



The Fifth Annual  
HealthGrades  
Hospital Quality and Clinical  
Excellence Study

★ January 2007



HEALTHGRADES®  
GUIDING AMERICA TO BETTER HEALTHCARE™





HEALTHGRADES

## HealthGrades Fifth Annual Hospital Quality and Clinical Excellence Study January 2007

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### **Executive Summary**

For the fifth year in a row, HealthGrades researched the overall quality in almost 5,000 non-federal U.S. hospitals. This study identifies hospitals that earned the designation of Distinguished Hospital for Clinical Excellence™ based on risk-adjusted mortality and complication rates across a wide range of procedures and diagnoses, indicating institutional success in achieving high-quality outcomes.

HealthGrades' analysis is based on over 40 million Medicare hospital discharges in the years 2003, 2004 and 2005. We identify the top U.S. hospitals based on overall performance of risk-adjusted outcomes associated with the 28 common Medicare inpatient procedures and diagnoses. Of the 4,971 short-term, non-federal, non-children's, acute care hospitals, only 266 hospitals are designated as Distinguished Hospitals for Clinical Excellence™.

The Distinguished Hospitals for Clinical Excellence are then compared to all other U.S. hospitals to identify trends in outcomes, relative risk, and improvement over the years 2003, 2004 and 2005.

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### **Summary of Findings**

Key findings from this study include:

Distinguished Hospitals for Clinical Excellence outperformed all other hospitals across all procedures and diagnoses studied. During 2003-2005, they had:

- On average, **28 percent overall lower in-hospital risk-adjusted mortality** associated with the 16 procedures and diagnoses studied (*see Exhibit C*).

For the second year in a row, the top four areas associated with the greatest relative reduction in risk-adjusted in-hospital mortality associated with Distinguished Hospitals as compared to all other hospitals, were noted in:

- Diabetic Acidosis & Coma – approximately 40% lower
- Pancreatitis – approximately 36% lower
- Community Acquired Pneumonia – approximately 33% lower
- Heart Failure – approximately 32% lower
- On average, **5 percent overall lower in-hospital risk-adjusted complications** associated with the 10 procedures studied (*see Exhibit D*).

The top three areas associated with the greatest relative reduction in risk-adjusted in-hospital complications associated with Distinguished Hospitals as compared to all other hospitals, were noted in:

- Hip Fracture Repair – approximately 11% lower
- Partial Hip Replacement – approximately 10% lower
- Prostatectomy – approximately 8% lower

When extrapolated, assuming all patients with any of the 26 conditions studied were treated at Distinguished Hospitals for Clinical Excellence during 2003-2005, **158,264 lives may have been saved** and **12,410 patients may have avoided an in-hospital complication** (see Exhibits C and D).

On average, Distinguished Hospitals for Clinical Excellence improved overall by **11.74 percent in in-hospital risk-adjusted mortality** and **3.39 percent in in-hospital risk-adjusted complications** from 2003 to 2005 (see Exhibits C and D).

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## Introduction

As changes to healthcare coverage give consumers more responsibility for choosing where they seek care, the call for transparency is gaining momentum and attention. In turn, the government, public and private organizations and insurers are expected to identify and publicly display where patients can access high quality healthcare.

In the past decade, compelling evidence has indicated that a serious gap continues to persist within the quality spectrum of healthcare provided in America. This difference is caused by variability in hospital performance, specifically in in-hospital mortality and in-hospital complications where there continues to be a clear delineation between two tiers of hospital providers—those who reach clinical excellence and all other hospitals across the nation. With the increasing national focus on quality transparency and accountability, the demand for accessible hospital quality information will continue to increase.

Each year, HealthGrades meets this increasing demand by researching and profiling the quality in almost 5,000 U.S. hospitals across 30 procedures and diagnoses. Over 2.5 million users a month access the free ratings published on its website, [www.HealthGrades.com](http://www.HealthGrades.com). In addition to assessing each of the nation's hospital's quality annually, HealthGrades researches and identifies the top performing hospitals in the U.S., based on comparing what is expected to occur at each facility to the observed complication and mortality rates across 28 of the 30 procedures and diagnoses. This elite group of hospitals is designated as the 2007 Distinguished Hospitals for Clinical Excellence™ (DH-CE). For the full list of the 266 recipients, see Exhibit A or [www.HealthGrades.com](http://www.HealthGrades.com). For a listing of percentage of DH-CE recipients by state, see Exhibit B.

This study assesses and compares quality outcomes and trends of Distinguished Hospitals for Clinical Excellence (DH-CE) to all other U.S. hospitals across 26 of the 30 procedures and diagnoses rated by HealthGrades. The 26 cohorts in this study are some of the most common procedures and diagnoses among Medicare beneficiaries 65 years and older during the years 2003, 2004 and 2005.

The four procedures and diagnoses not included in this study are:

- Appendectomy and Bariatrics – These procedures are not included because this study is based on the Medicare patient population only and because HealthGrades only rates these two procedures for seventeen states where all payer data is publicly available.
- Gastrointestinal Surgery and Respiratory Failure – This procedure and diagnosis is not included because the 26 procedures and diagnoses used in this study are based on a logistic regression methodology, whereas the risk adjustment for this procedure and diagnosis is based upon APR-DRG

methodology. (APR-DRG stands for All Patient Refined Diagnosis Related Group and is a methodology developed by 3M™ Corporation. All copyrights in and to APR-DRGs are owned by 3M™.) This methodology is described in the APR-DRG-Based Ratings section of *Exhibit E*.

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## 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 process:

- Mortality and Complication Based Outcomes Methodology
- Distinguished Hospital Award – Clinical Excellence™ Methodology

This study concentrates on the 26 procedures and diagnoses for which HealthGrades has developed a predictive logistic regression model. The 26 procedures and diagnoses in this study are as follows.

- Atrial Fibrillation
- Back and Neck Surgery (Spinal Fusion)
- Back and Neck Surgery (except Spinal Fusion)
- Bowel Obstruction
- Carotid Endarterectomy
- Cholecystectomy
- Chronic Obstructive Pulmonary Disease (COPD)
- Community Acquired Pneumonia
- Coronary Bypass Surgery
- Coronary Interventional Procedures
- Diabetic Acidosis and Coma
- Gastrointestinal Bleed
- Heart Attack
- Heart Failure
- Hip Fracture Repair
- Pancreatitis
- Partial Hip Replacement
- Peripheral Vascular Bypass
- Prostatectomy
- Pulmonary Embolism
- Resection / Replacement of Abdominal Aorta
- Sepsis
- Stroke
- Total Hip Replacement
- Total Knee Replacement
- Valve Replacement Surgery

## Mortality and Complication Based Outcomes 2007 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 purchases the initial data from the Centers for Medicare and Medicaid Services (CMS). The Medicare data (MedPAR file) from CMS contained the 40 million inpatient records for Medicare patients. The ratings for 28 procedures and diagnoses are based upon the HealthGrades methodology described in the *Multivariate Logistic Regression-Based Ratings* section of *Exhibit E*.

The purpose of risk adjustment is to obtain fair statistical comparisons between 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.

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 2007 Methodology White Paper* (or see *Exhibit E*).

## **Distinguished Hospital Award – Clinical Excellence™ 2007 Methodology**

For the Distinguished Hospital Award for Clinical Excellence™, hospitals were segregated into two groups:

- Teaching hospitals
- Non-teaching hospitals (which were further segmented by size with community hospitals being fewer than 200 beds)

To be considered for the Distinguished Hospital Award for Clinical Excellence (DHA-CE), a hospital had to have had in-hospital mortality or complication ratings in at least 22 of the 28 HealthGrades 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 star rating for each hospital by averaging all their MedPAR-based ratings.
- 2 Calculated the average z-score from all cohorts.
- 3 Ranked hospitals in descending order by their average star rating within the two groups: teaching and non-teaching.
- 4 Broke ranking ties by average z-score.
- 5 Selected the top 20 percent of hospitals from each group.
- 6 Excluded hospitals whose average star was less than 3.30.
- 7 Designated the hospitals that remained on the list as the 2007 DHA-CE recipients.

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

Another purpose of the study is to evaluate the variation in in-hospital mortality or complications across 26 procedures and diagnoses.

The actual (observed) and predicted (expected) mortality rates are calculated for each of the 26 procedures and diagnoses 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 procedure and diagnoses.

With sicker patients having higher associated observed mortality, the observed (O) to expected (E) ratios are calculated by procedure or diagnosis, by year, for both groups of hospitals, and unadjusted (observed) mortality rates are also evaluated for trends.

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

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## Results

Distinguished Hospitals for Clinical Excellence (DH-CE) consistently demonstrated significantly lower risk-adjusted in-hospital mortality compared to all other hospitals during the years 2003, 2004 and 2005. During the three years studied, DH-CE performed, on average, **28 percent** better than all other hospitals in in-hospital risk-adjusted mortality associated with cardiac surgery, angioplasty and stent, heart attack and heart failure, atrial fibrillation, chronic obstructive pulmonary disease, community acquired pneumonia, stroke, abdominal aortic aneurysm repair, bowel obstruction, gastrointestinal bleed, pancreatitis, diabetic acidosis and coma, pulmonary embolism, and sepsis (*see Exhibit C*).

### On Average, DH-CE had 28 Percent Lower Risk-Adjusted In-hospital Mortality.

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

Table 1 Relative Reduction in Risk-adjusted Mortality Associated with DH-CE Compared to All Other Hospitals	
Diabetic Acidosis & Coma	40.63%
Pancreatitis	36.27%
Community Acquired Pneumonia	33.11%
Heart Failure	32.23%

### On Average, DH-CE Performed 5 percent Better in In-hospital Complications.

Similar trends were also noted when evaluating in-hospital risk-adjusted complications. Overall, Distinguished Hospitals for Clinical Excellence (DH-CE) demonstrated lower risk-adjusted in-hospital complications compared to all other hospitals during 2003-2005. During the three years studied, DH-CE performed, on average, 5 percent better than all other hospitals in in-hospital complications associated with orthopedic and neurosurgery, vascular surgery, prostate surgery, and gall bladder surgery (*see Exhibit D*).

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

Table 2 Relative Reduction in Risk-adjusted Complications Associated with DH-CE Compared to All Other Hospitals	
Hip Fracture Repair	11.25%
Partial Hip Replacement	10.61%
Prostatectomy	8.43%

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

Even though Distinguished Hospitals for Clinical Excellence (DH-CE) had significantly lower in-hospital risk-adjusted mortality and complications for all three years studied, they also improved at a greater rate than all other hospitals. DH-CE risk-adjusted in-hospital mortality and complications improved by 11.74 percent (mortality) and 3.39 percent (complications) between the years 2003 and 2005 (compared to All Other hospitals that had an improvement rate by 11.11 percent and 1.47 percent respectively).

Despite these apparent differences in rates of improvement, both DH-CE and all other hospitals had the greatest improvements in these areas (see Exhibits C and D):

- Community Acquired Pneumonia
- Pancreatitis
- Pulmonary Embolism
- Hip Fracture Repair
- Partial Hip Replacement

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## ***Interpretation of Results***

As a group, Distinguished Hospitals for Clinical Excellence outperformed all other U.S. hospitals across all 26 procedures and diagnoses studied. Among the Medicare beneficiaries admitted to U.S. hospitals during 2003-2005, **158,264 lives may have been saved** and **12,410 patients may have avoided a major complication** if they had been treated at Distinguished Hospitals for Clinical Excellence.

Distinguished Hospitals for Clinical Excellence made a big impact during the three-year study period. Not only did they have lower risk-adjusted mortality and complications for all three years studied, but overall they continued to outpace all other hospitals by improving their already better-than-expected outcomes more than all other hospitals. Realizing that it is extremely difficult to be perfect in all cohorts studied, we do believe that in the aggregate, these hospitals explicitly define exceptional quality by demonstrating consistency and dedication to continually raising the standards within the medical arena and by the strong commitment among executive leadership to improve patient care.

In conclusion, our study identified an overall quality benchmark that is quite high but demonstrably achievable by an elite group of distinguished hospitals. By identifying these Distinguished Hospitals for Clinical Excellence, HealthGrades is providing an objective measurement of overall quality and with statistical significance, and identifying those hospitals that have the most impact on quality healthcare. The benchmark set by the 266 top performing hospitals in the nation can be used by payers, employees, employers, physicians and patients to make informed choices about where to receive the highest overall quality of healthcare. Hospitals are encouraged to utilize the analysis and results of this study as a catalyst to assess their quality endeavors.

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

### Teaching Distinguished Hospitals for Clinical Excellence™\*

DH-CE Teaching Hospitals	City	State
Abbott Northwestern Hospital	Minneapolis	MN
Advocate Lutheran General Hospital	Park Ridge	IL
Advocate Illinois Masonic Medical Center	Chicago	IL
Akron General Medical Center	Akron	OH
Alta Bates Summit - Summit Campus	Oakland	CA
Aspirus Wausau Hospital	Wausau	WI
Avera McKennan Hospital and University Health Center	Sioux Falls	SD
Baptist Medical Center	Jacksonville	FL
Bethesda North Hospital	Cincinnati	OH
Bon Secours Hospital	Grosse Pointe	MI
Broward General Medical Center	Fort Lauderdale	FL
Cape Fear Valley Health System	Fayetteville	NC
Cedars-Sinai Medical Center	Los Angeles	CA
Charleston Area Medical Center	Charleston	WV
CJW Medical Center	Richmond	VA
Christ Hospital	Cincinnati	OH
Christiana Care Health System - Christiana	Newark	DE
Christus Santa Rosa Healthcare	San Antonio	TX
Christus Spohn Hospital Memorial	Corpus Christi	TX
Cleveland Clinic Hospital	Cleveland	OH
Community Health Partners	Lorain	OH
Conemaugh Memorial Medical Center	Johnstown	PA
Danbury Hospital	Danbury	CT
Del E Webb Memorial Hospital	Sun City West	AZ
Easton Hospital	Easton	PA
Ellis Hospital	Schenectady	NY
Evanston Hospital	Evanston	IL
Fairview Hospital	Cleveland	OH
Florida Hospital	Orlando	FL
Franklin Square Hospital Center	Baltimore	MD
Genesys Regional Medical Center	Grand Blanc	MI
Glendale Adventist Medical Center	Glendale	CA
Good Samaritan Hospital	Los Angeles	CA
Good Samaritan Hospital of Maryland	Baltimore	MD
Grandview Hospital and Medical Center	Dayton	OH
Greater Baltimore Medical Center	Baltimore	MD
Hackensack University Medical Center	Hackensack	NJ
Hamot Medical Center	Erie	PA
Hillcrest Hospital	Mayfield Heights	OH
Huntington Memorial Hospital	Pasadena	CA
Inova Fairfax Hospital	Falls Church	VA

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DH-CE Teaching Hospitals* (continued)	City	State
Jersey Shore University Medical Center	Neptune	NJ
Jewish Hospital	Louisville	KY
Kendall Regional Medical Center	Miami	FL
Kettering Medical Center	Kettering	OH
Lancaster General Hospital	Lancaster	PA
Lankenau Hospital	Wynnewood	PA
Lehigh Valley Hospital	Allentown	PA
Lehigh Valley Hospital-Muhlenberg	Bethlehem	PA
Lutheran Hospital of Indiana	Fort Wayne	IN
Maimonides Medical Center	Brooklyn	NY
Mayo Clinic Hospital	Phoenix	AZ
McAllen Heart Hospital	McAllen	TX
Memorial Health University Medical Center	Savannah	GA
Memorial Hermann Southwest Hospital	Houston	TX
Mercy General Health Partners	Muskegon	MI
Mercy Hospital	Miami	FL
Mercy Hospital	Coon Rapids	MN
Mercy Hospital and Medical Center	Chicago	IL
Mercy Hospital of Scranton	Scranton	PA
Mercy Medical Center	Des Moines	IA
Methodist Hospital	Minneapolis	MN
Miami Valley Hospital	Dayton	OH
MidMichigan Medical Center	Midland	MI
Midwest Regional Medical Center	Midwest City	OK
Mission Hospitals Memorial Campus	Asheville	NC
Missouri Baptist Medical Center	St. Louis	MO
Monmouth Medical Center	Long Branch	NJ
Morton Plant Hospital	Clearwater	FL
Munson Medical Center	Traverse City	MI
New York Presbyterian Hospital/Weill Cornell	New York	NY
Newton Wellesley Hospital	Newton	MA
North Memorial Health Care	Robbinsdale	MN
North Shore Medical Center Salem Hospital	Salem	MA
Oakwood Hospital and Medical Center	Dearborn	MI
Ohio State University Hospital East	Columbus	OH
Pennsylvania Hospital	Philadelphia	PA
Penrose - St Francis Health Services	Colorado Springs	CO
Piedmont Hospital	Atlanta	GA
Poudre Valley Hospital	Fort Collins	CO
Presbyterian Intercommunity Hospital	Whittier	CA
Providence Hospital	Southfield	MI
Reading Hospital and Medical Center	West Reading	PA
Robert Wood Johnson University Hospital	New Brunswick	NJ
Rose Medical Center	Denver	CO

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DH-CE Teaching Hospitals* (continued)	City	State
Rush North Shore Medical Center	Skokie	IL
Saint Barnabas Medical Center	Livingston	NJ
Saint Joseph Hospital	Chicago	IL
Saint Joseph's Hospital	Marshfield	WI
Scottsdale Healthcare Osborn	Scottsdale	AZ
Scottsdale Healthcare Shea	Scottsdale	AZ
Sentara Virginia Beach General Hospital	Virginia Beach	VA
Shawnee Mission Medical Center	Shawnee Mission	KS
Sibley Memorial Hospital	Washington	DC
Sinai Grace Hospital	Detroit	MI
Sioux Valley Hospital USD Medical Center	Sioux Falls	SD
South Miami Hospital	South Miami	FL
South Pointe Hospital	Warrensville Heights	OH
Southwest General Health Center	Middleburg Heights	OH
St Alexius Medical Center	Hoffman Estates	IL
St Elizabeth Health Center	Youngstown	OH
St Elizabeth Medical Center South	Edgewood	KY
St Francis Hospital and Health Center	Blue Island	IL
St John Macomb Hospital	Warren	MI
St John West Shore Hospital	Westlake	OH
St John's Hospital	Maplewood	MN
St Joseph Mercy Oakland	Pontiac	MI
St Joseph's Hospital	St. Paul	MN
St Joseph's Mercy of Macomb East	Clinton Township	MI
St Luke's Episcopal Hospital	Houston	TX
St Luke's Hospital	Jacksonville	FL
St Luke's Hospital	Duluth	MN
St Luke's Hospital	Chesterfield	MO
St Luke's Hospital-Bethlehem Campus	Bethlehem	PA
St Luke's Methodist Hospital	Cedar Rapids	IA
St Mark's Hospital	Salt Lake City	UT
St Mary's Hospital of Rochester	Rochester	MN
St Mary's Medical Center	Duluth	MN
St Vincent Charity Hospital	Cleveland	OH
St Vincent Health System	Little Rock	AR
St Vincent Medical Center	Los Angeles	CA
St Vincent Mercy Medical Center	Toledo	OH
St Vincent's Medical Center	Jacksonville	FL
Suburban Hospital	Bethesda	MD
Summa Health Systems Hospitals	Akron	OH
Swedish Covenant Hospital	Chicago	IL
Swedish Medical Center	Seattle	WA
The Jewish Hospital	Cincinnati	OH
Toledo Hospital and Toledo Children's Hospital	Toledo	OH
UCLA Medical Center	Los Angeles	CA
UHHS Bedford Medical Center	Bedford	OH

