from outside coding and clinical experts. For the following service lines, we describe the major changes for each rated cohort and provide the rationale behind these changes.

### All Cohorts

Cohorts Affected	2009 Ratings' Model Change	Rationale for Change
All Cohorts	Exclude patients with history of kidney, lung, liver, bone marrow, pancreatic, and intestinal transplants.	Patients with a history of major organ transplants are immunosuppressed making them susceptible to complications and infections. The volume of these patients nationally is too low to adequately risk-adjust for their immunocompromised states.

### All Medical Cohorts

Cohorts Affected	2009 Ratings' Model Change	Rationale for Change
Heart Attack, Heart Failure Pneumonia, Chronic Obstructive Pulmonary Disease, Stroke, Gastrointestinal Bleed, Bowel Obstruction, Pancreatitis, Diabetic Acidosis and Comma, Respiratory Failure, Sepsis, Pulmonary Embolism	Exclude patients with a disposition code of discharge to hospice.	HealthGrades rates hospitals at three time periods: in-hospital, 30-days, and 180-days. Without having additional access to information about patient preferences and wishes, these patients cannot be adequately risk-adjusted for.

### Cardiac

Cohorts Affected	2009 Ratings' Model Change	Rationale for Change
Atrial Fibrillation	No longer rated.	While the optimal management of Atrial Fibrillation is very important, simply reporting its associated all-cause mortality may not be the best quality indicator. HealthGrades has decided to no longer rate atrial fibrillation until we can obtain access to better quality indicators, such as anticoagulation, rate control and stroke complications.

### Vascular

Cohorts Affected	2009 Ratings' Model Change	Rationale for Change
Abdominal Aortic Aneurysm	Exclude patients with a primary procedure code for resection of abdominal aorta, excision of the abdominal aorta or an endovascular graft that also have one of these procedures in the secondary position.	Patients having more than one of these procedures represent a low volume in the Medicare population as well as additional operative complexity and are difficult to adequately risk-adjust for.
Carotid Surgery	Exclude patients with a diagnosis code of subarachnoid hemorrhage.	The procedure code 39.72 includes coil embolization procedures as well as carotid endovascular grafting procedures. To exclude patients who are having coil embolization procedures, patients with a diagnosis code of subarachnoid hemorrhage have been excluded.

## Orthopedics

Cohorts Affected	2009 Ratings' Model Change	Rationale for Change
Total Hip Replacement	Exclude patients with a primary diagnosis of femur neck fractures.	In patients with femur neck fractures, Total Hip Replacement is a means to address the fracture repair. These patients are not representative of the elective Total Hip Replacement population.
Total Hip Replacement	Add new procedure codes for total and partial resurfacing procedures.	These are new ICD-9 codes added by Medicare in Oct 2006 to capture the resurfacing procedures for hip replacement.
Hip Fracture Repair	Exclude patients with femur shaft fractures from the cohort definition.	Femur fractures are technically very different from hip fractures and thus, are difficult to adequately risk-adjust for in the Hip Fracture Repair cohort.
Back and Neck and Fusion	Exclude patients with secondary bone cancer from cohort definition.	These patients represent a very low volume of patients in the Medicare back surgery population and are therefore, difficult to adequately risk-adjust for.