

**Technical Description of Analytic Techniques**  
**Center for the Study of Services**  
**Performed by Michael Pine & Associates, Inc.**  
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1. Analyses of risk-adjusted 30-day mortality rates and risk-adjusted inpatient adverse outcome rates were performed for qualifying acute care hospitals using Medicare billing data for calendar years 2004, 2005, and 2006.
2. Outcomes for 10 medical conditions and 11 surgical procedures were studied. Medical conditions were identified by ICD-9-CM principal diagnosis codes. Surgical procedures were identified using ICD-9-CM procedure codes. For some conditions, medical cases were eliminated from analyses if they were associated with specific, related ICD-9-CM procedure codes. Surgical cases were eliminated from analyses if they were not associated with a clinically related principal diagnosis.

Detailed Definitions of conditions and procedures studied are as follows:

- D1: Acute Myocardial Infarction (including AMI with PTCA or CABG)  
Diagnostic Codes: 410x1.  
Exclude Case for Procedure Codes: None.
- D2: Obstructive Pulmonary Disease  
Diagnostic Codes: 49y2x,y=1,3; 49yxx, y=2,4,6.  
Exclude Case for Procedure Codes: 33yx,y=5,6.
- D3: Congestive Heart Failure  
Diagnostic Codes: 39891; 40yx1,y=2,4; 404xy,y=1,3; 428xx.  
Exclude Case for Procedure Codes: 336x; 3yxx,y=5,6; 375x.
- D4: Primary Pneumonia (including aspiration)  
Diagnostic Codes: 48yxx,y=0,1,2,3,5,6; 4870x; 5070x.  
Exclude Case for Procedure Codes: None.
- D5: Septicemia  
Diagnostic Codes: 0031x; 036yx, y=2,3; 038xx; 09889; 9959y, y=1,2.  
Exclude Case for Procedure Codes: None.
- D6: Cerebrovascular Accident (ischemic and hemorrhagic)  
Diagnostic Codes: 43yx1, y=3,4; 43yxx, y=0,1,2,6; 99702.  
Exclude Case for Procedure Codes: None.
- D7: Non-Surgical Gastrointestinal hemorrhage  
Diagnostic Codes: 4560x; 5307x; 53082; 531yx,y=0,4; 532yx,y=0,4; 533yx,  
y=0,4; 534yx,y=0,4; 535x1; 5378y,y=3,4; 562xy,y=2,3; 5693x; 5698y,y=5,6;  
578xx.  
Exclude Case for Procedure Codes: 42yx,y=4,5,6; 4282; 4291; 43yx,y=5,6,7,8,9;  
44yx,y=0,2,3; 444y, y=0,1,2,9; 44y1, y=6,9; 45yx, y=6,7,8,9; 467y,y=1,3,5;  
48yx,y=4,5,6; 4871; 494x.

- D8: Fluid, Electrolyte, & Acid-Base Disorders  
Diagnostic Codes: 276xx.  
Exclude Case for Procedure Codes: None.
- D9: Respiratory Failure & Arrest  
Diagnostic Codes: 5185x; 5188y, y=1,2,3,4; 7991x; 7860y,y=3,9.  
Exclude Case for Procedure Codes: 33yx,y=5,6.
- D10: Renal Failure  
Diagnostic Codes: 403x1; 404yx,y=2,3; 58yxx,y=4,5,6; 7885x.  
Exclude Case for Procedure Codes: 3927; 556x.
- P1: Coronary Artery Bypass Graft Surgery (not post-acute myocardial infarction)  
Procedure Codes: 361x.  
Include for Principal Diagnostic Codes: 39yxx,y=4,5,6; 39891,40yx1,y=2,4;  
404x3; 428xx; 4111x; 4118x; 414xx; 424yx,y=0,1; 9960y,y=2,3.
- P2: Cholecystectomy (open and laparoscopic)  
Procedure Codes: 512y,y=2,3.  
Include for Principal Diagnostic Codes: 57yxx,y=4,5,6; 577yx,y=0,1.
- P3: Total Knee Replacement (primary)  
Procedure Codes: 8154.  
Include for Principal Diagnostic Codes: 7140x; 715xy,y=6,9; 716y6,y=1,9; 71996;  
7366x.
- P4: Total Hip Replacement (primary)  
Procedure Codes: 8151.  
Include for Principal Diagnostic Codes: 7140x; 715xy,y=5,9; 716y5,y=1,9;  
73314; 73342; 7338x; 7363x; 820yx, y=0,2,8; 9964x; 9967y,y=7,8.
- P5: Large Bowel Resection  
Procedure Codes: 45yx,y=7,8; 48yx,y=4,5,6.  
Include for Principal Diagnostic Codes: 15yxx,y=3,4; 211yx,y=3,4; 230yx,y=3,4;  
2352x; 555yx,y=1,2; 55yxx,y=6,7; 560yx,y=2,8,9; 5621x; 5647x; 569yx,y=1,5,8;  
5789x.
- P6: Simple Prostatectomy  
Procedure Codes: 60yx,y=2,3,4,6.  
Include for Principal Diagnostic Codes: 85xx; 600xx; 601yx,y=0,1; 7882y,y=0,9.
- P7: Laminectomy  
Procedure Codes: 805x.  
Include for Principal Diagnostic Codes: 72yxx,y=1,2; 72y0x,y=3,4; 7384x;  
75612.
- P8: Carotid Endarterectomy  
Procedure Codes: 3812.  
Include for Principal Diagnostic Codes: 433y0,y=1,3; 435yx,y=8,9.
- P9: Repair of Abdominal Aortic & Iliac Aneurysms  
Procedure Codes: 38y4,y=3,4; 38y6,y=3,4.  
Include for Principal Diagnostic Codes: 4414x; 4422x.
- P10: Herniorrhaphy  
Procedure Codes: 53yx,y=0,1,2,3.  
Include for Principal Diagnostic Codes: 550xx; 55y0x,y=1,2,3.
- P11: Hysterectomy for Benign Disease