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DH-CE Teaching Hospitals* (continued)	City	State
UPMC McKeesport	McKeesport	PA
Valley Baptist Health System	Harlingen	TX
Via Christi Regional Medical Center	Wichita	KS
Virginia Baptist Hospital	Lynchburg	VA
Walter O Boswell Memorial Hospital	Sun City	AZ
West Suburban Hospital Medical Center	Oak Park	IL
Westside Regional Medical Center	Plantation	FL
William Beaumont Hospital	Royal Oak	MI
William Beaumont Hospital Troy	Troy	MI
Willis-Knighton Medical Center	Shreveport	LA
Winchester Medical Center	Winchester	VA
Yale New Haven Hospital	New Haven	CT

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### Non-Teaching Distinguished Hospitals for Clinical Excellence™\*

DH-CE Non-Teaching Hospitals*	City	State
Advocate Good Samaritan Hospital	Downers Grove	IL
Alexian Brothers Medical Center	Elk Grove Village	IL
Alle Kiski Medical Center	Natrona Heights	PA
Alta Bates Summit Campus	Berkeley	CA
Baptist Hospital East	Louisville	KY
Baptist Hospital of Miami	Miami	FL
Bay Medical Center	Panama City	FL
Bayshore Medical Center	Pasadena	TX
Benefis Healthcare East Campus	Great Falls	MT
Bethesda Memorial Hospital	Boynton Beach	FL
Boca Raton Community Hospital	Boca Raton	FL
Brandon Regional Hospital	Brandon	FL
Central DuPage Hospital	Winfield	IL
Central Florida Regional Hospital	Sanford	FL
Centra State Medical Center	Freehold	NJ
Chesapeake General Hospital	Chesapeake	VA
Citrus Valley Medical Center Queen of the Valley Campus	West Covina	CA
Clear Lake Regional Medical Center	Webster	TX
Community Hospital	Munster	IN
Community Medical Center	Toms River	NJ
Delray Medical Center	Delray Beach	FL
El Camino Hospital	Mountain View	CA
Elmhurst Memorial Hospital	Elmhurst	IL
Fairview Southdale Hospital	Edina	MN
Fawcett Memorial Hospital	Port Charlotte	FL
Flagler Hospital	St. Augustine	FL
Florida Hospital Oceanside	Ormond Beach	FL

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DH-CE Non-Teaching Hospitals* (continued)	City	State
Florida Hospital Waterman	Tavares	FL
Florida Medical Center	Fort Lauderdale	FL
Garfield Medical Center	Monterey Park	CA
Glendale Memorial Hospital and Health Center	Glendale	CA
Good Samaritan Medical Center	West Palm Beach	FL
Good Shepherd Medical Center	Longview	TX
Henrico Doctors' Hospital	Richmond	VA
Hoag Memorial Hospital Presbyterian	Newport Beach	CA
Holmes Regional Medical Center	Melbourne	FL
Holy Cross Hospital	Fort Lauderdale	FL
Holy Name Hospital	Teaneck	NJ
Ingalls Hospital	Harvey	IL
Inova Alexandria Hospital	Alexandria	VA
John Muir Medical Center Concord	Concord	CA
John Muir Medical Center Walnut Creek	Walnut Creek	CA
Lawnwood Regional Medical Center and Heart Institute	Fort Pierce	FL
Lee Memorial Health System	Fort Myers	FL
Lewis Gale Medical Center	Salem	VA
Martin Memorial Health Systems Inc	Stuart	FL
Marymount Hospital	Garfield Heights	OH
Memorial Health Care System	Chattanooga	TN
Munroe Regional Medical Center	Ocala	FL
NCH Health Care Systems	Naples	FL
Northeast Georgia Medical Center	Gainesville	GA
Northern Westchester Hospital Center	Mount Kisco	NY
Northwest Community Health Care	Arlington Heights	IL
Oak Hill Hospital	Brooksville	FL
Ocala Regional Medical Center	Ocala	FL
Palm Beach Gardens Medical Center	Palm Beach Gardens	FL
Palos Community Hospital	Palos Heights	IL
Parkwest Medical Center	Knoxville	TN
Parma Community General Hospital	Parma	OH
Providence Everett Medical Center	Everett	WA
Regency Hospital Of Cincinnati, LLC	Cincinnati	OH
Rex Health Care	Raleigh	NC
Rio Grande Regional Hospital	McAllen	TX
Robert Wood Johnson University Hospital	Hamilton	NJ
Rockingham Memorial Hospital	Harrisonburg	VA
Saint John's Health Center	Santa Monica	CA
Saint John's Health System	Anderson	IN
Sarasota Memorial Hospital	Sarasota	FL
Sempercare Hospital of Belleville	Belleville	NJ
Sequoia Hospital	Redwood City	CA
Seton Highland Lakes	Burnet	TX
Shady Grove Adventist Hospital	Rockville	MD

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DH-CE Non-Teaching Hospitals* (continued)	City	State
Sharp Chula Vista Medical Center	Chula Vista	CA
South Shore Hospital	South Weymouth	MA
SSM St Joseph Health Center	St. Charles	MO
St John's Regional Medical Center	Oxnard	CA
St Joseph's Hospital	Tampa	FL
St Joseph's Hospital of Atlanta	Atlanta	GA
St Mary Mercy Hospital	Livonia	MI
St Mary's Health System	Knoxville	TN
Valley Baptist Medical Center of Brownsville	Brownsville	TX

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## Community Distinguished Hospitals for Clinical Excellence™\*

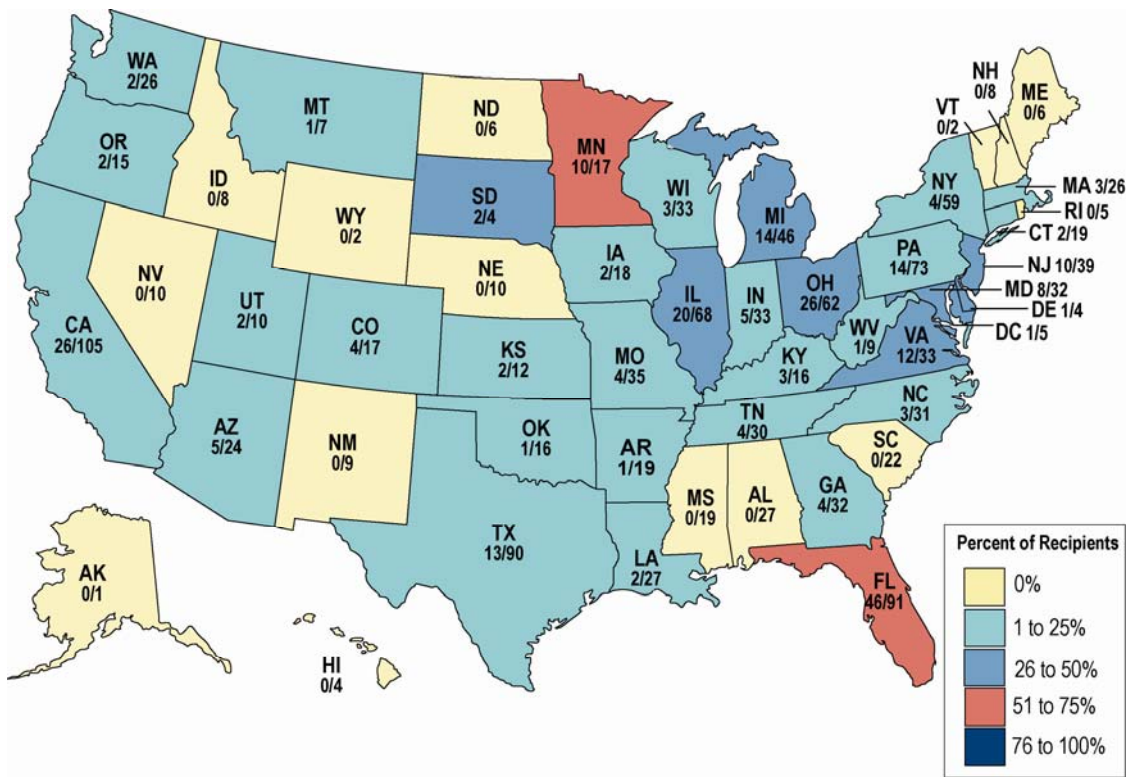
DH-CE Community Hospitals*	City	State
Advocate Good Shepherd Hospital	Barrington	IL
Advocate South Suburban Hospital	Hazel Crest	IL
Augusta Medical Center	Fishersville	VA
Beverly Hospital	Montebello	CA
Centegra Memorial Medical Center	Woodstock	IL
Charlotte Regional Medical Center	Punta Gorda	FL
Cleveland Clinic Florida Hospital Naples	Naples	FL
Community Health Care System St Catherine	East Chicago	IN
Cookeville Regional Medical Center	Cookeville	TN
Cottonwood Hospital and Medical Center	Murray	UT
Crittenton Hospital Medical Center	Rochester	MI
Doctors Community Hospital	Lanham	MD
Eden Medical Center San Leandro Hospital	San Leandro	CA
Ephrata Community Hospital	Ephrata	PA
Euclid Hospital	Euclid	OH
Florida Hospital Fish Memorial	Orange City	FL
Florida Hospital Heartland Medical Center	Sebring	FL
Floyd Memorial Hospital and Health Services	New Albany	IN
Fort Walton Beach Medical Center	Fort Walton Beach	FL
Hackley Hospital	Muskegon	MI
Helen Ellis Memorial Hospital	Tarpon Springs	FL
Jupiter Medical Center	Jupiter	FL
Lakewood Hospital	Lakewood	OH
Los Robles Hospital and Medical Center	Thousand Oaks	CA
Marshall Hospital	Placerville	CA
Mease Countryside Hospital	Safety Harbor	FL
Memorial Regional Medical Center	Mechanicsville	VA
Mercy Medical Center	Roseburg	OR
Peace River Regional Medical Center	Port Charlotte	FL
Port Huron Hospital	Port Huron	MI
Porter Adventist Hospital	Denver	CO
Providence Holy Cross Medical Center	Mission Hills	CA

DH-CE Community Hospitals* (continued)	City	State
Providence Medford Medical Center	Medford	OR
Sacred Heart Hospital	Cumberland	MD
Scripps Memorial Hospital Encinitas	Encinitas	CA
Sebastian River Medical Center	Sebastian	FL
Skaggs Community Health Center	Branson	MO
South Bay Hospital	Sun City Center	FL
Texoma Medical Center	Denison	TX
Theda Clark Medical Center	Neenah	WI
Upper Chesapeake Medical Center	Bel Air	MD
Willis Knighton Bossier Health Center	Bossier City	LA

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## Exhibit B: Percentage of DH-CE Recipients by State

Number of DH-CE Recipients / Number of Eligible Hospitals



State	Percent of Recipients	DH-CE Recipients	Eligible Hospitals
AK	0.00%	0	1
AL	0.00%	0	27
AR	5.26%	1	19
AZ	20.83%	5	24
CA	24.76%	26	105
CO	23.53%	4	17
CT	10.53%	2	19
DC	20.00%	1	5
DE	25.00%	1	4
FL	50.55%	46	91
GA	12.50%	4	32
HI	0.00%	0	4
IA	11.11%	2	18
ID	0.00%	0	8
IL	29.41%	20	68
IN	14.29%	5	35
KS	16.67%	2	12
KY	18.75%	3	16
LA	7.41%	2	27
MA	11.54%	3	26
MD	25.00%	8	32
ME	0.00%	0	6
MI	36.96%	17	46
MN	58.82%	10	17
MO	11.43%	4	35

State	Percent of Recipients	DH-CE Recipients	Eligible Hospitals
MS	0.00%	0	19
MT	14.29%	1	7
NC	9.68%	3	31
ND	0.00%	0	6
NE	0.00%	0	10
NH	0.00%	0	8
NJ	25.64%	10	39
NM	0.00%	0	9
NV	0.00%	0	10
NY	6.78%	4	59
OH	41.94%	26	62
OK	6.25%	1	16
OR	13.33%	2	15
PA	19.18%	14	73
RI	0.00%	0	5
SC	0.00%	0	22
SD	50.00%	2	4
TN	13.33%	4	30
TX	14.44%	13	90
UT	20.00%	2	10
VA	36.36%	12	33
VT	0.00%	0	2
WA	7.69%	2	26
WI	9.09%	3	33

**Exhibit C: 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: 2003-2005)**

Diagnosis or Procedure	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 Treated at DH-CE Hospitals (2003-2005) <sup>4</sup>	P-Value (DH-CE Hospital Mortality Compared to National Mortality Average)
Coronary Artery Bypass Surgery	2003	119,803	0.83		1.14				<.001
	2004	110,046	0.79		1.08				<.001
	2005	103,199	0.83		0.95				<.001
	2003-2005	333,048	0.82	-0.02%	1.06	16.73%	23.13%	1,898	<.001
Valve Replacement Surgery	2003	37,259	0.89		1.17				<.001
	2004	37,869	0.81		1.06				<.001
	2005	37,617	0.70		1.01				<.001
	2003-2005	112,745	0.80	20.97%	1.08	13.14%	25.90%	1,696	<.001
Coronary Interventional Procedures (Angioplasty/ Stent)	2003	320,922	0.73		.96				<.001
	2004	344,924	0.84		1.09				<.001
	2005	343,729	0.89		1.14				<.001
	2003-2005	1,009,575	0.81	-21.36%	1.06	-19.13%	23.23%	3,347	<.001
Heart Attack	2003	301,698	0.86		1.05				<.001
	2004	293,466	0.84		1.05				<.001
	2005	277,722	0.79		1.01				<.001
	2003-2005	872,886	0.83	8.06%	1.04	3.63%	20.22%	17,752	<.001
Heart Failure	2003	667,291	0.79		1.13				<.001
	2004	679,150	0.72		1.06				<.001
	2005	663,028	0.66		1.01				<.001
	2003-2005	2,009,469	0.72	17.38%	1.06	10.83%	32.23%	25,266	<.001



Diagnosis or Procedure	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 Treated at DH-CE Hospitals (2003-2005) <sup>4</sup>	P-Value (DH-CE Hospital Mortality Compared to National Mortality Average)
Atrial Fibrillation	2003	185,581	0.84		1.16				<.001
	2004	186,758	0.72		1.02				<.001
	2005	187,385	0.65		1.02				<.001
	2003-2005	559,724	0.73	22.25%	1.06	11.74%	31.14%	2,150	<.001
Chronic Obstructive Pulmonary Disease (COPD)	2003	344,723	0.78		1.12				<.001
	2004	360,866	0.71		1.04				<.001
	2005	377,382	0.67		1.01				<.001
	2003-2005	1,082,971	0.72	13.11%	1.05	8.98%	31.77%	7,625	<.001
Community Acquired Pneumonia	2003	527,692	0.79		1.14				<.001
	2004	563,347	0.71		1.05				<.001
	2005	572,950	0.61		0.95				<.001
	2003-2005	1,663,989	0.70	22.77%	1.05	16.44%	33.11%	30,006	<.001
Stroke	2003	276,015	0.82		1.09				<.001
	2004	267,214	0.79		1.05				<.001
	2005	262,478	0.75		1.00				<.001
	2003-2005	805,707	0.79	7.71%	1.05	8.26%	24.84%	19,259	<.001
Resection/Replacement of Abdominal Aorta	2003	18,956	0.88		1.15				.036
	2004	20,556	0.87		0.95				.018
	2005	21,611	0.82		1.00				.002
	2003-2005	61,123	0.86	7.07%	1.04	12.99%	17.16%	540	<.001
Bowel Obstruction	2003	170,734	0.85		1.11				<.001
	2004	170,588	0.78		1.04				<.001
	2005	170,584	0.73		0.98				<.001
	2003-2005	511,906	0.78	15.03%	1.05	11.66%	25.17%	6,551	<.001
Gastrointestinal Bleed	2003	289,828	0.78		1.13				<.001
	2004	294,134	0.76		1.06				<.001
	2005	285,924	0.67		0.99				<.001
	2003-2005	869,886	0.73	14.07%	1.06	12.73%	30.64%	7,363	<.001

Diagnosis or Procedure	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 Treated at DH-CE Hospitals (2003-2005) <sup>4</sup>	P-Value (DH-CE Hospital Mortality Compared to National Mortality Average)
Pancreatitis	2003	54,164	0.76		1.22				<.001
	2004	55,748	0.66		1.08				<.001
	2005	53,220	0.63		0.92				<.001
	2003-2005	163,132	0.68	17.85%	1.07	24.73%	36.27%	1,703	<.001
Diabetic Acidosis and Coma	2003	94,443	0.66		1.17				<.001
	2004	98,337	0.63		1.06				<.001
	2005	101,203	0.61		0.97				<.001
	2003-2005	293,983	0.63	6.85%	1.07	17.71%	40.63%	1,766	<.001
Pulmonary Embolism	2003	42,648	0.85		1.19				<.001
	2004	45,749	0.76		1.07				<.001
	2005	50,232	0.60		0.97				<.001
	2003-2005	138,629	0.73	28.85%	1.07	18.63%	31.56%	2,209	<.001
Sepsis	2003	183,485	0.82		1.10				<.001
	2004	208,291	0.81		1.07				<.001
	2005	253,101	0.76		1.00				<.001
	2003-2005	644,877	0.79	7.19%	1.05	8.45%	24.66%	29,133	<.001
<b>Totals</b>		<b>11,133,650</b>		<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>158,264</b>	
<b>3-Year Performance Averages</b>			<b>0.76</b>	<b>11.74%</b>	<b>1.06</b>	<b>11.11%</b>	<b>28.23%</b>		

<sup>1</sup> Percent improvement determines improvement over time (2003 to 2005) for aggregate DH-CE hospitals. Calculated as follows: (O/E for 2003 – O/E for 2005) / (O/E for 2003) where the O/E is for the DH-CE hospitals.

<sup>2</sup> Percent improvement determines improvement over time (2003 to 2005) for aggregate Non-DH-CE hospitals. Calculated as follows: (O/E for 2003 – O/E for 2005) / (O/E for 2003) 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 D: 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: 2003-2005)**

Diagnosis or Procedure	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 $\geq 1$ Post-Op Complications If All Patients Treated at DH-CE Hospitals (2003-2005) <sup>4</sup>	P-Value (DH-CE Hospital Complications Compared to National Complication Average)
Total Knee Replacement	2003	191,269	1.05		1.03				.994
	2004	216,871	0.98		0.98				.195
	2005	242,238	0.93		1.00				<.001
	2003-2005	650,378	0.98	11.00%	1.00	2.90%	1.99%	757	.063
Total Hip Replacement	2003	93,172	1.01		1.02				.637
	2004	99,461	0.94		0.99				.006
	2005	102,097	0.94		1.02				.006
	2003-2005	294,730	0.96	6.96%	1.01	0.32%	4.95%	932	.003
Hip Fracture Repair	2003	128,798	0.97		1.04				.126
	2004	128,595	0.88		1.01				<.001
	2005	126,309	0.86		1.01				<.001
	2003-2005	383,702	0.90	11.47%	1.02	3.35%	11.25%	3,641	<.001
Partial Hip Replacement	2003	75,967	0.99		1.06				.431
	2004	76,113	0.88		0.99				<.001
	2005	74,463	0.86		0.99				<.001
	2003-2005	226,543	0.91	13.66%	1.02	6.51%	10.61%	2,443	<.001
Back and Neck Surgery (without Spinal Fusion)	2003	70,084	0.97		1.00				.079
	2004	71,431	0.97		1.00				.127
	2005	69,156	1.00		1.00				.471
	2003-2005	210,671	0.98	-3.38%	1.01	-0.69%	2.69%	477	.066
Spinal Fusion	2003	44,976	0.96		0.98				.043
	2004	50,321	0.99		1.01				.280
	2005	55,263	1.00		1.02				.557
	2003-2005	150,560	0.98	-4.62%	1.00	-4.00%	2.08%	417	.112

Diagnosis or Procedure	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 Treated at DH-CE Hospitals (2003-2005) <sup>4</sup>	P-Value (DH-CE Hospital Complications Compared to National Complication Average)
Carotid Endarterectomy	2003	102,228	0.86		1.03				.043
	2004	104,305	0.90		1.03				.619
	2005	111,276	0.91		1.02				.851
	2003-2005	317,809	0.89	-6.29%	1.03	1.68%	0.25%	56	.439
Peripheral Vascular Bypass	2003	31,636	0.98		1.06				.268
	2004	29,487	0.95		0.99				.083
	2005	27,323	0.93		0.98				.052
	2003-2005	88,446	0.95	4.43%	1.01	7.86%	5.79%	450	.019
Prostatectomy	2003	90,557	0.94		0.97				.017
	2004	85,978	0.90		1.04				<.001
	2005	78,775	0.95		1.05				.067
	2003-2005	255,310	0.93	-1.54%	1.02	-7.70%	8.43%	1,236	<.001
Cholecystectomy	2003	106,822	0.96		1.03				.015
	2004	104,014	0.98		1.01				.160
	2005	101,027	0.93		0.98				<.001
	2003-2005	311,863	0.96	2.45%	1.01	4.45%	5.05%	2,001	<.001
<b>Totals</b>		<b>2,890,012</b>						<b>12,410</b>	
<b>3-Year Performance Average</b>			<b>0.96</b>	<b>3.39%</b>	<b>1.01</b>	<b>1.47%</b>	<b>5.31%</b>		

<sup>1</sup> Percent improvement determines improvement over time (2003 to 2005) for aggregate DH-CE hospitals. Calculated as follows: (O/E for 2003 – O/E for 2005) / (O/E for 2003) where the O/E is for the DH-CE hospitals.

<sup>2</sup> Percent improvement determines improvement over time (2003 to 2005) for aggregate Non-DH-CE hospitals. Calculated as follows: (O/E for 2003 – O/E for 2005) / (O/E for 2003) 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).

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## **Exhibit E: Hospital Report Card™ Mortality and Complication Based Outcomes 2006 Methodology White Paper**

### **Introduction**

To help consumers evaluate and compare hospital performance, HealthGrades analyzed patient outcome data for virtually every hospital in the country. Health Grades, Inc. uses two data sources:

- Medicare inpatient data from the MedPAR database (purchased from the Centers for Medicare and Medicaid Services). Medicare data is available for years 2003 through 2005.
- Inpatient data on all patients (all payer data) provided by individual states for years 2002 through 2004 to analyze outcomes in appendectomy and bariatric surgery.

Ratings were based upon two different risk-adjustment methodologies.

- For 28 medical issues, the risk adjustment was based upon the HealthGrades methodology described in the *Multivariate Logistic Regression-Based Ratings* section of this white paper.
- For respiratory failure and gastrointestinal procedures and surgeries, the risk adjustment was based upon APR-DRG methodology developed by 3M™ Corporation. APR-DRG stands for All Patient Refined Diagnosis Related Group. (All copyrights in and to APR-DRGs are owned by 3M™. All rights reserved.) This methodology is described in the *APR-DRG-Based Ratings* section of this white paper.

The purpose of risk adjustment is to obtain fair statistical comparisons between 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, with approximately 55 percent to 60 percent of all cardiac patients and 75 percent to 80 percent of all joint replacement surgeries, for example

However, since the appendectomy and bariatric surgery cohorts include very few cases over 65 years of age, all payer state data were used to rate hospitals in those states where state data are available.

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 (except appendectomy and bariatric surgery)
- 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 equal to or less than one day (except for coronary interventional procedures, heart attack, heart failure, resection / replacement of abdominal aorta, carotid endarterectomy, back and neck surgery (spinal fusion), back and neck surgery (except spinal fusion), chronic obstructive pulmonary disease, community acquired pneumonia, peripheral vascular bypass, and atrial fibrillation)
- Patients who were still in the hospital when the Medicare claim was filed
- Patients with an invalid gender

## **Methodology for Ratings**

Our 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. Specifics about the statistical methods used are provided here and include:

- Multivariate Logistic Regression-Based Ratings
- APR-DRG-Based Ratings

## **Multivariate Logistic Regression-Based Ratings**

The in-hospital data for 28 diagnoses and procedures on the HealthGrades Web site represent three years of patient discharges from 2003 to 2005 for MedPAR and three years of patient discharges from 2002 to 2004 for state data.

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 (e.g., quadruple bypass surgery), a list of risk factors (Appendix C), and a list of post-surgical complications. These latter two lists were developed in two steps:

- 1 We identified all diagnoses occurring in more than .5 percent of the patients for the current analysis and the previous analysis.
- 2 We used a team of clinical and coding experts to identify the complications in the list created in Step One.

In some cases an ICD9 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 (e.g., predicted mortality or complications) was obtained using logistic regression models discussed in the next section.
- 2 Second, the predicted value was compared with the actual, or observed, value (e.g., actual mortality or complications). 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 very 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 were correlated with the quality measure (e.g., mortality). A risk factor stayed in the model if it had an odds ratio greater than one (except that clinically relevant procedures, cohort defining principal diagnoses, and some protective factors as documented in the medical literature were allowed to have an odds ratio less than one) and was also statistically significant ( $p < 0.05$ ).

Exceptions to this rule should be noted for the cardiac service line (specifically CABG, PCI and AMI) where cardiogenic shock, anoxic brain injury, and cardiac arrest were excluded from the final model as risk factors. In a few cases, risk factors that have odds ratios less than one are included in the models if the risk has been previously accepted in the medical literature. 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 z statistic 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.

## APR-DRG-Based Ratings

For respiratory failure and gastrointestinal procedures and surgeries, the risk adjustment was based upon APR-DRGs, a methodology developed by 3M™ Corporation. APR-DRGs are an enhanced extension of the basic DRG (diagnosis related group) concept developed by 3M™'s Clinical Research Group, the National Association of Children's Hospitals and Research Institutes (NACHRI), and several physician groups.



While DRGs focus on the Medicare population, APR-DRGs describe a complete cross-section of acute care patients and are specifically designed to adjust data for severity of illness (How sick is the patient?) and risk of mortality (How likely is it that the patient will die?).

The fundamental principle of APR-DRGs is that the severity of illness and risk of mortality are both dependent on the patient's underlying condition. High severity of illness and risk of mortality are characterized by multiple serious diseases and the interactions between the disorders.

The 3M™ APR-DRG methodology is the most widely used severity-of-illness and risk-of-mortality adjustment tool available today. It has become the standard for adjusting large volumes of data to account for differences related to the individual's severity of illness or risk of mortality. As a result, the focus can be on the differences in clinical care, thus providing equitable comparisons of quality and cost of care. APR-DRGs are also recognized as the tool of choice by commissions, state agencies, and others who disseminate comparative performance data to regulators, payers and the general public.

## Data Analysis

The output from the APR-DRG software was twofold:

- It told us how many patients had respiratory failure or gastrointestinal procedures or surgeries in each hospital.
- It identified each patient as being in one of four subclasses of mortality risk:
  - Minor
  - Major
  - Moderate
  - Extreme



HealthGrades then took the above APR-DRG output and went through these steps:

- 1 For each patient, a predicted probability of death was calculated based on the average national mortality rate for that age group, gender, and mortality risk class in that APR-DRG.
- 2 Based on the observed and predicted deaths, a z-score was calculated for each hospital across the APR-DRGs that defines the cohort.
- 3 Any hospital that did not have at least 30 cases across three years of data was removed, and any hospital that did not have at least five cases in the most current year was removed.

### 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.

### 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
Appendectomy	Principal Procedures – Inclusions: 47.01, 47.09 Procedures – Exclusions: 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63 Note: This cohort uses all payer data from states which provide it.
Atrial Fibrillation	Principal Diagnoses – Inclusions: 427.31 Procedures – Exclusions: 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63 Diagnoses – Exclusions: 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, V42.1, V66.7
Back and Neck Surgery (Spinal Fusion)	Principal Procedures – Inclusions: 81.00, 81.01, 81.02, 81.03, 81.04, 81.05, 81.06, 81.07, 81.08, 81.09, 81.61, 81.62, 81.63, 81.64 Procedures – Exclusions: 03.02, 37.5, 37.51, 37.52, 37.53, 37.54, 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 Diagnoses – Exclusions: 722.80, 722.81, 722.82, 722.83, 996.4, V45.4
Back and Neck Surgery (except Spinal Fusion)	Principal Procedures – Inclusions: 03.09, 03.53, 80.50, 80.51, 80.59, 84.58, 84.59, 84.60, 84.61, 84.62, 84.63, 84.64, 84.65 Procedures – Exclusions: 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 Diagnoses – Exclusions: 722.80, 722.81, 722.82, 722.83, 996.4, V42.4, V45.4, V54.0, V54.01, V54.09
Bariatric Surgery	Principal Procedures – Inclusions: 43.89, 44.31, 44.38, 44.39, 44.68, 44.93, 44.95, 45.51, or 45.91 with diagnosis 278.00 or 278.01 also present Procedures – Exclusions: 44.5, 44.94, 44.96, 44.97 Diagnoses – Exclusions: 530.0, 530.1, 530.10, 530.11, 530.12, 530.19, 530.2, 530.20, 530.21, 530.3, 530.4, 530.5, 530.6, 530.7, 530.8, 530.81, 530.82, 530.83, 530.84, 530.85, 530.86, 530.87, 530.89, 530.9, 531, 531.0, 531.00, 531.01, 531.1, 531.10, 531.11, 531.2, 531.20, 531.21, 531.3, 531.30, 531.31, 531.4, 531.40, 531.41, 531.5, 531.50, 531.51, 531.6, 531.60, 531.61, 531.7, 531.70, 531.71, 531.9, 531.90, 531.91, 532, 532.0, 532.00, 532.01, 532.1, 532.10, 532.11, 532.2, 532.20, 532.21, 532.3, 532.30, 532.31, 532.4, 532.40, 532.41, 532.5, 532.50, 532.51, 532.6, 532.60, 532.61, 532.7, 532.70, 532.71, 532.9, 532.90, 532.91, 533, 533.0, 533.00, 533.01, 533.1, 533.10, 533.11, 533.2, 533.20, 533.21, 533.3, 533.30, 533.31, 533.4, 533.40, 533.41, 533.5, 533.50, 533.51, 533.6, 533.60, 533.61, 533.7, 533.70, 533.71, 533.9, 533.90, 533.91, 534, 534.0, 534.00, 534.01, 534.1, 534.10, 534.11, 534.2, 534.20, 534.21, 534.3, 534.30, 534.31, 534.4, 534.40, 534.41, 534.5, 534.50, 534.51, 534.6, 534.60, 534.61, 534.7, 534.70, 534.71, 534.9, 534.90, 534.91, 535, 535.0, 535.00, 535.01, 535.1, 535.10, 535.11, 535.2, 535.20, 535.21, 535.3, 535.30, 535.31, 535.4, 535.40, 535.41, 535.5, 535.50, 535.51, 535.6, 535.60, 535.61, 536, 536.0, 536.1, 536.2, 536.3, 536.4, 536.40, 536.41, 536.42, 536.49, 536.8, 536.9, 537, 537.0, 537.1, 537.2, 537.3, 537.4, 537.5, 537.6, 537.8, 537.81, 537.82, 537.83, 537.84, 537.89, 537.9, 540.0, 540.1, 540.9, 550, 550.0, 550.00, 550.01, 550.02, 550.03, 550.1, 550.2, 550.3, 550.4, 550.5, 550.10, 550.11, 550.12, 550.13, 550.9, 550.90, 550.91, 550.92, 550.93, 551, 551.0, 551.00, 551.01, 551.02, 551.03, 551.1, 551.2, 551.20, 551.21, 551.29, 551.3, 551.8, 551.9, 552, 552.0, 552.00, 552.01, 552.02, 552.03, 552.1, 552.2, 552.20, 552.21, 552.29, 552.3, 552.8, 552.9, 553, 553.0, 553.00, 553.01, 553.02, 553.03, 553.1, 553.2, 553.20, 553.21, 553.29, 553.3, 553.8, 553.9, 555, 555.0, 555.1, 555.2, 555.9, 556, 556.0, 556.1, 556.2, 556.3, 556.4, 556.5, 556.6, 556.8, 556.9, 557, 557.0, 557.1, 557.9, 558, 558.1, 558.2, 558.3, 558.9, 560, 560.0, 560.1, 560.2, 560.3, 560.30, 560.31, 560.39, 560.8, 560.81, 560.89, 560.9, 562, 562.0, 562.00, 562.01, 562.02, 562.03, 562.1, 562.10, 562.11, 562.12, 562.13, 564, 564.0, 564.00, 564.01, 564.02, 564.09, 564.1, 564.2, 564.3, 564.4, 564.5, 564.6, 564.7, 564.8, 564.81, 564.89, 564.9, 565, 565.0, 565.1, 566, 567, 567.0, 567.1, 567.2, 567.8, 567.9, 568, 568.0, 568.8, 568.81, 568.82, 568.89, 568.9, 569, 569.0, 569.1, 569.2, 569.3, 569.4, 569.41, 569.42, 569.49, 569.5, 569.6, 569.60, 569.61, 569.62, 569.69, 569.8, 569.81, 569.82, 569.83, 569.84, 569.85, 569.86, 569.89, 569.9, 571.2, 571.5, 572.2, 574.10, 574.20, 576.1, 576.8, 577.0, 577.1, 577.2, 577.8, 578.0, 578.9, 579.3, 579.9, 584.5, 584.9, 585, 595.89, 596, 596.0, 596.1, 596.2, 596.3, 596.4, 596.5, 596.51, 596.52, 596.53, 596.54, 596.55, 596.59, 596.6, 596.7, 596.8, 596.9, 599.0, 619.1, 625.6, 643.13, 647.83, 648.93, 682.6, 693.0, 714.0, 715.36, 715.89, 715.90, 715.96, 716.90, 721.3, 722.10, 724.02, 724.2, 724.5, 729.9, 730.28, 733.13, 733.82, 747.61, 750.9, 751.0, 751.1, 751.2, 751.3, 751.4, 751.5, 751.6, 751.7, 751.8, 751.9, 759.6, 780.39, 780.57, 783.1, 783.7, 786.05, 786.09, 786.50, 786.59, 787.01, 787.02, 787.03, 787.2, 787.91, 789.00, 789.01, 789.03, 789.09, 789.39, 789.5, 800.25, 801.22, 805.01, 805.4, 806.36, 810.03, 851.42, 851.46, 851.80, 852.20, 861.21, 862.0, 863.0, 863.1, 863.20, 863.21, 863.29, 863.30, 863.31, 863.39, 863.50, 863.51, 863.52, 863.53, 863.83, 863.89, 863.90, 863.99, 866.12, 868.09, 868.13, 875.1, 892.1, 933.0, 935.2, 942.24, 983.2, 995.92, 996.1, 996.52, 996.59, 996.62, 996.64, 996.69, 996.79, 996.82, 996.86, 996.87, 997.02, 997.1, 997.2, 997.3, 997.4, 997.91, 998.11, 998.12, 998.2, 998.3, 998.31, 998.32, 998.59, 998.6, 998.89, 998.9, 999.5, E950.9, V45.3, V54.19, V55.1, V55.2, V55.3, V55.4, V55.5, V57.89, V58.1, V58.43, V58.49, V58.89 Note: This cohort uses all payer data from states which provide it.

Patient Cohort	ICD-9-CM Procedure/Diagnosis Codes and Criteria
<b>Bowel Obstruction</b>	Principal Diagnoses – Inclusions: 277.01, 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, 557.0, 560.0, 560.1, 560.2, 560.30, 560.31, 560.39, 560.81, 560.89, 560.9, 936, 937 Procedures – Exclusions: 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63 Diagnoses – Exclusions: 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, V66.7
<b>Carotid Endarterectomy</b>	Principal Procedures – Inclusions: 00.55, 00.61, 00.63, 38.12, 39.50, 39.72, 39.79 Procedures – Exclusions: 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
<b>Cholecystectomy</b>	Principal Procedures – Inclusions: 51.21, 51.22, 51.23, 51.24 Procedures – Exclusions: 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63 Diagnoses – Exclusions: V66.7
<b>Chronic Obstructive Pulmonary Disease (COPD)</b>	Principal Diagnoses – Inclusions: 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 Procedures – Exclusions: 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63 Diagnoses – Exclusions: 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, V66.7, V66.7
<b>Community Acquired Pneumonia</b>	Principal Diagnoses – Inclusions: 480.0, 480.1, 480.2, 480.8, 480.9, 481, 482.2, 482.30, 482.31, 482.32, 482.39, 482.9, 483.0, 483.1, 483.8, 485, 486, 487.0 Procedures – Exclusions: 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63 Diagnoses – Exclusions: 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, V66.7
<b>Coronary Bypass Surgery</b>	Principal Procedures – Inclusions: 36.10, 36.11, 36.12, 36.13, 36.14, 36.15, 36.16, 36.19 Procedures – Exclusions: 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, 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 – Exclusions: 414.06, 414.07, 441.00, 441.01, 441.02, 441.03, V42.1
<b>Coronary Interventional Procedures</b>	Principal Procedures – Inclusions: 36.01, 36.02, 36.05, 36.06, 36.07, 36.09 Procedures – Exclusions: 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 – Exclusions: 414.06, 414.07, V42.1
<b>Diabetic Acidosis and Coma</b>	Principal Diagnosis – Inclusions: 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 Procedures – Exclusions: 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63 Diagnoses – Exclusions: 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, V66.7
<b>Gastrointestinal Bleed</b>	Principal Diagnoses – Inclusions: 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, 751.0 Procedures – Exclusions: 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63 Diagnoses – Exclusions: 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, V66.7
<b>Gastrointestinal Procedures and Surgeries</b>	APR-DRG: 220-224, 226, 229, 260, 261, 264
<b>Heart Attack</b>	Principal Diagnoses – Inclusions: 410.01, 410.11, 410.21, 410.31, 410.41, 410.51, 410.61, 410.71, 410.81, 410.91 Procedures – Exclusions: 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63 Diagnoses – Exclusions: 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, V42.1, V66.7
<b>Heart Failure</b>	Principal Diagnoses – Inclusions: 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 Procedures – Exclusions: 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63, 39.95 Diagnoses – Exclusions: 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, V42.1, V66.7

Patient Cohort	ICD-9-CM Procedure/Diagnosis Codes and Criteria
<b>Hip Fracture Repair</b>	Principal Procedures – Inclusions: 79.05, 79.15, 79.25, 79.35 Procedures – Exclusions: 37.5, 37.51, 37.52, 37.53, 37.54, 78.65, 78.66, 78.67, 80.05, 80.06, 81.54, 81.55 Diagnoses – Exclusions: 800.6, 820.10, 820.11, 820.12, 820.13, 820.19, 820.30, 820.31, 820.32, 820.9, 821.10, 821.11, 821.30, 821.31, 821.32, 821.33, 821.39, 996.4, V66.7
<b>Pancreatitis</b>	Principal Diagnoses – Inclusions: 577.0, 577.1 Procedures – Exclusions: 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63 Diagnoses – Exclusions: 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, V66.7
<b>Partial Hip Replacement</b>	Principal Procedures – Inclusions: 81.52 Procedures – Exclusions: 37.5, 37.51, 37.52, 37.53, 37.54, 78.65, 78.66, 78.67, 80.05, 80.06, 81.54, 81.55 Diagnoses – Exclusions: 800.6, 820.10, 820.11, 820.12, 820.13, 820.19, 820.20, 820.22, 820.30, 820.31, 820.32, 820.9, 821.10, 821.11, 821.30, 821.31, 821.32, 821.33, 821.39, 996.4, V66.7
<b>Peripheral Vascular Bypass</b>	Principal Procedures – Inclusions: 39.29 Principal Diagnoses – Inclusions: 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, 445.05, 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 Procedures – Exclusions: 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63, 39.25, 39.49 Diagnoses – Exclusions: 440.31, 445.01
<b>Prostatectomy</b>	Principal Procedures – Inclusions: 60.21, 60.29, 60.3, 60.4, 60.5, 60.61, 60.62, 60.69 Procedures – Exclusions: 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63
<b>Pulmonary Embolism</b>	Principal Diagnoses – Inclusions: 415.11, 415.19 Procedures – Exclusions: 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63 Diagnoses – Exclusions: 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, V66.7
<b>Resection / Replacement of Abdominal Aorta</b>	Principal Procedures – Inclusions: 38.34, 38.44, 38.64, 39.71 Procedures – Exclusions: 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 Diagnoses – Exclusions: 441.00, 441.01, 441.02, 441.03, 441.1, 441.2, 441.6, 441.7, 441.9
<b>Respiratory Failure</b>	APR-DRG: 130, 133
<b>Sepsis</b>	Principal Diagnoses – Inclusions: 003.1, 022.3, 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, 995.90, 995.91, 995.92, 999.3 Procedures – Exclusions: 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63 Diagnoses – Exclusions: 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, V66.7
<b>Stroke</b>	Principal Diagnoses – Inclusions: 430, 431, 432.0, 432.1, 432.9, 433.01, 433.11, 433.21, 433.31, 433.81, 433.91, 434.01, 434.11, 434.91, 436 Procedures – Exclusions: 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63 Diagnoses – Exclusions: 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, V66.7
<b>Total Hip Replacement</b>	Principal Procedures – Inclusions: 81.51 Procedures – Exclusions: 00.70, 00.71, 00.72, 00.73, 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, 81.53, 81.54, 81.55 Diagnoses – Exclusions: 996.4, 996.40, 996.41, 996.42, 996.43, 996.44, 996.45, 996.46, 996.47, 996.49, 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, 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, E992.5, V15.5, V58.43, V58.49