Procedure Codes: 68yx,y=3,4,5,9.

Include for Principal Diagnostic Codes: 21yxx,y=8,9; 220xx; 233yx,y=1,2;  
61yxx,y=4,5,6,7,8,9; 62yxx,y=0,1,2,6,7; 6256x.

(Codes above formatted with x equal to any digit from 0 to 9 or blank and y equal to any designated digit.)

3. For each medical or surgical category, the observed mortality rate for each hospital in the study was computed as the percentage of qualifying patients who died within 30 days of the qualifying admission.
4. For each medical and surgical category, an equation was derived to predict 30-day mortality using stepwise logistic regression. Independent variables included age, sex, selected principal and secondary diagnostic codes, and selected procedure codes. Because secondary diagnoses might be indicative of hospital-acquired complications rather than valid risk factors present on admission, a secondary diagnosis was used as a candidate independent variable only when it met the following two criteria:
  - a. based on California data that distinguished between inpatient complications and valid risk factors present on admission, the secondary diagnosis, when present on admission, was found, in conjunction with other risk factors, to be a statistically significant predictor on inpatient mortality, and
  - b. based on the same California data, the secondary diagnosis was an inpatient complication no more than 30 percent of the time, or was a complication between 30 and 40 percent of the time but was clinically associated with other secondary diagnoses that were complications no more than 30 percent of the time.

Independent variables were selected using 1997 data and were validated using 1998 and 1999 data. Final predictive equations were based on data from 2004, 2005, and 2006 combined.

Diagnostic and procedural codes that appear in one or more predictive equation for mortality, routine length of stay, or prolonged standardized length of stay are listed below. Names of variables created for inclusion only in a single category are followed by designation of the category for which they were created. Codes are formatted with x equal to any digits from 0 to 9 or no entry and y equal to any designated digit. Five digit codes are ICD-9-CM diagnostic codes; four digit codes are ICD-9-CM procedure codes.

Independent variables that appear in one or more predictive equations are listed below:

1. Anterolateral AMI (D1 only):41001.
2. Subendocardial AMI (D1 only):41071.
3. Moderate Risk COPD ((D2 only):4928x; 496xx.
4. Associated CABG (D1 only):361x.
5. Emphysematous bleb (D2 only):4920x.
6. Aspiration pneumonia (D4 only):5070x.

7. High risk gram negative pneumonia (D4 only):482yx,y=0,1,2;4828y,y=1,2,3.
8. High risk renal disease (D3 only):403x1;404xy,y=2,3.
9. Moderate risk non-bacterial pneumonia:480xx.
10. Staph pneumonia (D4 only):4824x.
11. Moderate risk bacterial pneumonia (D4 only):48239;4828y,y=3,9;4838x.
12. Moderate risk bacterial/nonbacterial pneumonia (D4 only):4809x;4822x;48y0x,y=;48239;4828y,y=3,9;4838x.
13. Anaerobic & staph septicemia (D5 only): 038yx,y=1,3.
14. Intracranial/cerebral hemorrhage (D6 only):431xx;432yx,y=0,9.
15. Low risk precerebral occlusion (D6 only):433y1,y=1,2,3,8,9.
16. Subarachnoid hemorrhage (D6 only):430xx.
17. Subdural hemorrhage (D6 only):4321x.
18. Diverticulosis with hemorrhage (D7 only):56212.
19. Hematemesis/esophageal varices (D7 only):4560x;5780x.
20. Ulcer with obstruction (D7 only):53y01,y=1,2,3,4;53y41,y=1,2,3,4.
21. Acidosis (D8 only):276yx,y=2,4.
22. Hyperosmolarity (D8 only):2760x.
23. Hypopotassemia (D8 only):2768x.
24. Hypovolemia (D8 only):2765x.
25. Post-traumatic respiratory insufficiency (D9 only):5185x.
26. Respiratory arrest (D9 only):7991x.
27. Hemodialysis (D10 only):V451xx;3995.
28. Repeat CABG (P1 only):4140y,y=2,3,4,5;99603;V4581.
29. Valvuloplasty without valve replacement (P1 only):351x;3533.
30. Aortic valve replacement (P1 only):352y,y=1,2.
31. Mitral valve replacement (P1 only):352y,y=3,4.
32. Aortic & mitral valve replacement (P1 only):352y,y=1,2;352y,y=3,4.
33. Associated PTCA (P1 only):360x.
34. Associated carotid endarterectomy (P1 only):3812.
35. Abdominal cholecystectomy (P2 only):5122.
36. Common duct procedure (P2 only):5136;51yx,y=4,5.
37. High risk gall bladder disorders (P2 only):57431;576yx,y=1,2,3.
38. High & moderate risk gall bladder disorders (P2 only):57431;576yx,y=1,2,3;57411;57430;574yx,y=0,4,6,7,8;5750x;57512;577yx,y=0,1.
39. Closed fracture (P4 only):73314;820yx,y=0,2,8.
40. Pre-op hip complication (P4 only):9964x;9967y,y=7,8.
41. Acute vascular insufficiency (P5 only):5570x.
42. Associated small bowel surgery (P5 only):456x;4591.
43. Associated splenectomy (P5 only):415x.
44. Intestinal perforation (P5 only):56983.
45. Diverticulosis without hemorrhage (P5 only):5621y,y=0,1.
46. High risk GI disorders (P5 only):557yx,y=1,9;5647x;5789x.
47. Colonic malignancy (P5 only):153xx.
48. Partial large bowel resection (P5 only):457x.
49. Total large bowel resection (P5 only):458x.

50. Moderate risk GI disorder (P5 only): 555yx,y=1,2;556xx;560yx,y=0,2,8,9; 5621y,y=2,3;5695x;5698y,y=1,2,5,9.
51. Supra & retropubic prostatectomy (P6 only):60yx,y=3,4.
52. Acute prostatitis/retention (P6 only):6010x;78820.
53. Prostatic malignancy (P6 only):185xx.
54. Pre-op myelopathy (P7 only):721yx,y=1,4;72191;7227x.
55. Multiartery disease (P8 only):4333x.
56. Cervical disease without myelopathy (P7 only):72y0x,y=1,3;722yx,y=0,4; 722y1,y=8,9.
57. Iliac disease (P9 only):4422x.
58. Lumbosacral disc displacement without myelopathy (P7 only):72210.
59. TIA (P8 only):435yx,y=8,9.
60. Associated myelopathy (P7 only):721yx,y=1,4;72191;7227x.
61. Associated high risk abdominal surgery (P10 only):45yx,y=6,7,8,9;468y,y=0,1,2; 5122;541x;5459.
62. Vaginal procedure (P11 only):685x.
63. Femoral procedure (P10 only):53yx,y=2,3.
64. Acute myocardial infarction:410x1.
65. Coronary artery disease:410xy,y=0,2;41yxx,y=1,2,3,4.
66. Thoracoabdominal disease (P9 only):4417x.
67. Gangrene (P10 only):55y0x=0,1.
68. Obstruction (P10 only):5501x;5520x.
69. Malignancy of uterus (P11 only):1820x.
70. Congestive heart failure:39891;40yx1,y=2,4;428xx.
71. Cardiac arrest/ventricular fibrillation:427yx,y=4,5.
72. Cardiac dysrhythmia/block:4260x;4261y,y=2,3;426yx,y=2,3,4,5;42689; 427yx,y=0,1,2,3,8,9;4276y,y=1,9;9720x.
73. Atrial fibrillation/flutter;4273x.
74. Cardiomyopathy:425xx.
75. Shock:6395x;6691y,y=0,1,2,3,4;9584x;9980x.
76. Cardiogenic shock;78551.
77. Non-cardiogenic shock:6395x;6691y,y=0,1,2,3,4;7855y,y=0,2,9;9584x;9980x.
78. Complete AV Block:4260x.
79. Pericardial disease:4209x;423yx,y=8,9;4200x.
80. Ventricular tachycardia:4271x.
81. Other moderate risk dysrhythmia:4268x;427yx,y=0,2,6,8,9;9720x.
82. Second degree & fascicular block:4261y,y=2,3;426yx,y=2,3,4,5.
83. Pulmonary heart disease:4150x,416xx.
84. Cardiac valve disease:39yxx,y=4,5,6,7;424yx,y=0,1,2,3.
85. Mitral valve disorder:39yxx,y=4,5,6,7;4240x.
86. Non-mitral valve disorder:39yxx,y=5,7;424yx,y=1,2,3.
87. Diseases of arteries & large veins:44yxx,y=0,1,2,3;451xx;452xx;453xx; 4542x; 7854x.
88. Other moderate risk cardiac disease:0860x;093xx;3989y,y=0,9;429yx,y=2,3; 9729x;9741x;9757x;99603;V450x.
89. Thrombosis/embolus/gangrene:4402y,y=3,4;444xx;7854x.