<b>Total Knee Replacement</b>	Principal Procedures – Inclusions: 81.54 Procedures – Exclusions: 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 Diagnoses – Exclusions: 996.4, 996.40, 996.41, 996.42, 996.43, 996.44, 996.45, 996.46, 996.47, 996.49
<b>Valve Replacement Surgery</b>	Principal Procedures – Inclusions: 35.20, 35.21, 35.22, 35.23, 35.24, 35.25, 35.26, 35.27, 35.28 Procedures – Exclusions: 35.1, 35.33, 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 – Exclusions: 414.06, 414.07, 441.00, 441.01, 441.02, 441.03, 441.2, V42.1

## Appendix B: Major Complications

### Major Complications – Appendectomy

Major Complications – Appendectomy			
292.81	DRUG-INDUCED DELIRIUM	997.3	RESPIR COMPLICATIONS, NEC
415.11	IATROG PULM EMBOLISM/INF	997.4	DIGESTIVE SYST COMPL, NEC
415.19	PULM EMBOLISM/INFARCT, NEC	997.5	URINARY COMPLICATION, NEC
427.41	VENTRICULAR FIBRILLATION	998.0	POSTOPERATIVE SHOCK NEC
427.5	CARDIAC ARREST	998.11	HEMORRHAGE COMPLIC PROC
512.1	IATROGENIC PNEUMOTHORAX	998.2	ACC PUNCTUR/LAC-PROC, NEC
518.5	PULM INSUF PST TRAUM/SRG	998.3	DISRUPT SURGCL WOUND, NEC
518.81	RESPIRATORY FAILURE	998.31	DISRUPT INTERNL OP WOUND
996.62	INF/INFLAM VASC DEV/GRFT	998.32	DISRUPT EXTERNL OP WOUND
997.02	IATROGN C-VSC INFRCT/HEM	998.59	POSTOPERATIV INFECTN, NEC
997.1	CARDIAC COMPLICATION, NEC		

### Dependent Complications – Appendectomy

Must occur with 997.1 Cardiac Complications			
410.01	AMI-ANTEROLATERL-INITIAL	428.2	SYSTOLIC HEART FAILURE
410.11	AMI-ANT WALL, NEC-INITIAL	428.20	SYSTOLC HEART FAILURE, NOS
410.21	AMI-INFEROLATERL-INITIAL	428.21	AC SYSTOLC HEART FAILURE
410.51	AMI-LAT WALL, NEC-INITIAL	428.23	AC ON CHR SYSTOL HT FAIL
410.61	AMI-TRUE POST WL-INITIAL	428.3	DIASTOLIC HEART FAILURE
410.71	AMI-SUBEND INFRCT-INIT'L	428.31	AC DIASTOL HEART FAILURE
410.81	AMI-SITE, NEC-INITIAL EPI	428.33	AC ON CHR DIASTL HT FAIL
410.91	AMI-SITE, NOS-INITIAL EPI	428.4	CMB SYST & DIAST HT FAIL
427.0	PAROXYSMAL SVT	428.40	CMB SYS/DIAS HT FAIL, NOS
427.1	PAROXYSML VENT TACHYCARD	428.41	AC COMB SYS/DIAS HT FAIL
427.31	ATRIAL FIBRILLATION	428.43	AC ON CH SYS/DIA HT FAIL
427.32	ATRIAL FLUTTER	428.9	HEART FAILURE, NOS
428.0	CONGESTIVE HEART FAILURE	427.89	CARDIAC DYSRHYTHMIAS, NEC
428.1	LEFT HEART FAILURE	428.30	DIASTOLC HEART FAILR, NOS
Must occur with 997.3 Respiratory Complications			
480	VIRAL PNEUMONIA	482.8	PNEUMONIA-BACTERIA, NEC
480.0	PNEUMONIA DT ADENOVIRUS	482.81	PNEUMONIA DT ANAEROBES
480.1	PNEUMONIA DUE TO RSV	482.82	PNEUMONIA-E. COLI
480.2	PNEUMON-PARAINFLUENZA VR	482.83	PNEUMONIA-GRM NG BAC, NEC
480.3	PNEUMONIA DT SARS	482.84	LEGIONNAIRES' DISEASE
480.8	PNEUMONIA DT VIRUS, NEC	482.89	PNEUMONIA-BACTERIA, NEC
480.9	VIRAL PNEUMONIA, NOS	482.9	BACTERIAL PNEUMONIA, NOS
481	PNEUMOCOCCAL PNEUMONIA	483	PNEUMONIA-OTHER ORGANISM
482	OTHR BACTERIAL PNEUMONIA	483.0	PNEUMONIA-M. PNEUMONIAE
482.0	PNEUMONIA-K. PNEUMONIAE	483.1	PNEUMONIA DT CHLAMYDIA
482.1	PNEUMONIA DT PSEUDOMONAS	483.8	PNEUMONIA DT ORGANISM, NEC
482.2	PNEUMONIA-H. INFLUENZAE	484	PNEUMONIA-OTH INFECT DIS
482.3	PNEUMONIA-STREPTOCOCCUS	484.1	PNEUMONIA-CM INCLUSN DIS
482.30	PNEUMONIA-STREPTOCOC, NOS	484.3	PNEUMONIA-WHOOPING COUGH
482.31	PNEUMONIA-GROUP A STREP	484.5	PNEUMONIA IN ANTHRAX
482.32	PNEUMONIA-GROUP B STREP	484.6	PNEUMONIA-ASPERGILLOSIS
482.39	PNEUMONIA DT STREP, NEC	484.7	PNEUMON-SYST MYCOSES, NEC
482.4	PNEUMONIA-STAPHYLOCOCCUS	484.8	PNEUMON IN INFCT DIS, NEC
482.40	STAPH PNEUMONIA, NOS	485	BRONCHOPNEUM-ORGANISM, NOS
482.41	STAPH AUREUS PNEUMONIA	486	PNEUMONIA-ORGANISM, NOS
482.49	STAPH PNEUMONIA, NEC	507.0	PNEUMONIT-INH FOOD/VOMIT
Must occur with 997.4 Digestive System Complications			
569.83	PERFORATION OF INTESTINE		
Must occur with 997.5 Urinary Complications			
584.5	AC REN FAIL-LES TUBL, NEC	788.20	RETENTION OF URINE, NOS
584.8	AC REN FAIL-PATH LES, NEC	788.29	RETENTION OF URINE, NEC
584.9	ACUTE RENAL FAILURE, NOS		
Must occur with 998.11 Hemorrhage Complicating a Procedure			
568.81	HEMOPERITONEUM		
Must occur with 998.2 Accidental Puncture or Laceration During a Procedure			
568.81	HEMOPERITONEUM	569.83	PERFORATION OF INTESTINE

Must occur with 998.59 Postoperative Infection			
008.45	C. DIFFICILE INTESTN INF	038.40	SEPTICEMIA GRAM-NEGS, NOS
038	SEPTICEMIA	038.41	SEPTICEMIA-H. INFLUENZAE
038.0	STREPTOCOCCAL SEPTICEMIA	038.42	SEPTICEMIA DT E. COLI
038.1	STAPHYLOCOCC SEPTICEMIA	038.43	SEPTICEMIA - PSEUDOMONAS
038.10	STAPHLOCOCC SEPTICEM, NOS	038.44	SEPTICEMIA DT SERRATIA
038.11	SEPTICEMIA-STAPH AUREUS	038.49	SEPTICEMIA GRAM-NEG, NEC
038.19	STAPHLOCOCC SEPTICEM, NEC	038.8	OTH SPECIFIED SEPTICEMIA
038.2	PNEUMOCOCCAL SEPTICEMIA	038.9	UNSPECIFIED SEPTICEMIA
038.3	SEPTICEMIA DT ANAEROBES	682.2	CELLULITIS/ABSCESS-TRUNK
038.4	SEPTICEMIA GRAM-NEGS, NEC		

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

Major Complications – Back and Neck Surgery (Spinal Fusion)			
038	SEPTICEMIA	482.40	STAPH PNEUMONIA, NOS
038.0	STREPTOCOCCAL SEPTICEMIA	482.41	STAPH AUREUS PNEUMONIA
038.1	STAPHYLOCOCC SEPTICEMIA	482.49	STAPH PNEUMONIA, NEC
038.10	STAPHLOCOCC SEPTICEM, NOS	482.8	PNEUMONIA-BACTERIA, NEC
038.11	SEPTICEMIA-STAPH AUREUS	482.81	PNEUMONIA DT ANAEROBES
038.19	STAPHLOCOCC SEPTICEM, NEC	482.82	PNEUMONIA-E. COLI
038.2	PNEUMOCOCCAL SEPTICEMIA	482.83	PNEUMONIA-GRM NG BAC, NEC
038.3	SEPTICEMIA DT ANAEROBES	482.84	LEGIONNAIRES' DISEASE
038.4	SEPTICEMIA GRAM-NEGS, NEC	482.89	PNEUMONIA-BACTERIA, NEC
038.40	SEPTICEMIA GRAM-NEGS, NOS	482.9	BACTERIAL PNEUMONIA, NOS
038.41	SEPTICEMIA-H. INFLUENZAE	483	PNEUMONIA-OTHER ORGANISM
038.42	SEPTICEMIA DT E. COLI	483.0	PNEUMONIA-M. PNEUMONIAE
038.43	SEPTICEMIA - PSEUDOMONAS	483.1	PNEUMONIA DT CHLAMYDIA
038.44	SEPTICEMIA DT SERRATIA	483.8	PNEUMONIA DT ORGANISM, NEC
038.49	SEPTICEMIA GRAM-NEG, NEC	484	PNEUMONIA-OTH INFECT DIS
038.8	OTH SPECIFIED SEPTICEMIA	484.1	PNEUMONIA-CM INCLUSN DIS
038.9	UNSPECIFIED SEPTICEMIA	484.3	PNEUMONIA-WHOOPING COUGH
292.81	DRUG-INDUCED DELIRIUM	484.5	PNEUMONIA IN ANTHRAX
293.0	DELIRIUM DT CONDITNS, NEC	484.6	PNEUMONIA-ASPERGILLOSIS
410.01	AMI-ANTEROLATERL-INITIAL	484.7	PNEUMON-SYST MYCOSES, NEC
410.11	AMI-ANT WALL, NEC-INITIAL	484.8	PNEUMON IN INFCT DIS, NEC
410.21	AMI-INFEROLATERL-INITIAL	485	BRONCHOPNEUM-ORGNISM, NOS
410.31	AMI-INFEROPOSTER-INITIAL	486	PNEUMONIA-ORGANISM, NOS
410.41	AMI-INF WALL, NEC-INITIAL	507.0	PNEUMONIT-INH FOOD/VOMIT
410.51	AMI-LAT WALL, NEC-INITIAL	511.9	PLEURAL EFFUSION, NOS
410.61	AMI-TRUE POST WL-INITIAL	518.5	PULM INSUF PST TRAUM/SRG
410.71	AMI-SUBEND INFRACT-INIT'L	518.81	RESPIRATORY FAILURE
410.81	AMI-SITE, NEC-INITIAL EPI	584.5	AC REN FAIL-LES TUBL, NEC
410.91	AMI-SITE, NOS-INITIAL EPI	584.8	AC REN FAIL-PATH LES, NEC
415.11	IATROG PULM EMBOLISM/INF	584.9	ACUTE RENAL FAILURE, NOS
415.19	PULM EMBOLSM/INFARCT, NEC	995.91	SIRS DT INFCT-NO ORG DYS
480	VIRAL PNEUMONIA	995.92	SIRS DT INFCT W ORG DYSF
480.0	PNEUMONIA DT ADENOVIRUS	996.4	MECH COMPL-INT ORTHO DEV
480.1	PNEUMONIA DUE TO RSV	996.77	COMP, NEC-INTRN JT PROSTH
480.2	PNEUMON-PARAINFLUENZA VR	996.78	COMP, NEC-ORTHOPD DEV, NEC
480.3	PNEUMONIA DT SARS	997.02	IATROGN C-VSC INFRACT/HEM
480.8	PNEUMONIA DT VIRUS, NEC	997.09	NERVOUS SYST COMPLIC, NEC
480.9	VIRAL PNEUMONIA, NOS	997.1	CARDIAC COMPLICATION, NEC
481	PNEUMOCOCCAL PNEUMONIA	997.3	RESPIR COMPLICATIONS, NEC
482	OTHR BACTERIAL PNEUMONIA	997.4	DIGESTIVE SYST COMPL, NEC
482.0	PNEUMONIA-K. PNEUMONIAE	997.5	URINARY COMPLICATION, NEC
482.1	PNEUMONIA DT PSEUDOMONAS	998.0	POSTOPERATIVE SHOCK, NEC
482.2	PNEUMONIA-H. INFLUENZAE	998.11	HEMORRHAGE COMPLIC PROC
482.3	PNEUMONIA-STREPTOCOCCUS	998.2	ACC PUNCTUR/LAC-PROC, NEC
482.30	PNEUMONIA-STREPTOCOC, NOS	998.3	DISRUPT SURGCL WOUND, NEC
482.31	PNEUMONIA-GROUP A STREP	998.31	DISRUPT INTERNL OP WOUND
482.32	PNEUMONIA-GROUP B STREP	998.32	DISRUPT EXTERNL OP WOUND
482.39	PNEUMONIA DT STREP, NEC	998.59	POSTOPERATIV INFECTN, NEC
482.4	PNEUMONIA-STAPHYLOCOCCUS		

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

Must occur with 997.1 Cardiac Complications			
427.0	PAROXYSMAL SVT	428.23	AC ON CHR SYSTOL HT FAIL
427.1	PAROXYSML VENT TACHYCARD	428.3	DIASTOLIC HEART FAILURE
427.31	ATRIAL FIBRILLATION	428.30	DIASTOLC HEART FAILR, NOS
427.32	ATRIAL FLUTTER	428.31	AC DIASTOL HEART FAILURE
427.89	CARDIAC DYSRHYTHMIAS, NEC	428.33	AC ON CHR DIASTL HT FAIL
428.0	CONGESTIVE HEART FAILURE	428.4	CMB SYST & DIAST HT FAIL
428.1	LEFT HEART FAILURE	428.40	CMB SYS/DIAS HT FAIL, NOS
428.2	SYSTOLIC HEART FAILURE	428.41	AC COMB SYS/DIAS HT FAIL
428.20	SYSTOLC HEART FAILUR, NOS	428.43	AC ON CH SYS/DIA HT FAIL
428.21	AC SYSTOLC HEART FAILURE	428.9	HEART FAILURE, NOS
Must occur with 997.3 Respiratory Complications			
518.0	PULMONARY COLLAPSE		
Must occur with 997.4 Digestive System Complications			
560.1	PARALYTIC ILEUS		
Must occur with 997.5 Urinary Complications			
788.20	RETENTION OF URINE, 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	482.89	PNEUMONIA-BACTERIA, NEC
410.01	AMI-ANTEROLATERL-INITIAL	482.9	BACTERIAL PNEUMONIA, NOS
410.11	AMI-ANT WALL, NEC-INITIAL	483	PNEUMONIA-OTHER ORGANISM
410.21	AMI-INFEROLATERL-INITIAL	483.0	PNEUMONIA-M. PNEUMONIAE
410.31	AMI-INFEROPOSTER-INITIAL	483.1	PNEUMONIA DT CHLAMYDIA
410.41	AMI-INF WALL, NEC-INITIAL	483.8	PNEUMONIA DT ORGNISM, NEC
410.51	AMI-LAT WALL, NEC-INITIAL	484	PNEUMONIA-OTH INFECT DIS
410.61	AMI-TRUE POST WL-INITIAL	484.1	PNEUMONIA-CM INCLUSN DIS
410.71	AMI-SUBEND INFRCT-INIT'L	484.3	PNEUMONIA-WHOOPING COUGH
410.81	AMI-SITE, NEC-INITIAL EPI	484.5	PNEUMONIA IN ANTHRAX
410.91	AMI-SITE, NOS-INITIAL EPI	484.6	PNEUMONIA-ASPERGILLOSIS
480	VIRAL PNEUMONIA	484.7	PNEUMON-SYST MYCOSES, NEC
480.0	PNEUMONIA DT ADENOVIRUS	484.8	PNEUMON IN INFCT DIS, NEC
480.1	PNEUMONIA DUE TO RSV	485	BRONCHOPNEUM-ORGNISM, NOS
480.2	PNEUMON-PARAINFLUENZA VR	486	PNEUMONIA-ORGANISM, NOS
480.3	PNEUMONIA DT SARS	507.0	PNEUMONIT-INH FOOD/VOMIT
480.8	PNEUMONIA DT VIRUS, NEC	511.9	PLEURAL EFFUSION, NOS
480.9	VIRAL PNEUMONIA, NOS	518.5	PULM INSUF PST TRAUM/SRG
481	PNEUMOCOCCAL PNEUMONIA	518.81	RESPIRATORY FAILURE
482	OTHR BACTERIAL PNEUMONIA	584.5	AC REN FAIL-LES TUBL, NEC
482.0	PNEUMONIA-K. PNEUMONIAE	584.8	AC REN FAIL-PATH LES, NEC
482.1	PNEUMONIA DT PSEUDOMONAS	584.9	ACUTE RENAL FAILURE, NOS
482.2	PNEUMONIA-H. INFLUENZAE	995.91	SIRS DT INFCT-NO ORG DYS
482.3	PNEUMONIA-STREPTOCOCCUS	995.92	SIRS DT INFCT W ORG DYSF
482.30	PNEUMONIA-STREPTOCOC, NOS	996.4	MECH COMPL-INT ORTHO DEV
482.31	PNEUMONIA-GROUP A STREP	996.77	COMP, NEC-INTRN JT PROSTH
482.32	PNEUMONIA-GROUP B STREP	996.78	COMP, NEC-ORTHOPD DEV, NEC
482.39	PNEUMONIA DT STREP, NEC	997.00	NERVOUS SYST COMPLIC, NOS
482.4	PNEUMONIA-STAPHYLOCOCCUS	997.02	IATROGN C-VSC INFRCT/HEM
482.40	STAPH PNEUMONIA, NOS	997.09	NERVOUS SYST COMPLIC, NEC
482.41	STAPH AUREUS PNEUMONIA	997.1	CARDIAC COMPLICATION, NEC
482.49	STAPH PNEUMONIA, NEC	997.3	RESPIR COMPLICATIONS, NEC
482.8	PNEUMONIA-BACTERIA, NEC	997.4	DIGESTIVE SYST COMPL, NEC
482.81	PNEUMONIA DT ANAEROBES	997.5	URINARY COMPLICATION, NEC
482.82	PNEUMONIA-E. COLI	998.11	HEMORRHAGE COMPLIC PROC
482.83	PNEUMONIA-GRM NG BAC, NEC	998.2	ACC PUNCTUR/LAC-PROC, NEC
482.84	LEGIONNAIRES' DISEASE	998.59	POSTOPERATIV INFECTN, NEC