90. Aneurysm:441xx.
91. Venous disease:451yx,y=1,2,8;452xx;453yx,y=0,2,8;4542x.
92. Other moderate risk vascular disease:4439x.
93. Hypertension:401xx;40yx0,y=2,3,4;405xx.
94. Hypertensive heart disease without CHF:402x0.
95. Uncomplicated hypertension:401xx.
96. Hypertension & renal disease without CRF:40yx0,y=3,4;405x1.
97. Hypotension:458xx.
98. Pulmonary embolism/infarct:4151x;9581x.
99. High risk pulmonary conditions:4151x;5120x;518yx,y=4,5;5188y,y=1,2;  
799yx,y=0,1;9581x;994yx,y=1,7;v46yx,y=1,8.
100. Respiratory failure/respiratory arrest:5185x;5188y,y=1,2;7991x;V46yx,y=1,8.
101. Other high risk pulmonary conditions:5120x;5184x;7990x.
102. Pneumonia:0521x;0796x;1124x;1140x;115y5,y=0,9;1363x;48yxx,y=0,1,2,3,5,6;  
484yx,y=1,6;4870x;5070x.
103. Very high risk pneumonia:1124x;482yx,y=0,1,4;48232;484yx,y=1,6;1363x.
104. Moderate risk pneumonia:48yxx,y=1,5,6;4823y,y=0,9;4870x.
105. Very high & high risk pneumonia:1124x;482yx,y=0,1,4;48232;484yx,y=1,6;  
1363x;4828y,y=1,2,3,9.
106. Moderate risk & other pneumonias:48yxx,y=1,5,6;4823y,y=0,9;4870x;0796x;  
1140x;115y5,y=0,9;48yxx,y=0,3;482yx,y=2,8;48231.
107. High & moderate risk & other pneumonias:1363x;4828y,y=1,2,3,9;0521x;  
48yxx,y=1,5,6;4823y,y=0,9;4829x;4870x;0730x;0796x;1140x;115y5,y=0,9;  
1304x;48yxx,y=0,3;482yx,y=2,8;48231.
108. Aspiration pneumonia:5070x.
109. Very high risk & aspiration pneumonia:1124x;482yx,y=0,1,4;48232;  
484yx,y=1,6;5070x.
110. Other specified pneumonias:0730x;0796x;1304x;48yxx,y=0,3;482yx,y=2,8;  
1140x;115y5,y=0,9;48231.
111. COPD/bronchiectasis:49y2x,y=1,3;49yxx,y=2,4,6.
112. Bronchitis/asthma:490xx;491yx,y=0,1;493yx,y=0,1,9.
113. Moderate risk pulmonary disorders:27700;495xx;50yxx,y=0,1,2,3,4,5;5081x;  
51yxx,y=0,1,4;512yx,y=1,8;518yx,y=0,1,2,3;51889;5192x;7863x.
114. Septicemia:0031x;036yx,y=2,3;03yxx,y=7,8;9959y,y=1,2.
115. Bacterial endocarditis:0932x;421xx.
116. Septicemia/bacterial endocarditis:0031x;036yx,y=2,3;03yxx,y=7,8;3642x;  
0932x;9884x;421xx;9959y,y=1,2.
117. Moderate risk bacterial infections:00yxx,y=1,2,4;003yx,y=0,8,9;0051x;  
008yx,y=0,1,2,3,4,5;03yxx,y=2,3,4;7110x.
118. Osteomyelitis/other specified infections:730yx,y=0,1,2,9;00yxx,y=1,2,4;  
003yx,y=0,8,9;0051x;008yx,y=0,1,2,3,4,5;03yxx,y=2,3,4;7110x.
119. Non-specific bacterial infections:041xx;590xx;59y0x,y=5,9.
120. Osteomyelitis & other non-specific infections:730yx,y=0,1,2,9;041xx;590xx;  
59y0x,y=5,9.
121. Pulmonary tuberculosis:011xx.
122. Endocarditis/osteomyelitis/other specified infections:3642x;0932x;9884x;