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

Must occur with 997.1 Cardiac Complications			
427.0	PAROXYSMAL SVT	428.3	DIASTOLIC HEART FAILURE
427.1	PAROXYSML VENT TACHYCARD	428.30	DIASTOLC HEART FAILR, NOS
427.31	ATRIAL FIBRILLATION	428.31	AC DIASTOL HEART FAILURE
427.89	CARDIAC DYSRYTHMIAS, NEC	428.33	AC ON CHR DIASTL HT FAIL
428.0	CONGESTIVE HEART FAILURE	428.4	CMB SYST & DIAST HT FAIL
428.1	LEFT HEART FAILURE	428.40	CMB SYS/DIAS HT FAIL, NOS
428.2	SYSTOLIC HEART FAILURE	428.41	AC COMB SYS/DIAS HT FAIL
428.20	SYSTOLC HEART FAILUR, NOS	428.43	AC ON CH SYS/DIA HT FAIL
428.21	AC SYSTOLC HEART FAILURE	428.9	HEART FAILURE, NOS
428.23	AC ON CHR SYSTOL HT FAIL		
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	788.29	RETENTION OF URINE, NEC
788.20	RETENTION OF URINE, NOS		
Must occur with 998.59 Postoperative Infection			
038	SEPTICEMIA	038.40	SEPTICEMIA GRAM-NEGS, NOS
038.0	STREPTOCOCCAL SEPTICEMIA	038.41	SEPTICEMIA-H. INFLUENZAE
038.1	STAPHYLOCOCC SEPTICEMIA	038.42	SEPTICEMIA DT E. COLI
038.10	STAPHLOCOCC SEPTICEM, NOS	038.43	SEPTICEMIA - PSEUDOMONAS
038.11	SEPTICEMIA-STAPH AUREUS	038.44	SEPTICEMIA DT SERRATIA
038.19	STAPHLOCOCC SEPTICEM, NEC	038.49	SEPTICEMIA GRAM-NEG, NEC
038.2	PNEUMOCOCCAL SEPTICEMIA	038.8	OTH SPECIFIED SEPTICEMIA
038.3	SEPTICEMIA DT ANAEROBES	038.9	UNSPECIFIED SEPTICEMIA
038.4	SEPTICEMIA GRAM-NEGS, NEC		

## Major Complications – Bariatric Surgery

Major Complications – Bariatric Surgery			
038	SEPTICEMIA	433.21	OCL VRTB ART W INFRCT
038.0	STREPTOCOCCAL SEPTICEMIA	433.30	OCL MLT BI ART WO INFRCT
038.1	STAPHYLOCOCC SEPTICEMIA	433.31	OCL MLT BI ART W INFRCT
038.10	STAPHLOCOCC SEPTICEM, NOS	433.80	OCL SPCF ART WO INFRCT
038.11	SEPTICEMIA-STAPH AUREUS	433.81	OCL SPCF ART W INFRCT
038.19	STAPHLOCOCC SEPTICEM, NEC	433.90	OCL ART NOS WO INFRCT
038.2	PNEUMOCOCCAL SEPTICEMIA	433.91	OCL ART NOS W INFRCT
038.3	SEPTICEMIA DT ANAEROBES	434.00	CRBL THRMBS WO INFRCT
038.4	SEPTICEMIA GRAM-NEGS, NEC	434.01	CRBL THRMBS W INFRCT
038.40	SEPTICEMIA GRAM-NEGS, NOS	434.10	CRBL EMBLSM WO INFRCT
038.41	SEPTICEMIA-H. INFLUENZAE	434.11	CRBL EMBLSM W INFRCT
038.42	SEPTICEMIA DT E. COLI	434.90	CRBL ART OC NOS WO INFRC
038.43	SEPTICEMIA - PSEUDOMONAS	434.91	CRBL ART OC NOS W INFRC
038.44	SEPTICEMIA DT SERRATIA	436	CVA
038.49	SEPTICEMIA GRAM-NEG, NEC	437.1	AC CEREBROVASC INSUF NOS
038.8	OTH SPECIFIED SEPTICEMIA	453.8	VENOUS THROMBOSIS NEC
038.9	UNSPECIFIED SEPTICEMIA	453.9	VENOUS THROMBOSIS NOS
410.01	AMI-ANTEROLATERL-INITIAL	480	VIRAL PNEUMONIA
410.11	AMI-ANT WALL, NEC-INITIAL	480.0	PNEUMONIA DT ADENOVIRUS
410.21	AMI-INFEROLATERL-INITIAL	480.1	PNEUMONIA DUE TO RSV
410.31	AMI INFEROPOST, INITIAL	480.2	PNEUMON-PARAINFLUENZA VR
410.41	AMI INFERIOR WALL, INIT	480.3	PNEUMONIA DT SARS
410.51	AMI-LAT WALL, NEC-INITIAL	480.8	PNEUMONIA DT VIRUS, NEC
410.61	AMI-TRUE POST WL-INITIAL	480.9	VIRAL PNEUMONIA, NOS
410.71	AMI-SUBEND INFRCT-INIT'L	481	PNEUMOCOCCAL PNEUMONIA
410.81	AMI-SITE, NEC-INITIAL EPI	482	OTHR BACTERIAL PNEUMONIA
410.91	AMI-SITE, NOS-INITIAL EPI	482.0	PNEUMONIA-K. PNEUMONIAE
415.11	IATROGEN PULM EMB/INFARC	482.1	PNEUMONIA DT PSEUDOMONAS
415.19	PULM EMBOL/INFARCT NEC	482.2	PNEUMONIA-H. INFLUENZAE
427.0	PAROXYSMAL SVT	482.3	PNEUMONIA-STREPTOCOCCUS
427.1	PAROXYSML VENT TACHYCARD	482.30	PNEUMONIA-STREPTOCOC, NOS
427.41	VENTRICULAR FIBRILLATION	482.31	PNEUMONIA-GROUP A STREP
431	INTRACEREBRAL HEMORRHAGE	482.32	PNEUMONIA-GROUP B STREP
433.00	OCL BSLR ART WO INFRCT	482.39	PNEUMONIA DT STREP, NEC
433.01	OCL BSLR ART W INFRCT	482.4	PNEUMONIA-STAPHYLOCOCCUS
433.10	OCL CRTD ART WO INFRCT	482.40	STAPH PNEUMONIA, NOS
433.11	OCL CRTD ART W INFRCT	482.41	STAPH AUREUS PNEUMONIA
433.20	OCL VRTB ART WO INFRCT	482.49	STAPH PNEUMONIA, NEC

Major Complications – Bariatric Surgery (continued)			
482.8	PNEUMONIA-BACTERIA, NEC	560.30	IMPACTION OF INTESTINE, UNSPEC
482.81	PNEUMONIA DT ANAEROBES	560.39	OTHER IMPACTION OF INTESTINE
482.82	PNEUMONIA-E. COLI	560.81	INTESTINAL ADHES W OBSTR
482.83	PNEUMONIA-GRM NG BAC, NEC	560.89	INTESTINAL OBSTRUCT NEC
482.84	LEGIONNAIRES' DISEASE	560.9	INTESTINAL OBSTRUCTN, NOS
482.89	PNEUMONIA-BACTERIA, NEC	564.2	POSTGASTRIC SURGERY SYNDROMES
482.9	BACTERIAL PNEUMONIA, NOS	578.9	HEMORRHAGE OF GI TRACT, UNSPEC
483	PNEUMONIA-OTHER ORGANISM	584.5	AC REN FAIL-LES TUBL, NEC
483.0	PNEUMONIA-M. PNEUMONIAE	584.8	AC REN FAIL-PATH LES, NEC
483.1	PNEUMONIA DT CHLAMYDIA	584.9	ACUTE RENAL FAILURE, NOS
483.8	PNEUMONIA IN ANTHRAX	599.0	URIN TRACT INFECTION NOS
484	PNEUMONIA-OTH INFECT DIS	997.1	CARDIAC COMPLICATION, NEC
484.1	PNEUMONIA-CM INCLUSN DIS	997.3	RESPIR COMPLICATIONS, NEC
484.3	PNEUMONIA-WHOOPING COUGH	997.4	DIGESTIVE SYST COMPL, NEC
484.5	PNEUMONIA IN ANTHRAX	997.5	URINARY COMPLICATION, NEC
484.6	PNEUMONIA-ASPERGILLOSIS	998.0	POSTOPERATIVE SHOCK, NEC
484.7	PNEUMON-SYST MYCOSES, NEC	998.11	HEMORRHAGE COMPLIC PROC
484.8	PNEUMON IN INFCT DIS, NEC	998.12	HEMATOMA COMPLIC PROC
485	BRONCHOPNEUM-ORGNISM, NOS	998.2	ACC PUNCTUR/LAC-PROC, NEC
486	PNEUMONIA-ORGANISM, NOS	998.31	DISRUPT INTERNL OP WOUND
518.5	PULM INSUF PST TRAUM/SRG	998.32	DISRUPT EXTERNL OP WOUND
518.81	RESPIRATORY FAILURE	998.51	INFECTED POSTOP SEROMA
560.1	PARALYTIC ILEUS	998.59	POSTOPERATIV INFECTN, NEC
560.2	VOLVULUS	998.6	PERSISTENT POSTOP FISTULA, NEC

## Dependent Complications - Bariatric Surgery

Must occur with 997.1 Cardiac Complications	
427.31	ATRIAL FIBRILLATION
Must occur with 997.3 Respiratory Complications	
518.0	PULMONARY COLLAPSE

## Major Complications – Carotid Endarterectomy

Major Complications – Carotid Endarterectomy			
410.01	AMI-ANTEROLATERL-INITIAL	482.84	LEGIONNAIRES' DISEASE
410.11	AMI-ANT WALL, NEC-INITIAL	482.89	PNEUMONIA-BACTERIA, NEC
410.21	AMI-INFEROLATERL-INITIAL	482.9	BACTERIAL PNEUMONIA, NOS
410.51	AMI-LAT WALL, NEC-INITIAL	483	PNEUMONIA-OTHER ORGANISM
410.61	AMI-TRUE POST WL-INITIAL	483.0	PNEUMONIA-M. PNEUMONIAE
410.71	AMI-SUBEND INFCT-INIT'L	483.1	PNEUMONIA DT CHLAMYDIA
410.81	AMI-SITE, NEC-INITIAL EPI	483.8	PNEUMONIA DT ORGNISM, NEC
410.91	AMI-SITE, NOS-INITIAL EPI	484	PNEUMONIA-OTH INFECT DIS
427.5	CARDIAC ARREST	484.1	PNEUMONIA-CM INCLUSN DIS
458.2	IATROGENIC HYPOTENSION	484.3	PNEUMONIA-WHOOPING COUGH
458.29	IATROGENIC HYPOTENSN, NEC	484.5	PNEUMONIA IN ANTHRAX
480	VIRAL PNEUMONIA	484.6	PNEUMONIA-ASPERGILLOSIS
480.0	PNEUMONIA DT ADENOVIRUS	484.7	PNEUMON-SYST MYCOSES, NEC
480.1	PNEUMONIA DUE TO RSV	484.8	PNEUMON IN INFCT DIS, NEC
480.2	PNEUMON-PARAINFLUENZA VR	485	BRONCHOPNEUM-ORGNISM, NOS
480.3	PNEUMONIA DT SARS	486	PNEUMONIA-ORGANISM, NOS
480.8	PNEUMONIA DT VIRUS, NEC	507.0	PNEUMONIT-INH FOOD/VOMIT
480.9	VIRAL PNEUMONIA, NOS	518.5	PULM INSUF PST TRAUM/SRG
481	PNEUMOCOCCAL PNEUMONIA	518.81	RESPIRATORY FAILURE
482	OTHR BACTERIAL PNEUMONIA	780.01	COMA
482.0	PNEUMONIA-K. PNEUMONIAE	951.7	INJURY-HYPOGLOSSAL NERVE
482.1	PNEUMONIA DT PSEUDOMONAS	957.1	NERVE INJURIES, NEC
482.2	PNEUMONIA-H. INFLUENZAE	997.00	NERVOUS SYST COMPLIC, NOS
482.3	PNEUMONIA-STREPTOCOCCUS	997.01	CENTRL NERV SYST COMPLIC
482.30	PNEUMONIA-STREPTOCOC, NOS	997.02	IATROGN C-VSC INFRACT/HEM
482.31	PNEUMONIA-GROUP A STREP	997.09	NERVOUS SYST COMPLIC, NEC
482.32	PNEUMONIA-GROUP B STREP	997.1	CARDIAC COMPLICATION, NEC
482.39	PNEUMONIA DT STREP, NEC	997.3	RESPIR COMPLICATIONS, NEC
482.4	PNEUMONIA-STAPHYLOCOCCUS	997.4	DIGESTIVE SYST COMPL, NEC
482.40	STAPH PNEUMONIA, NOS	997.5	URINARY COMPLICATION, NEC
482.41	STAPH AUREUS PNEUMONIA	997.91	HYPERTENSION AS COMPLIC
482.49	STAPH PNEUMONIA, NEC	998.0	POSTOPERATIVE SHOCK, NEC
482.8	PNEUMONIA-BACTERIA, NEC	998.11	HEMORRHAGE COMPLIC PROC
482.81	PNEUMONIA DT ANAEROBES	998.2	ACC PUNCTUR/LAC-PROC, NEC
482.82	PNEUMONIA-E. COLI	998.59	POSTOPERATIV INFECTN, NEC
482.83	PNEUMONIA-GRM NG BAC, NEC		

## Dependent Complications - Carotid Endarterectomy

Must occur with 997.09 Nervous System Complications			
434.11	CEREBRAL EMBOLISM-INFRACT	434.91	CEREBR ART OCCL-INFRACTN
Must occur with 997.1 Cardiac Complications			
427.1	PAROXYSMAL VENT TACHYCARD	428.3	DIASTOLIC HEART FAILURE
427.31	ATRIAL FIBRILLATION	428.30	DIASTOLC HEART FAILR, NOS
427.89	CARDIAC DYSRHYTHMIAS, NEC	428.31	AC DIASTOL HEART FAILURE
428.0	CONGESTIVE HEART FAILURE	428.33	AC ON CHR DIASTL HT FAIL
428.1	LEFT HEART FAILURE	428.4	CMB SYST & DIAST HT FAIL
428.2	SYSTOLIC HEART FAILURE	428.40	CMB SYS/DIAS HT FAIL, NOS
428.20	SYSTOLC HEART FAILUR, NOS	428.41	AC COMB SYS/DIAS HT FAIL
428.21	AC SYSTOLC HEART FAILURE	428.43	AC ON CH SYS/DIA HT FAIL
428.23	AC ON CHR SYSTOL HT FAIL	428.9	HEART FAILURE, NOS
Must occur with 997.4 Digestive System 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	788.20	RETENTION OF URINE, NOS
Must occur with 998.59 Postoperative Infection			
038	SEPTICEMIA	038.40	SEPTICEMIA GRAM-NEGS, NOS
038.0	STREPTOCOCCAL SEPTICEMIA	038.41	SEPTICEMIA-H. INFLUENZAE
038.1	STAPHYLOCOCC SEPTICEMIA	038.42	SEPTICEMIA DT E. COLI
038.10	STAPHLOCOCC SEPTICEM, NOS	038.43	SEPTICEMIA - PSEUDOMONAS
038.11	SEPTICEMIA-STAPH AUREUS	038.44	SEPTICEMIA DT SERRATIA
038.19	STAPHLOCOCC SEPTICEM, NEC	038.49	SEPTICEMIA GRAM-NEG, NEC
038.2	PNEUMOCOCCAL SEPTICEMIA	038.8	OTH SPECIFIED SEPTICEMIA
038.3	SEPTICEMIA DT ANAEROBES	038.9	UNSPECIFIED SEPTICEMIA
038.4	SEPTICEMIA GRAM-NEGS, NEC		

## Major Complications – Cholecystectomy

Major Complications – Cholecystectomy			
292.81	DRUG-INDUCED DELIRIUM	997.3	RESPIR COMPLICATIONS, NEC
415.11	IATROG PULM EMBOLISM/INF	997.4	DIGESTIVE SYST COMPL, NEC
415.19	PULM EMBOLSM/INFARCT, NEC	997.5	URINARY COMPLICATION, NEC
427.41	VENTRICULAR FIBRILLATION	998.0	POSTOPERATIVE SHOCK, NEC
427.5	CARDIAC ARREST	998.11	HEMORRHAGE COMPLIC PROC
512.1	IATROGENIC PNEUMOTHORAX	998.2	ACC PUNCTUR/LAC-PROC, NEC
518.5	PULM INSUF PST TRAUM/SRSG	998.3	DISRUPT SURGCL WOUND, NEC
518.81	RESPIRATORY FAILURE	998.31	DISRUPT INTERNL OP WOUND
996.62	INF/INFLAM VASC DEV/GRFT	998.32	DISRUPT EXTERNL OP WOUND
997.02	IATROGN C-VSC INFRACT/HEM	998.59	POSTOPERATIV INFECTN, NEC
997.1	CARDIAC COMPLICATION, NEC		

## Dependent Complications - Cholecystectomy

Must occur with 997.1 Cardiac Complications			
410.01	AMI-ANTEROLATERL-INITIAL	428.1	LEFT HEART FAILURE
410.11	AMI-ANT WALL, NEC-INITIAL	428.2	SYSTOLIC HEART FAILURE
410.21	AMI-INFEROLATERL-INITIAL	428.20	SYSTOLC HEART FAILUR, NOS
410.51	AMI-LAT WALL, NEC-INITIAL	428.21	AC SYSTOLC HEART FAILURE
410.61	AMI-TRUE POST WL-INITIAL	428.23	AC ON CHR SYSTOL HT FAIL
410.71	AMI-SUBEND INFRACT-INIT'L	428.3	DIASTOLIC HEART FAILURE
410.81	AMI-SITE, NEC-INITIAL EPI	428.31	AC DIASTOL HEART FAILURE
410.91	AMI-SITE, NOS-INITIAL EPI	428.33	AC ON CHR DIASTL HT FAIL
427.31	ATRIAL FIBRILLATION	428.4	CMB SYST & DIAST HT FAIL
427.89	CARDIAC DYSRHYTHMIAS, NEC	428.40	CMB SYS/DIAS HT FAIL, NOS
427.0	PAROXYSMAL SVT	428.41	AC COMB SYS/DIAS HT FAIL
427.1	PAROXYSMAL VENT TACHYCARD	428.43	AC ON CH SYS/DIA HT FAIL
427.32	ATRIAL FLUTTER	428.9	HEART FAILURE, NOS
428.0	CONGESTIVE HEART FAILURE	428.30	DIASTOLC HEART FAILR, NOS

## Dependent Complications – Cholecystectomy (continued)

Must occur with 997.3 Respiratory Complications			
480	VIRAL PNEUMONIA	482.81	PNEUMONIA DT ANAEROBES
480.0	PNEUMONIA DT ADENOVIRUS	482.82	PNEUMONIA-E. COLI
480.1	PNEUMONIA DUE TO RSV	482.83	PNEUMONIA-GRM NG BAC, NEC
480.2	PNEUMON-PARAINFLUENZA VR	482.84	LEGIONNAIRES' DISEASE
480.3	PNEUMONIA DT SARS	482.89	PNEUMONIA-BACTERIA, NEC
480.8	PNEUMONIA DT VIRUS, NEC	482.9	BACTERIAL PNEUMONIA, NOS
480.9	VIRAL PNEUMONIA, NOS	483	PNEUMONIA-OTHER ORGANISM
481	PNEUMOCOCCAL PNEUMONIA	483.0	PNEUMONIA-M. PNEUMONIAE
482	OTHR BACTERIAL PNEUMONIA	483.1	PNEUMONIA DT CHLAMYDIA
482.0	PNEUMONIA-K. PNEUMONIAE	483.8	PNEUMONIA DT ORGANSM, NEC
482.1	PNEUMONIA DT PSEUDOMONAS	484	PNEUMONIA-OTH INFECT DIS
482.2	PNEUMONIA-H. INFLUENZAE	484.1	PNEUMONIA-CM INCLUSN DIS
482.3	PNEUMONIA-STREPTOCOCCUS	484.3	PNEUMONIA-WHOOPING COUGH
482.30	PNEUMONIA-STREPTOCOC, NOS	484.5	PNEUMONIA IN ANTHRAX
482.31	PNEUMONIA-GROUP A STREP	484.6	PNEUMONIA-ASPERGILLOSIS
482.32	PNEUMONIA-GROUP B STREP	484.7	PNEUMON-SYST MYCOSES, NEC
482.39	PNEUMONIA DT STREP, NEC	484.8	PNEUMON IN INFCT DIS, NEC
482.4	PNEUMONIA-STAPHYLOCOCCUS	485	BRONCHOPNEUM-ORGNISM, NOS
482.40	STAPH PNEUMONIA, NOS	486	PNEUMONIA-ORGANISM, NOS
482.41	STAPH AUREUS PNEUMONIA	507.0	PNEUMONIT-INH FOOD/VOMIT
482.49	STAPH PNEUMONIA, NEC	799.0	ASPHYXIA
482.8	PNEUMONIA-BACTERIA, NEC		
Must occur with 997.4 Digestive System Complications			
569.83	PERFORATION OF INTESTINE		
Must occur with 997.5 Urinary Complications			
584.5	AC REN FAIL-LES TUBL, NEC	788.20	RETENTION OF URINE, NOS
584.8	AC REN FAIL-PATH LES, NEC	788.29	RETENTION OF URINE, NEC
584.9	ACUTE RENAL FAILURE, NOS		
Must occur with 998.11 Hemorrhage Complicating a Procedure			
568.81	HEMOPERITONEUM		
Must occur with 998.2 Accidental Puncture or Laceration During a Procedure			
568.81	HEMOPERITONEUM	569.83	PERFORATION OF INTESTINE
Must occur with 998.59 Postoperative Infection			
008.45	C. DIFFICILE INTESTN INF	038.40	SEPTICEMIA GRAM-NEGS, NOS
038	SEPTICEMIA	038.41	SEPTICEMIA-H. INFLUENZAE
038.0	STREPTOCOCCAL SEPTICEMIA	038.42	SEPTICEMIA DT E. COLI
038.1	STAPHYLOCOCC SEPTICEMIA	038.43	SEPTICEMIA - PSEUDOMONAS
038.10	STAPHLOCOCC SEPTICEM, NOS	038.44	SEPTICEMIA DT SERRATIA
038.11	SEPTICEMIA-STAPH AUREUS	038.49	SEPTICEMIA GRAM-NEG, NEC
038.19	STAPHLOCOCC SEPTICEM, NEC	038.8	OTH SPECIFIED SEPTICEMIA
038.2	PNEUMOCOCCAL SEPTICEMIA	038.9	UNSPECIFIED SEPTICEMIA
038.3	SEPTICEMIA DT ANAEROBES	682.2	CELLULITIS/ABSCSS-TRUNK
038.4	SEPTICEMIA GRAM-NEGS, NEC		

## Major Complications – Hip Fracture Repair

Major Complications – Hip Fracture Repair			
292.81	DRUG-INDUCED DELIRIUM	997.02	IATROGN C-VSC INFRCT/HEM
415.11	IATROG PULM EMBOLISM/INF	997.1	CARDIAC COMPLICATION, NEC
415.19	PULM EMBOLSM/INFARCT, NEC	997.3	RESPIR COMPLICATIONS, NEC
512.1	IATROGENIC PNEUMOTHORAX	997.4	DIGESTIVE SYST COMPL, NEC
518.5	PULM INSUF PST TRAUM/SRG	997.5	URINARY COMPLICATION, NEC
785.59	SHOCK NEC-NO MENT TRAUMA	998.0	POSTOPERATIVE SHOCK, NEC
996.4	MECH COMPL-INT ORTHO DEV	998.11	HEMORRHAGE COMPLIC PROC
996.77	COMP NEC-INTRN JT PROSTH	998.59	POSTOPERATIV INFECTN, NEC
996.78	COMP NEC-ORTHOPD DEV, NEC		

## Dependent Complications – Hip Fracture Repair

<b>Must occur with 997.1 Cardiac Complications</b>			
410.01	AMI-ANTEROLATERL-INITIAL	428.2	SYSTOLIC HEART FAILURE
410.11	AMI-ANT WALL, NEC-INITIAL	428.20	SYSTOLC HEART FAILUR, NOS
410.21	AMI-INFEROLATERL-INITIAL	428.21	AC SYSTOLC HEART FAILURE
410.31	AMI-INFEROPSTER-INITIAL	428.23	AC ON CHR SYSTOL HT FAIL
410.41	AMI-INF WALL, NEC-INITIAL	428.3	DIASTOLIC HEART FAILURE
410.51	AMI-LAT WALL, NEC-INITIAL	428.30	DIASTOLC HEART FAILR, NOS
410.61	AMI-TRUE POST WL-INITIAL	428.31	AC DIASTOL HEART FAILURE
410.71	AMI-SUBEND INFRCCT-INIT'L	428.33	AC ON CHR DIASTL HT FAIL
410.81	AMI-SITE, NEC-INITIAL EPI	428.4	CMB SYST & DIAST HT FAIL
410.91	AMI-SITE, NOS-INITIAL EPI	428.40	CMB SYS/DIAS HT FAIL, NOS
427.31	ATRIAL FIBRILLATION	428.41	AC COMB SYS/DIAS HT FAIL
427.89	CARDIAC DYSRYTHMIAS, NEC	428.43	AC ON CH SYS/DIA HT FAIL
428.0	CONGESTIVE HEART FAILURE	428.9	HEART FAILURE, NOS
428.1	LEFT HEART FAILURE		
<b>Must occur with 997.3 Respiratory Complications</b>			
480	VIRAL PNEUMONIA	482.82	PNEUMONIA-E. COLI
480.0	PNEUMONIA DT ADENOVIRUS	482.83	PNEUMONIA-GRM NG BAC, NEC
480.1	PNEUMONIA DUE TO RSV	482.84	LEGIONNAIRES' DISEASE
480.2	PNEUMON-PARAINFLUENZA VR	482.89	PNEUMONIA-BACTERIA, NEC
480.3	PNEUMONIA DT SARS	482.9	BACTERIAL PNEUMONIA, NOS
480.8	PNEUMONIA DT VIRUS, NEC	483	PNEUMONIA-OTHER ORGANISM
480.9	VIRAL PNEUMONIA, NOS	483.0	PNEUMONIA-M. PNEUMONIAE
481	PNEUMOCOCCAL PNEUMONIA	483.1	PNEUMONIA DT CHLAMYDIA
482	OTHR BACTERIAL PNEUMONIA	483.8	PNEUMONIA DT ORGANSM, NEC
482.0	PNEUMONIA-K. PNEUMONIAE	484	PNEUMONIA-OTH INFECT DIS
482.1	PNEUMONIA DT PSEUDOMONAS	484.1	PNEUMONIA-CM INCLUSN DIS
482.2	PNEUMONIA-H. INFLUENZAE	484.3	PNEUMONIA-WHOOPING COUGH
482.3	PNEUMONIA-STREPTOCOCCUS	484.5	PNEUMONIA IN ANTHRAX
482.30	PNEUMONIA-STREPTOCOC, NOS	484.6	PNEUMONIA-ASPERGILLOSIS
482.31	PNEUMONIA-GROUP A STREP	484.7	PNEUMON-SYST MYCOSES, NEC
482.32	PNEUMONIA-GROUP B STREP	484.8	PNEUMON IN INFCT DIS, NEC
482.39	PNEUMONIA DT STREP, NEC	485	BRONCHOPNEUM-ORGNISM, NOS
482.4	PNEUMONIA-STAPHYLOCOCCUS	486	PNEUMONIA-ORGANISM, NOS
482.40	STAPH PNEUMONIA, NOS	507.0	PNEUMONIT-INH FOOD/VOMIT
482.41	STAPH AUREUS PNEUMONIA	518.81	RESPIRATORY FAILURE
482.49	STAPH PNEUMONIA, NEC	518.82	OTH PULMONARY INSUFF, NEC
482.8	PNEUMONIA-BACTERIA, NEC	518.84	AC & CHRON RESP FAILURE
482.81	PNEUMONIA DT ANAEROBES		
<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 REN FAIL-LES TUBL, NEC	584.9	ACUTE RENAL FAILURE, NOS
584.8	AC REN FAIL-PATH LES, NEC	788.20	RETENTION OF URINE, NOS
593.9	KIDNEY & URETER DIS, NOS		
<b>Must occur with 998.59 Postoperative Infection</b>			
008.45	C. DIFFICILE INTESTN INF	038.41	SEPTICEMIA-H. INFLUENZAE
038	SEPTICEMIA	038.42	SEPTICEMIA DT E. COLI
038.0	STREPTOCOCCAL SEPTICEMIA	038.43	SEPTICEMIA - PSEUDOMONAS
038.1	STAPHYLOCOCC SEPTICEMIA	038.44	SEPTICMIA DT SERRATIA
038.10	STAPHLOCOCC SEPTICEM, NOS	038.49	SEPTICEMIA GRAM-NEG, NEC
038.11	SEPTICEMIA-STAPH AUREUS	038.8	OTH SPECIFIED SEPTICEMIA
038.19	STAPHLOCOCC SEPTICEM, NEC	038.9	UNSPECIFIED SEPTICEMIA
038.2	PNEUMOCOCCAL SEPTICEMIA	041.4	E. COLI INF IN OTHER DIS
038.3	SEPTICEMIA DT ANAEROBES	785.52	SEPTIC SHOCK
038.4	SEPTICEMIA GRAM-NEGS, NEC	995.91	SIRS DT INFCT-NO ORG DYS
038.40	SEPTICEMIA GRAM-NEGS, NOS		

## Major Complications – Partial Hip Replacement

Major Complications – Partial Hip Replacement		
292.81	DRUG-INDUCED DELIRIUM	996.78 COMP, NEC-ORTHOPD DEV, NEC
293.0	DELIRIUM DT CONDITNS, NEC	997.02 IATROGN C-VSC INFRCT/HEM
415.11	IATROG PULM EMBOLISM/INF	997.1 CARDIAC COMPLICATION, NEC
415.19	PULM EMBOLSM/INFARCT, NEC	997.3 RESPIR COMPLICATIONS, NEC
512.1	IATROGENIC PNEUMOTHORAX	997.4 DIGESTIVE SYST COMPL, NEC
518.5	PULM INSUF PST TRAUM/SRG	997.5 URINARY COMPLICATION, NEC
785.59	SHOCK, NEC-NO MENT TRAUMA	998.0 POSTOPERATIVE SHOCK, NEC
996.4	MECH COMPL-INT ORTHO DEV	998.11 HEMORRHAGE COMPLIC PROC
996.77	COMP, NEC-INTRN JT PROSTH	998.59 POSTOPERATIV INFECTN, NEC

## Dependent Complications – Partial Hip Replacement

Must occur with 997.1 Cardiac Complications		
410.01	AMI-ANTEROLATERL-INITIAL	428.1 LEFT HEART FAILURE
410.11	AMI-ANT WALL, NEC-INITIAL	428.2 SYSTOLIC HEART FAILURE
410.21	AMI-INFEROLATERL-INITIAL	428.20 SYSTOLC HEART FAILUR, NOS
410.31	AMI-INFEROPOSTER-INITIAL	428.21 AC SYSTOLC HEART FAILURE
410.41	AMI-INF WALL, NEC-INITIAL	428.23 AC ON CHR SYSTOL HT FAIL
410.51	AMI-LAT WALL, NEC-INITIAL	428.3 DIASTOLIC HEART FAILURE
410.61	AMI-TRUE POST WL-INITIAL	428.30 DIASTOLC HEART FAILR, NOS
410.71	AMI-SUBEND INFRCT-INIT'L	428.31 AC DIASTOL HEART FAILURE
410.81	AMI-SITE, NEC-INITIAL EPI	428.33 AC ON CHR DIASTL HT FAIL
410.91	AMI-SITE, NOS-INITIAL EPI	428.4 CMB SYST & DIAST HT FAIL
427.0	PAROXYSMAL SVT	428.40 CMB SYS/DIAS HT FAIL, NOS
427.1	PAROXYSML VENT TACHYCARD	428.41 AC COMB SYS/DIAS HT FAIL
427.31	ATRIAL FIBRILLATION	428.43 AC ON CH SYS/DIA HT FAIL
427.89	CARDIAC DYSRHYTHMIAS, NEC	428.9 HEART FAILURE, NOS
428.0	CONGESTIVE HEART FAILURE	593.9 KIDNEY & URETER DIS, NOS
Must occur with 997.3 Respiratory Complications		
480	VIRAL PNEUMONIA	482.82 PNEUMONIA-E. COLI
480.0	PNEUMONIA DT ADENOVIRUS	482.83 PNEUMONIA-GRM NG BAC, NEC
480.1	PNEUMONIA DUE TO RSV	482.84 LEGIONNAIRES' DISEASE
480.2	PNEUMON-PARAINFLUENZA VR	482.89 PNEUMONIA-BACTERIA, NEC
480.3	PNEUMONIA DT SARS	482.9 BACTERIAL PNEUMONIA, NOS
480.8	PNEUMONIA DT VIRUS, NEC	483 PNEUMONIA-OTHER ORGANISM
480.9	VIRAL PNEUMONIA, NOS	483.0 PNEUMONIA-M. PNEUMONIAE
481	PNEUMOCOCCAL PNEUMONIA	483.1 PNEUMONIA DT CHLAMYDIA
482	OTHR BACTERIAL PNEUMONIA	483.8 PNEUMONIA DT ORGANSM, NEC
482.0	PNEUMONIA-K. PNEUMONIAE	484 PNEUMONIA-OTH INFECT DIS
482.1	PNEUMONIA DT PSEUDOMONAS	484.1 PNEUMONIA-CM INCLUSN DIS
482.2	PNEUMONIA-H. INFLUENZAE	484.3 PNEUMONIA-WHOOPING COUGH
482.3	PNEUMONIA-STREPTOCOCCUS	484.5 PNEUMONIA IN ANTHRAX
482.30	PNEUMONIA-STREPTOCOC, NOS	484.6 PNEUMONIA-ASPERGILLOSIS
482.31	PNEUMONIA-GROUP A STREP	484.7 PNEUMON-SYST MYCOSES, NEC
482.32	PNEUMONIA-GROUP B STREP	484.8 PNEUMON IN INFCT DIS, NEC
482.39	PNEUMONIA DT STREP, NEC	485 BRONCHOPNEUM-ORGNSM, NOS
482.4	PNEUMONIA-STAPHYLOCOCCUS	486 PNEUMONIA-ORGANISM, NOS
482.40	STAPH PNEUMONIA, NOS	507.0 PNEUMONIT-INH FOOD/VOMIT
482.41	STAPH AUREUS PNEUMONIA	518.81 RESPIRATORY FAILURE
482.49	STAPH PNEUMONIA, NEC	518.82 OTH PULMONARY INSUFF, NEC
482.8	PNEUMONIA-BACTERIA, NEC	518.84 AC & CHRON RESP FAILURE
482.81	PNEUMONIA DT ANAEROBES	
Must occur with 997.4 Digestive System 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	788.20 RETENTION OF URINE, NOS
Must occur with 998.59 Postoperative Infection		
038	SEPTICEMIA	038.41 SEPTICEMIA-H. INFLUENZAE
038.0	STREPTOCOCCAL SEPTICEMIA	038.42 SEPTICEMIA DT E. COLI
038.1	STAPHYLOCOCC SEPTICEMIA	038.43 SEPTICEMIA - PSEUDOMONAS
038.10	STAPHLOCOCC SEPTICEM, NOS	038.44 SEPTICEMIA DT SERRATIA
038.11	SEPTICEMIA-STAPH AUREUS	038.49 SEPTICEMIA GRAM-NEG, NEC
038.19	STAPHLOCOCC SEPTICEM, NEC	038.8 OTH SPECIFIED SEPTICEMIA
038.2	PNEUMOCOCCAL SEPTICEMIA	038.9 UNSPECIFIED SEPTICEMIA
038.3	SEPTICEMIA DT ANAEROBES	041.4 E. COLI INF IN OTHER DIS
038.4	SEPTICEMIA GRAM-NEGS, NEC	785.52 SEPTIC SHOCK
038.40	SEPTICEMIA GRAM-NEGS, NOS	995.91 SIRS DT INFCT-NO ORG DYS

## Major Complications – Peripheral Vascular Bypass

Major Complications – Peripheral Vascular Bypass			
518.5	PULM INSUF PST TRAUM/SRG	997.5	URINARY COMPLICATION, NEC
518.81	RESPIRATORY FAILURE	998.0	POSTOPERATIVE SHOCK, NEC
996.74	COMP, NEC-VASC DEV/GRAFT	998.11	HEMORRHAGE COMPLIC PROC
997.1	CARDIAC COMPLICATION, NEC	998.2	ACC PUNCTUR/LAC-PROC, NEC
997.3	RESPIR COMPLICATIONS, NEC	998.59	POSTOPERATIV INFECTN, NEC
997.4	DIGESTIVE SYST COMPL, NEC		
Must occur with 997.1 Cardiac Complications			
410.01	AMI-ANTEROLATERL-INITIAL	427.1	PAROXYSML VENT TACHYCARD
410.11	AMI-ANT WALL, NEC-INITIAL	427.31	ATRIAL FIBRILLATION
410.21	AMI-INFEROLATERL-INITIAL	427.89	CARDIAC DYSRHYTHMIAS, NEC
410.51	AMI-LAT WALL, NEC-INITIAL	428.0	CONGESTIVE HEART FAILURE
410.61	AMI-TRUE POST WL-INITIAL	428.1	LEFT HEART FAILURE
410.71	AMI-SUBEND INFRCCT-INIT'L	428.2	SYSTOLIC HEART FAILURE
410.81	AMI-SITE, NEC-INITIAL EPI	428.20	SYSTOLC HEART FAILUR, NOS
410.91	AMI-SITE, NOS-INITIAL EPI	428.21	AC SYSTOLC HEART FAILURE
428.23	AC ON CHR SYSTOL HT FAIL	428.40	CMB SYS/DIAS HT FAIL, NOS
428.3	DIASTOLIC HEART FAILURE	428.41	AC COMB SYS/DIAS HT FAIL
428.30	DIASTOLC HEART FAILR, NOS	428.43	AC ON CH SYS/DIA HT FAIL
428.33	AC ON CHR DIASTL HT FAIL	428.9	HEART FAILURE, NOS
428.4	CMB SYST & DIAST HT FAIL	428.31	AC DIASTOL HEART FAILURE

## Dependent Complications – Peripheral Vascular Bypass

Must occur with 997.3 Respiratory Complications			
480	VIRAL PNEUMONIA	482.8	PNEUMONIA-BACTERIA, NEC
480.0	PNEUMONIA DT ADENOVIRUS	482.81	PNEUMONIA DT ANAEROBES
480.1	PNEUMONIA DUE TO RSV	482.82	PNEUMONIA-E. COLI
480.2	PNEUMON-PARAINFLUENZA VR	482.83	PNEUMONIA-GRM NG BAC, NEC
480.3	PNEUMONIA DT SARS	482.84	LEGIONNAIRES' DISEASE
480.8	PNEUMONIA DT VIRUS, NEC	482.89	PNEUMONIA-BACTERIA, NEC
480.9	VIRAL PNEUMONIA, NOS	482.9	BACTERIAL PNEUMONIA, NOS
481	PNEUMOCOCCAL PNEUMONIA	483	PNEUMONIA-OTHER ORGANISM
482	OTHR BACTERIAL PNEUMONIA	483.0	PNEUMONIA-M. PNEUMONIAE
482.0	PNEUMONIA-K. PNEUMONIAE	483.1	PNEUMONIA DT CHLAMYDIA
482.1	PNEUMONIA DT PSEUDOMONAS	483.8	PNEUMONIA DT ORGANSM, NEC
482.2	PNEUMONIA-H. INFLUENZAE	484	PNEUMONIA-OTH INFECT DIS
482.3	PNEUMONIA-STREPTOCOCCUS	484.1	PNEUMONIA-CM INCLUSN DIS
482.30	PNEUMONIA-STREPTOCOC, NOS	484.3	PNEUMONIA-WHOOPING COUGH
482.31	PNEUMONIA-GROUP A STREP	484.5	PNEUMONIA IN ANTHRAX
482.32	PNEUMONIA-GROUP B STREP	484.6	PNEUMONIA-ASPERGILLOSIS
482.39	PNEUMONIA DT STREP, NEC	484.7	PNEUMON-SYST MYCOSES, NEC
482.4	PNEUMONIA-STAPHYLOCOCCUS	484.8	PNEUMON IN INFCT DIS, NEC
482.40	STAPH PNEUMONIA, NOS	485	BRONCHOPNEUM-ORGNSM, NOS
482.41	STAPH AUREUS PNEUMONIA	486	PNEUMONIA-ORGANISM, NOS
482.49	STAPH PNEUMONIA, NEC	507.0	PNEUMONIT-INH FOOD/VOMIT
Must occur with 997.4 Digestive System Complications			
560.1	PARALYTIC ILEUS		
Must occur with 997.5 Urinary Complications			
584.5	AC REN FAIL-LES TUBL, NEC	593.9	KIDNEY & URETER DIS, NOS
584.8	AC REN FAIL-PATH LES, NEC	788.20	RETENTION OF URINE, NOS
584.9	ACUTE RENAL FAILURE, NOS		
Must occur with 998.51 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			
008.45	C. DIFFICILE INTESTN INF	038.41	SEPTICEMIA-H. INFLUENZAE
038	SEPTICEMIA	038.42	SEPTICEMIA DT E. COLI
038.0	STREPTOCOCCAL SEPTICEMIA	038.43	SEPTICEMIA - PSEUDOMONAS
038.1	STAPHYLOCOCC SEPTICEMIA	038.44	SEPTICEMIA DT SERRATIA
038.10	STAPHLOCOCC SEPTICEM, NOS	038.49	SEPTICEMIA GRAM-NEG, NEC
038.11	SEPTICEMIA-STAPH AUREUS	038.8	OTH SPECIFIED SEPTICEMIA
038.19	STAPHLOCOCC SEPTICEM, NEC	038.9	UNSPECIFIED SEPTICEMIA
038.2	PNEUMOCOCCAL SEPTICEMIA	041.04	BACTR INF DT GRP D STREP
038.3	SEPTICEMIA DT ANAEROBES	041.11	BACTERL INF DT S. AUREUS
038.4	SEPTICEMIA GRAM-NEGS, NEC	041.7	PSEUDOMONAS IN OTHER DIS
038.40	SEPTICEMIA GRAM-NEGS, NOS	995.92	SIRS DT INFCT W ORG DYSF

## Major Complications – Prostatectomy

Major Complications – Prostatectomy			
008.45	C. DIFFICILE INTESTN INF	507.0	PNEUMONIT-INH FOOD/VOMIT
410.01	AMI-ANTEROLATERL-INITIAL	518.5	PULM INSUF PST TRAUM/SRG
410.11	AMI-ANT WALL NEC-INITIAL	518.81	RESPIRATORY FAILURE
410.21	AMI-INFEROLATERL-INITIAL	996.76	COMP NEC-GU DEV/IMP/GRFT
410.51	AMI-LAT WALL NEC-INITIAL	997.1	CARDIAC COMPLICATION NEC
410.61	AMI-TRUE POST WL-INITIAL	997.3	RESPIR COMPLICATIONS NEC
410.71	AMI-SUBEND INFRC'T-INIT'L	997.4	DIGESTIVE SYST COMPL NEC
410.81	AMI-SITE NEC-INITIAL EPI	997.5	URINARY COMPLICATION NEC
410.91	AMI-SITE NOS-INITIAL EPI	998.11	HEMORRHAGE COMPLIC PROC
427.1	PAROXYSML VENT TACHYCARD	998.2	ACC PUNCTUR/LAC-PROC NEC
427.5	CARDIAC ARREST		

## Dependent Complications – Prostatectomy

Must occur with 997.1 Cardiac Complications			
427.31	ATRIAL FIBRILLATION	428.30	DIASTOLC HEART FAILR NOS
427.89	CARDIAC DYSRHYTHMIAS NEC	428.31	AC DIASTOL HEART FAILURE
428.0	CONGESTIVE HEART FAILURE	428.33	AC ON CHR DIASTL HT FAIL
428.1	LEFT HEART FAILURE	428.4	CMB SYST & DIAST HT FAIL
428.2	SYSTOLIC HEART FAILURE	428.40	CMB SYS/DIAS HT FAIL NOS
428.20	SYSTOLC HEART FAILUR NOS	428.41	AC COMB SYS/DIAS HT FAIL
428.21	AC SYSTOLC HEART FAILURE	428.43	AC ON CH SYS/DIA HT FAIL
428.23	AC ON CHR SYSTOL HT FAIL	428.9	HEART FAILURE, NOS
428.3	DIASTOLIC HEART FAILURE		
Must occur with 997.3 Respiratory Complications			
480	VIRAL PNEUMONIA	482.8	PNEUMONIA-BACTERIA, NEC
480.0	PNEUMONIA DT ADENOVIRUS	482.81	PNEUMONIA DT ANAEROBES
480.1	PNEUMONIA DT TO RSV	482.82	PNEUMONIA-E. COLI
480.2	PNEUMON-PARAINFLUENZA VR	482.83	PNEUMONIA-GRM NG BAC, NEC
480.3	PNEUMONIA DT SARS	482.84	LEGIONNAIRES' DISEASE
480.8	PNEUMONIA DT VIRUS, NEC	482.89	PNEUMONIA-BACTERIA, NEC
480.9	VIRAL PNEUMONIA, NOS	482.9	BACTERIAL PNEUMONIA, NOS
481	PNEUMOCOCCAL PNEUMONIA	483	PNEUMONIA-OTHER ORGANISM
482	OTHR BACTERIAL PNEUMONIA	483.0	PNEUMONIA-M. PNEUMONIAE
482.0	PNEUMONIA-K. PNEUMONIAE	483.1	PNEUMONIA DT CHLAMYDIA
482.1	PNEUMONIA DT PSEUDOMONAS	483.8	PNEUMONIA DT ORGANSM, NEC
482.2	PNEUMONIA-H. INFLUENZAE	484	PNEUMONIA-OTH INFECT DIS
482.3	PNEUMONIA-STREPTOCOCCUS	484.1	PNEUMONIA-CM INCLUSN DIS
482.30	PNEUMONIA-STREPTOCOC, NOS	484.3	PNEUMONIA-WHOOPING COUGH
482.31	PNEUMONIA-GROUP A STREP	484.5	PNEUMONIA IN ANTHRAX
482.32	PNEUMONIA-GROUP B STREP	484.6	PNEUMONIA-ASPERGILLOSIS
482.39	PNEUMONIA DT STREP, NEC	484.7	PNEUMON-SYST MYCOSES, NEC
482.4	PNEUMONIA-STAPHYLOCOCCUS	484.8	PNEUMON IN INFCT DIS, NEC
482.40	STAPH PNEUMONIA, NOS	485	BRONCHOPNEUM-ORGNSM, NOS
482.41	STAPH AUREUS PNEUMONIA	486	PNEUMONIA-ORGANISM, NOS
482.49	STAPH PNEUMONIA, NEC		
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	SEPTICEMIA GRAM-NEGS, NOS
038.0	STREPTOCOCCAL SEPTICEMIA	038.41	SEPTICEMIA-H. INFLUENZAE
038.1	STAPHYLOCOCC SEPTICEMIA	038.42	SEPTICEMIA DT E. COLI
038.10	STAPHLOCOCC SEPTICEM, NOS	038.43	SEPTICEMIA - PSEUDOMONAS
038.11	SEPTICEMIA-STAPH AUREUS	038.44	SEPTICEMIA DT SERRATIA
038.19	STAPHLOCOCC SEPTICEM, NEC	038.49	SEPTICEMIA GRAM-NEG, NEC
038.2	PNEUMOCOCCAL SEPTICEMIA	038.8	OTH SPECIFIED SEPTICEMIA
038.3	SEPTICEMIA DT ANAEROBES	038.9	UNSPECIFIED SEPTICEMIA
038.4	SEPTICEMIA GRAM-NEGS, NEC		



## Major Complications – Total Hip Replacement

Major Complications – Total Hip Replacement		
292.81	DRUG-INDUCED DELIRIUM	483.0 PNEUMONIA-M. PNEUMONIAE
410.01	AMI-ANTEROLATERL-INITIAL	483.1 PNEUMONIA DT CHLAMYDIA
410.11	AMI-ANT WALL NEC-INITIAL	483.8 PNEUMONIA DT ORGANISM NEC
410.21	AMI-INFEROLATERL-INITIAL	484 PNEUMONIA-OTH INFECT DIS
410.31	AMI-INFEROPOSTER-INITIAL	484.1 PNEUMONIA-CM INCLUSN DIS
410.41	AMI-INF WALL NEC-INITIAL	484.3 PNEUMONIA-WHOOPING COUGH
410.51	AMI-LAT WALL NEC-INITIAL	484.5 PNEUMONIA IN ANTHRAX
410.61	AMI-TRUE POST WL-INITIAL	484.6 PNEUMONIA-ASPERGILLOSIS
410.71	AMI-SUBEND INFRCT-INIT'L	484.7 PNEUMON-SYST MYCOSES NEC
410.81	AMI-SITE NEC-INITIAL EPI	484.8 PNEUMON IN INFCT DIS NEC
410.91	AMI-SITE NOS-INITIAL EPI	485 BRONCHOPNEUM-ORGNISM NOS
415.11	IATROG PULM EMBOLISM/INF	486 PNEUMONIA-ORGANISM NOS
480	VIRAL PNEUMONIA	507.0 PNEUMONIT-INH FOOD/VOMIT
480.0	PNEUMONIA DT ADENOVIRUS	518.5 PULM INSUF PST TRAUM/SRG
480.1	PNEUMONIA DUE TO RSV	518.81 RESPIRATORY FAILURE
480.2	PNEUMON-PARAINFLUENZA VR	584.5 AC REN FAIL-LES TUBL NEC
480.3	PNEUMONIA DT SARS	584.8 AC REN FAIL-PATH LES NEC
480.8	PNEUMONIA DT VIRUS NEC	584.9 ACUTE RENAL FAILURE, NOS
480.9	VIRAL PNEUMONIA, NOS	707.0 DECUBITUS ULCER
481	PNEUMOCOCCAL PNEUMONIA	707.00 DECUBITUS ULCER NOS
482	OTHR BACTERIAL PNEUMONIA	707.01 DECUBITUS ULCER-ELBOW
482.0	PNEUMONIA-K. PNEUMONIAE	707.02 DECUBITUS ULCER-UP BACK
482.1	PNEUMONIA DT PSEUDOMONAS	707.03 DECUBITUS ULCER-LO BACK
482.2	PNEUMONIA-H. INFLUENZA E	707.04 DECUBITUS ULCER-HIP
482.3	PNEUMONIA-STREPTOCOCCUS	707.05 DECUBITUS ULCER-BUTTOCK
482.30	PNEUMONIA-STREPTOCOC NOS	707.06 DECUBITUS ULCER-ANKLE
482.31	PNEUMONIA-GROUP A STREP	707.07 DECUBITUS ULCER-HEEL
482.32	PNEUMONIA-GROUP B STREP	707.09 DECUBITUS ULCER NEC
482.39	PNEUMONIA DT STREP NEC	799.1 RESPIRATORY ARREST
482.4	PNEUMONIA-STAPHYLOCOCCUS	995.92 SIRS DT INFCT W ORG DYSF
482.40	STAPH PNEUMONIA NOS	996.4 MECH COMPL-INT ORTHO DEV
482.41	STAPH AUREUS PNEUMONIA	996.77 COMP NEC-INTRN JT PROSTH
482.49	STAPH PNEUMONIA NEC	996.78 COMP NEC-ORTHOPD DEV NEC
482.8	PNEUMONIA-BACTERIA NEC	997.02 IATROGN C-VSC INFRCT/HEM
482.81	PNEUMONIA DT ANAEROBES	997.1 CARDIAC COMPLICATION NEC
482.82	PNEUMONIA-E. COLI	997.3 RESPIR COMPLICATIONS NEC
482.83	PNEUMONIA-GRM NG BAC NEC	997.4 DIGESTIVE SYST COMPL NEC
482.84	LEGIONNAIRES' DISEASE	997.5 URINARY COMPLICATION NEC
482.89	PNEUMONIA-BACTERIA NEC	998.0 POSTOPERATIVE SHOCK NEC
482.9	BACTERIAL PNEUMONIA, NOS	998.11 HEMORRHAGE COMPLIC PROC
483	PNEUMONIA-OTHER ORGANISM	998.59 POSTOPERATIV INFECTN NEC

## Dependent Complications – Total Hip Replacement

Must occur with 997.1 Cardiac Complications		
427.31	ATRIAL FIBRILLATION	428.31 AC DIASTOL HEART FAILURE
427.89	CARDIAC DYSRHYTHMIAS, NEC	428.33 AC ON CHR DIASTL HT FAIL
428.0	CONGESTIVE HEART FAILURE	428.4 CMB SYST & DIAST HT FAIL
428.1	LEFT HEART FAILURE	428.40 CMB SYS/DIAS HT FAIL, NOS
428.2	SYSTOLIC HEART FAILURE	428.41 AC COMB SYS/DIAS HT FAIL
428.20	SYSTOLC HEART FAILUR, NOS	428.43 AC ON CH SYS/DIA HT FAIL
428.21	AC SYSTOLC HEART FAILURE	427.0 PAROXYSMAL SVT
428.23	AC ON CHR SYSTOL HT FAIL	427.1 PAROXYSML VENT TACHYCARD
428.3	DIASTOLIC HEART FAILURE	428.9 HEART FAILURE, NOS
428.30	DIASTOLC HEART FAILR, NOS	
Must occur with 997.4 Digestive 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 INFECT, NOS	788.29 RETENTION OF URINE, NEC

## Dependent Complications – Total Hip Replacement (continued)

Must occur with 998.59 Postoperative Infection			
038	SEPTICEMIA	038.40	SEPTICEMIA GRAM-NEGS, NOS
038.0	STREPTOCOCCAL SEPTICEMIA	038.41	SEPTICEMIA-H. INFLUENZAE
038.1	STAPHYLOCOCCAL SEPTICEMIA	038.42	SEPTICEMIA DT E. COLI
038.10	STAPHYLOCOCC SEPTICEM, NOS	038.43	SEPTICEMIA - PSEUDOMONAS
038.11	SEPTICEMIA-STAPH AUREUS	038.44	SEPTICEMIA DT SERRATIA
038.19	STAPHYLOCOCC SEPTICEM, NEC	038.49	SEPTICEMIA GRAM-NEG, NEC
038.2	PNEUMOCOCCAL SEPTICEMIA	038.8	OTH SPECIFIED SEPTICEMIA
038.3	SEPTICEMIA DT ANAEROBES	038.9	UNSPECIFIED SEPTICEMIA
038.4	SEPTICEMIA GRAM-NEGS, NEC		

## Major Complications – Total Knee Replacement

Major Complications – Total Knee Replacement			
292.81	DRUG-INDUCED DELIRIUM	483.0	PNEUMONIA-M. PNEUMONIAE
410.01	AMI-ANTEROLATERL-INITIAL	483.1	PNEUMONIA DT CHLAMYDIA
410.11	AMI-ANT WALL, NEC-INITIAL	483.8	PNEUMONIA DT ORGANISM, NEC
410.21	AMI-INFEROLATERL-INITIAL	484	PNEUMONIA-OTH INFECT DIS
410.31	AMI-INFEROPOSTER-INITIAL	484.1	PNEUMONIA-CM INCLUSN DIS
410.41	AMI-INF WALL, NEC-INITIAL	484.3	PNEUMONIA-WHOOPING COUGH
410.51	AMI-LAT WALL, NEC-INITIAL	484.5	PNEUMONIA IN ANTHRAX
410.61	AMI-TRUE POST WL-INITIAL	484.6	PNEUMONIA-ASPERGILLOSIS
410.71	AMI-SUBEND INFRCT-INIT'L	484.7	PNEUMON-SYST MYCOSES, NEC
410.81	AMI-SITE, NEC-INITIAL EPI	484.8	PNEUMON IN INFCT DIS, NEC
410.91	AMI-SITE, NOS-INITIAL EPI	485	BRONCHOPNEUM-ORGNISM, NOS
415.11	IATROG PULM EMBOLISM/INF	486	PNEUMONIA-ORGANISM, NOS
415.19	PULM EMBOLISM/INFARCT, NEC	507.0	PNEUMONIT-INH FOOD/VOMIT
480	VIRAL PNEUMONIA	518.5	PULM INSUF PST TRAUM/SRG
480.0	PNEUMONIA DT ADENOVIRUS	518.81	RESPIRATORY FAILURE
480.1	PNEUMONIA DUE TO RSV	584.5	AC REN FAIL-LES TUBL, NEC
480.2	PNEUMON-PARAINFLUENZA VR	584.8	AC REN FAIL-PATH LES, NEC
480.3	PNEUMONIA DT SARS	584.9	ACUTE RENAL FAILURE, NOS
480.8	PNEUMONIA DT VIRUS, NEC	707.0	DECUBITUS ULCER
480.9	VIRAL PNEUMONIA, NOS	707.00	DECUBITUS ULCER, NOS
481	PNEUMOCOCCAL PNEUMONIA	707.01	DECUBITUS ULCER-ELBOW
482	OTHR BACTERIAL PNEUMONIA	707.02	DECUBITUS ULCER-UP BACK
482.0	PNEUMONIA-K. PNEUMONIAE	707.03	DECUBITUS ULCER-LO BACK
482.1	PNEUMONIA DT PSEUDOMONAS	707.04	DECUBITUS ULCER-HIP
482.2	PNEUMONIA-H. INFLUENZAE	707.05	DECUBITUS ULCER-BUTTOCK
482.3	PNEUMONIA-STREPTOCOCCUS	707.06	DECUBITUS ULCER-ANKLE
482.30	PNEUMONIA-STREPTOCOC, NOS	707.07	DECUBITUS ULCER-HEEL
482.31	PNEUMONIA-GROUP A STREP	707.09	DECUBITUS ULCER, NEC
482.32	PNEUMONIA-GROUP B STREP	799.1	RESPIRATORY ARREST
482.39	PNEUMONIA DT STREP, NEC	995.92	SIRS DT INFCT W ORG DYSF
482.4	PNEUMONIA-STAPHYLOCOCCUS	996.4	MECH COMPL-INT ORTHO DEV
482.40	STAPH PNEUMONIA, NOS	996.77	COMP, NEC-INTRN JT PROSTH
482.41	STAPH AUREUS PNEUMONIA	996.78	COMP, NEC-ORTHOPD DEV, NEC
482.49	STAPH PNEUMONIA, NEC	997.02	IATROGN C-VSC INFRCT/HEM
482.8	PNEUMONIA-BACTERIA, NEC	997.1	CARDIAC COMPLICATION, NEC
482.81	PNEUMONIA DT ANAEROBES	997.3	RESPIR COMPLICATIONS, NEC
482.82	PNEUMONIA-E. COLI	997.4	DIGESTIVE SYST COMPL, NEC
482.83	PNEUMONIA-GRM NG BAC, NEC	997.5	URINARY COMPLICATION, NEC
482.84	LEGIONNAIRES' DISEASE	998.0	POSTOPERATIVE SHOCK, NEC
482.89	PNEUMONIA-BACTERIA, NEC	998.11	HEMORRHAGE COMPLIC PROC
482.9	BACTERIAL PNEUMONIA, NOS	998.59	POSTOPERATIV INFECTN, NEC
483	PNEUMONIA-OTHER ORGANISM	999.8	TRANSFUSION REACTION, NEC

## Dependent Complications – Total Knee Replacement

Must occur with 997.1 Cardiac Complications			
427.0	PAROXYSMAL SVT	428.3	DIASTOLIC HEART FAILURE
427.1	PAROXYSML VENT TACHYCARD	428.30	DIASTOLC HEART FAILR, NOS
427.31	ATRIAL FIBRILLATION	428.31	AC DIASTOL HEART FAILURE
427.89	CARDIAC DYSRYTHMIAS, NEC	428.33	AC ON CHR DIASTL HT FAIL
428.0	CONGESTIVE HEART FAILURE	428.4	CMB SYST & DIAST HT FAIL
428.1	LEFT HEART FAILURE	428.40	CMB SYS/DIAS HT FAIL, NOS
428.2	SYSTOLIC HEART FAILURE	428.41	AC COMB SYS/DIAS HT FAIL
428.20	SYSTOLC HEART FAILUR, NOS	428.43	AC ON CH SYS/DIA HT FAIL
428.21	AC SYSTOLC HEART FAILURE	428.9	HEART FAILURE, NOS
428.23	AC ON CHR SYSTOL HT FAIL		
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 INFECT, NOS	788.29	RETENTION OF URINE, NEC
Must occur with 998.59 Postoperative Infection			
038	SEPTICEMIA	038.40	SEPTICEMIA GRAM-NEGS, NOS
038.0	STREPTOCOCCAL SEPTICEMIA	038.41	SEPTICEMIA-H. INFLUENZAE
038.1	STAPHYLOCOCC SEPTICEMIA	038.42	SEPTICEMIA DT E. COLI
038.10	STAPHLOCOCC SEPTICEM, NOS	038.43	SEPTICEMIA - PSEUDOMONAS
038.11	SEPTICEMIA-STAPH AUREUS	038.44	SEPTICEMIA DT SERRATIA
038.19	STAPHLOCOCC SEPTICEM, NEC	038.49	SEPTICEMIA GRAM-NEG, NEC
038.2	PNEUMOCOCCAL SEPTICEMIA	038.8	OTH SPECIFIED SEPTICEMIA
038.3	SEPTICEMIA DT ANAEROBES	038.9	UNSPECIFIED SEPTICEMIA
038.4	SEPTICEMIA GRAM-NEGS, NEC		

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

Proc = Procedure Code      Diag = Diagnosis Code

Appendectomy	
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 540.1	AC APPENDICIT-PERIT ABSC
Diag 540.0	AC APPENDIC-PERITONITIS
Diag 787.01	NAUSEA WITH VOMITING
Diag 496	CHR AIRWAY OBSTRUCT, NEC
Atrial Fibrillation	
Diag 518.81	ACUTE RESPIRATORY FAILURE
Diag 584.5, 584.8, 584.9	ACUTE RENAL FAILURE
Diag 162.9	MALIGNANT NEOPLASM OF BRONCHUS & LUNG, UNSP
Diag 707.0	DECUBITUS ULCER
Diag 458.8, 458.9	HYPOTENSION, UNSP OR NEC
Back and Neck Surgery (Except Spinal Fusion)	
Diag 276.5	VOLUME DEPLETION
Diag 403.11, 403.91	NON-MALIGNANT RENAL DISEASE WITH FAILURE
Diag 276.1	HYOSMOLALITY AND/OR HYPONATREMIA
Diag 428.0	CONGESTIVE HEART FAILURE, UNSPECIFIED
Diag 276.8	HYPOPOTASSEMIA

<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/DORSOLUMB FUSION, ANT TECHNIQUE
Diag 403.11, 403.91	NON-MALIGNANT RENAL DISEASE WITH FAILURE
Diag 276.5	VOLUME DEPLETION
Diag 787.2	DYSPHAGIA
<b>Bariatric Surgery</b>	
Diag 785.0	TACHYCARDIA, NOS
Diag 427.89	CARDIAC DYSRHYTHMIAS NEC
Diag 428.0	CONGESTIVE HEART FAILURE
Diag 285.9	ANEMIA, UNSPECIFIED
Diag 518.0	PULMONARY COLLAPSE
<b>Bowel Obstruction</b>	
Diag 557.0	ACUTE VASCULAR INSUFFICIENCY OF INTESTINE
Diag 276.2	ACIDOSIS
Diag 458.8, 458.9	HYPOTENSION, UNSP OR NEC
Diag 584.5, 584.8, 584.9	ACUTE RENAL FAILURE
Diag 427.1	PAROXYSMAL VENTRICULAR TACHYCARDIA
<b>Carotid Endarterectomy</b>	
Diag 491.21	OBSTR CHR BRONC-AC EXACR
Diag 260, 261, 262, 263.0, 263.1, 263.2, 263.8, 263.9	MALNUTRITION
Proc 39.72	ENDOVASC REPR OR OCCLUSION OF HD/NCK VES
Diag 584.5, 584.8, 584.9	ACUTE RENAL FAILURE
Diag 342.90	UNSP HEMIPLEGIA & HEMIPARESIS AFFECTING UNSP SIDE
<b>Cholecystectomy</b>	
Diag 276.2	ACIDOSIS
Diag 995.92	SYST INFLM RESP SYNDR DT INFECT PROC-ORGAN DYSF
Diag 511.9	UNSPECIFIED PLEURAL EFFUSION
Diag 567.2	OTHER SUPPURATIVE PERITONITIS
Diag 491.21	OBSTR CHR BRONC-AC EXACR
<b>Chronic Obstructive Pulmonary Disease (COPD)</b>	
Diag 518.81	ACUTE RESPIRATORY FAILURE
Diag 518.84	ACUTE & CHRONIC RESPIRATORY FAILURE
Diag 584.5, 584.8, 584.9	ACUTE RENAL FAILURE
Diag 496	CHRONIC AIRWAY OBSTRUCTION, NEC
Diag 162.9	MALIGNANT NEOPLASM OF BRONC/LUNG, UNSP
<b>Community Acquired Pneumonia</b>	
Diag 518.81	ACUTE RESPIRATORY FAILURE
Diag 518.82	OTHER PULMONARY INSUFFICIENCY, NEC
Diag 162.9	MALIGNANT NEOPLASM OF BRONC/LUNG, UNSP
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 799.4	CACHEXIA

<b>Coronary Bypass Surgery</b>	
Diag 584.5, 584.8, 584.9	ACUTE RENAL FAILURE
Proc 37.61	IMPLANT OF PULSATION BALLOON
Diag 260, 261, 262, 263.0, 263.1, 263.2, 263.8, 263.9	MALNUTRITION
Diag 410.01, 410.11, 410.21, 410.51, 410.61, 410.81, 410.91	ANTERIOR/LATERAL WALL AMI
Diag 491.21	OBSTRUCTIVE CHRONIC BRONCHITIS W/ (ACUTE) EXACR
<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	ACUTE RENAL FAILURE
Diag 410.71	AC MYOCARD INFARCT/SUBENDOCARD INFARCT- INITIAL EPI
Diag V451	POSTSURGICAL RENAL DIALYSIS STATUS
<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 427.1	PAROXYSMAL VENTRICULAR TACHYCARDIA
Diag 458.8, 458.9	HYPOTENSION, UNSP OR NEC
Diag 578.9	HEMORRHAGE OF GASTROINTESTINAL TRACT, UNSPEC
<b>Gastrointestinal Bleed</b>	
Diag 518.81	ACUTE RESPIRATORY FAILURE
Diag 785.59	OTHER SHOCK WITHOUT MENTION OF TRAUMA
Diag 276.2	ACIDOSIS
Diag 458.8, 458.9	HYPOTENSION, UNSP OR NEC
Diag 507.0	PNEUMONIT DT INH FOOD/VOM
<b>Heart Attack</b>	
Diag 518.81	ACUTE RESPIRATORY FAILURE
Diag 410.01, 410.11, 410.21, 410.51, 410.61, 410.81, 410.91	ANTERIOR/LATERAL WALL AMI
Diag 586	RENAL FAILURE, UNSPECIFIED
Diag 410.31, 410.41	INFERIOR WALL AMI
Diag 426.0	ATRIOVENTRICULAR BLOCK, COMPLETE
<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 428.9	HEART FAILURE, UNSPECIFIED
Diag 507.0	PNEUMONITIS DUE TO INHALATION OF FOOD OR VOMITUS
Diag 458.8, 458.9	HYPOTENSION, UNSP OR NEC
<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 427.1	PAROXYSMAL VENTRICULAR TACHYCARDIA
Diag 584.9	ACUTE RENAL FAILURE, NOS
Diag 491.21	OBSTRUCTIVE CHRONIC BRONCHITIS W/ (ACUTE) EXACR

<b>Pancreatitis</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 458.8, 458.9	HYPOTENSION, UNSP OR NEC
Diag 276.2	ACIDOSIS
Diag 584.9	ACUTE RENAL FAILURE, NOS
Diag 507.0	PNEUMONITIS DUE TO INHALATION OF FOOD OR VOMITUS
<b>Partial Hip Replacement</b>	
Diag 507.0	PNEUMONITIS DUE TO INHALATION OF FOOD OR VOMITUS
Diag 511.9	UNSPECIFIED PLEURAL EFFUSION
Diag 584.5, 584.8, 584.9	ACUTE RENAL FAILURE
Diag 427.32	ATRIAL FLUTTER
Diag 491.21	OBSTRUCTIVE CHRONIC BRONCHITIS W/ (ACUTE) EXACR
<b>Peripheral Vascular Bypass</b>	
Diag 491.21	OBSTRUCTIVE CHRONIC BRONCHITIS W/ (ACUTE) EXACR
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	PNEUMONIA
Diag 682.6	CELLULITIS/ABSCSS OF LEG, EXCEPT FOOT
Diag 584.5, 584.8, 584.9	ACUTE RENAL FAILURE
Diag 427.32	ATRIAL FLUTTER
<b>Prostatectomy</b>	
Proc 60.3	SUPRAPUBIC PROSTATECTOMY
Proc 60.4	RETROPUBIC PROSTATECTOMY
Diag 276.1	HYPOSMOLALITY/HYPONATREMIA
Proc 60.5	RADICAL PROSTATECTOMY
Diag 287.5	THROMBOCYTOPENIA, UNSPECIFIED
<b>Pulmonary Embolism</b>	
Diag 518.81	ACUTE RESPIRATORY FAILURE
Diag 276.2	ACIDOSIS
Diag 518.82	OTHER PULMONARY INSUFFICIENCY, NEC
Diag 458.9	HYPOTENSION, UNSPEC
Diag 584.5, 584.8, 584.9	ACUTE RENAL FAILURE
<b>Resection/Replacement of Abdominal Aorta</b>	
Proc 38.64	OTHER EXCISION OF ABDOMINAL AORTA
Diag 441.3	ABDOMINAL ANEURYSM, RUPTURED
Diag 557.0	ACUTE VASCULAR INSUFFICIENCY OF INTESTINE
Diag 286.9	OTHER & UNSPECIFIED COAGULATION DEFECTS
Diag 458.8, 458.9	HYPOTENSION, UNSP OR NEC
<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	AC VASC INSUFF-INTESTINE
Diag 586	RENAL FAILURE, UNSP
Diag 518.81	ACUTE RESPIRATORY FAILURE
Diag 560.9	UNSP INTESTINAL OBSTR

<b>Stroke</b>	
Diag 780.01	COMA
Diag 432.9	UNSP INTRACRANIAL HEMORRHAGE
Diag 518.81	ACUTE RESPIRATORY FAILURE
Diag 430	SUBARACHNOID HEMORRHAGE
Diag 431	INTRACEREBRAL HEMORRHAGE
<b>Total Hip Replacement</b>	
Diag 403.11, 403.91	NON-MALIGNANT RENAL DISEASE-FAILURE
Diag 287.5	THROMBOCYTOPENIA, UNSPC
Diag 428.0	CONGESTIVE HEART FAILURE, UNSPC
Proc 815.1	BILATERAL HIP
Diag 496	CHRONIC AIRWAY OBSTRUCTION, NEC
<b>Total Knee Replacement</b>	
Diag 403.11, 403.91	NON-MALIGNANT RENAL DISEASE/FAIL
Diag 428.0	CONGESTIVE HEART FAILURE, UNSPC
Proc 815.4	BILATERAL KNEE
Diag 280.0	IDA SECONDARY TO BLOOD LOSS (CHRONIC)
Diag 496	CHRONIC AIRWAY OBSTRUCTION, NEC
<b>Valve Replacement Surgery</b>	
Diag 584.5, 584.8, 584.9	ACUTE RENAL FAILURE
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 996.61	INFCT/INFLAM REACT DT CARD DEV, IMPL/GRAFT
Proc 35.21, 35.22, 35.23, 35.24	AORTIC AND MITRAL VALVE REPLACEMENT

## Appendix D: Methodology Enhancements for 2007 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 changes for each rated cohort and provide the rationale behind these changes.

- All Service Lines
- Cardiac
- Orthopedic
- Vascular

### All Service Lines

Cohorts Affected	2007 Ratings' Model Change	Rationale for Changes
All	Decreased national volume for potential risk factors from 1% to 0.5%	Some risk factors, while infrequent, are highly correlated with the outcome of measure and thus should be risk adjusted for the patient population evaluated.
All	Required a hospital to have a total of 30 cases over the three year period and a minimum of five cases in the most current year of analysis (2005) to be rated in a cohort.	Previously hospitals were required to have a minimum of 30 cases over the three year period and one case in the most current year of analysis. Increasing the cases in the most current year of analysis ensures hospitals appropriately included in the cohort.
All diagnosis cohorts: Heart Attack, Heart Failure, Atrial Fibrillation, Community Acquired Pneumonia, COPD, Stroke, Bowel Obstruction, GI Bleed, Pancreatitis, Pulmonary Embolism, Sepsis, Diabetic Acidosis and Coma	Excluded patients with any code for secondary cancer diagnoses (196.0-196.9, 197.1-197.8, 198.0-198.8, 198.81-198.82, 198.89)	Patients with metastasized cancers present at various stages of illness with different end-of-life directives. Because these directives cannot be identified in administrative data, these patients were excluded from analysis.

### Cardiac

Cohorts Affected	2007 Ratings' Model Change	Rationale for Changes
Coronary Bypass Surgery	Excluded patients with Carotid Endarterectomy (38.12, 39.72) in the same hospitalization	Low volume prohibited achieving the statistical significance required to adequately risk adjust for this population.
Coronary Bypass Surgery Valve Surgery	Excluded patients with aortic dissection (441.0-441.03)	These patients were excluded because they are not representative of the bypass population. This rare group can represent the sickest, most acute population and possibly be under risk adjusted.
Coronary Bypass Surgery Valve Surgery	Excluded patients with aortic abdominal aneurysm, or thoracic aneurysm (38.44, 38.64, 39.71, 441.2)	This situation is infrequent but when it does occur, inadequate risk adjustment may occur due to the low volume of this patient population (and not reaching the statistical significance required to remain in the final prediction model), thus necessitating exclusion from the patient population evaluated.
Valve Surgery	As in the 2006 model, included combined codes for "other valve repair" (35.10, 35.11, 35.13, 35.14) and "mitral repair" (35.12) as potential predictors (positive or negative) of mortality	Although rates of valve repairs are increasing across several institutions, there are still insufficient numbers associated with each valve repair procedure code to reach statistical significance. As such, "like" valve repair codes were combined to increase the likelihood of reaching statistical significance to be included in the final model.



## Orthopedic

Cohorts Affected	2007 Ratings' Model Change	Rationale for Changes
Total Knee, Total Hip, Back and Neck Surgery, Spinal fusion	Consider Renal Failure, AMI, and Pneumonia as complications without a corresponding postoperative 900 complication code	In using administrative data, some codes that appear may be a complication but they can also be risks. In order to differentiate complications in the analysis, HealthGrades assigns codes as complications only if there is a corresponding 900 postoperative complication code. This year in the elective joint procedures, if codes for renal failure, AMI, or pneumonia appear, they are automatically assigned as complications. The rationale for this is that it is highly unlikely these conditions are risk factors in this population.
Total Knee and Total Hip Replacements	Exclude patients with mechanical complication of prosthetic joint device codes when primary diagnosis (9964)	Some patients receiving a joint replacement have had previous orthopedic surgery on that joint and are now experiencing complications on that same joint. Because this situation is infrequent, when it occurs, inadequate risk adjustment may occur due to the low volume of this patient population (and not reaching the statistical significance required to remain in the final prediction model), thus necessitating exclusion from the patient population evaluated.
Hip Fracture Repair Partial Hip Replacement	Exclude Removal of implanted devices from bone (78.65-78.67) and removal of hip and knee prostheses (80.05-80.06)	Some patients who have hip fracture repair surgery or partial hip replacements have had previous orthopedic surgery and require removal of fixation devices or limb lengthening devices. Patients who present with previous orthopedic devices that must be removed are sometimes coded as having a mechanical complication. In these cases, the complication appears to be post-operative in the administrative data. Thus these patients are removed.
Back and Neck Surgery (excluding fusion) Spinal Fusion	Exclude vertebroplasty (81.65) and kyphoplasty (81.66)	Vertebroplasty and kyphoplasty are minimally invasive, non-surgical procedures and therefore are not appropriate for inclusion in the back and neck surgery analysis.
Back and Neck Surgery (excluding fusion) Spinal Fusion	Exclude removal of disc prosthesis (84.60-84.65) and revisions of artificial spinal disc prostheses (84.66-84.69)  Exclude patients with V-codes for encounter for removal of internal fixation device and aftercare involving internal fixation device (v5401, v5409)	Patients with a history of previous spinal surgery may have "failed hardware" which is frequently coded with a primary diagnosis of complication of the joint prosthesis or mechanical failure of the device. In these instances, the mechanical complication would appear to be a postoperative complication. Therefore, these patients are excluded from the analysis.
Back and Neck Surgery (excluding fusion) Spinal Fusion	Exclude patients with history of bone transplants (v42.4)	This situation is infrequent and when it does occur, these patients may not be adequately risk adjusted due to the low volume and not reaching the statistical significance required to remain in the final prediction model thus necessitating exclusion from the patient population evaluated.
Spinal Fusion	Exclude patients with implantation of interspinous process decompression device (84.58)	This procedure is minimally invasive alternative to traditional spinal fusion surgery and therefore not appropriate for inclusion in the spinal fusion cohort.

## Vascular

Cohorts Affected	2007 Ratings' Model Change	Rationale for Changes
Repair/Replacement of Abdominal Aortic Aneurysm	Include patients with a length of stay one day or less.	With the increased use of endoluminal grafting procedures for AAA repair, there is increasing frequency of patients with a length of stay one day or less.
Carotid Endarterectomy	Included carotid stents and angioplasties	Due to ICD9 codes specific to carotid stenting and angioplasty and adequate volume, these patients can now be included and risk adjusted for in the carotid surgery study cohort.