- 421xx;730yx,y=0,1,2,9;00yxx,y=1,2,4;003yx,y=0,8,9;0032y,y=0,3,4,9;0051x;  
008yx,y=0,1,2,3,4,5;03yxx,y=2,3,4;7110x.
123. Moderate risk non-bacterial infections:006yx,y=0,1,2,3,9;0071x;  
031yx,y=1,2,8,9;046xx;0520x;053xx;054yx,y=1,2,8,9;0547y,y=1,4,9;  
06yxx,y=0,1,2,3,4,5,6;071xx;0722x;07y5x,y=8,9;086yx,y=3,4,5;  
112yx,y=0,1,2,3,5,9;114yx,y=1,3,4,5,9;1150y,y=0,4,9;1159y,y=0,4;  
117yx,y=3,5,9;124xx;130yx,y=2,3,5,7,8,9;363yx,y=1,2.
  124. Acute abdomen:531yx,y=1,2,5,6;532yx,y=1,2,5,6;533yx,y=1,2,5,6;  
534yx,y=1,2,5,6;5y00x,y=4,5;560yx,y=0,2;56983;551xx;5570x;78906.
  125. GI Perforation/peritonitis:531yx,y=1,2,5,6;532yx,y=1,2,5,6;533yx,y=1,2,5,6;  
534yx,y=1,2,5,6;5400x;567xx;56983.
  126. Other high risk acute GI conditions:5500x;560yx,y=0,2;551xx;5570x;552xx;  
78906.
  127. GI Hemorrhage:4560x;45620;5307x;53082;53y0x,y=1,2,3,4;53y4x,y=1,2,3,4;  
535x1;53783;5621y,y=2,3;5693x;56985;578xx.
  128. High risk liver disease:070yx,y=0,2,4,6;570xx;572yx,y=2,4;5734x;7895x;9821x.
  129. Hepatic coma/end stage liver disease:070yx,y=0,2,4,6;570xx;572yx,y=2,4;5734x.  
9821x.
  130. Ascites:7895x.
  131. Liver/biliary/pancreatic disorders:57yxx,y=1,7;572yx,y=0,1,3,8; 573yx,y=3,8,9;  
574y0,y=0,1,3;574x1;575yx,y=0,1,2,3,4,5;576yx,y=1,2,3,4,5,8; 9800x;  
98y1x,y=5,8.
  132. Other high risk liver disorders:571xx;572yx,y=0,1,3,8;573yx,y=3,8,9;  
576yx,y=1,2,3,4,5,8;9800x;98y1x,y=5,8.
  133. Biliary tract disorders:574y0,y=0,1,3;574x1;575yx,y=0,1,2,3,4,5;  
576yx,y=1,2,3,4,5,8.
  134. High risk liver & biliary tract disorders:571xx;572yx,y=0,1,3,8;  
573yx,y=3,8,9;576yx,y=1,2,3,4,5,8;5768x;9800x;98y1x,y=5,8;  
574y0,y=0,1,3;574x1;575yx,y=0,1,2,3,4,5.
  135. Pancreatic disease:577xx.
  136. Esophageal disease:530yx,y=0,1,2,3,5,6,9;5308y,y=1,9;5533x;787yx,y=1,2.
  137. Non-diabetic endocrine disorders:2273x;251yx,y=0,1,2,4,5,8,9;25yxx,y=2,5;  
253yx,y=0,1,2,3,4,6,7,8,9;2754x;9623x.
  138. Inflammatory/functional GI disorder:55yxx,y=5,6;5589x;5621y,y=0,1;  
564yx,y=0,1,8.
  139. Diabetes mellitus:250yx,y=1,2,3;250y2,y=0,4,5,6,7,8,9;250y3,y=0,4,5,6,7,8,9;  
250y0,y=4,5,6,7,8,9;250y1,y=4,5,6,7,8,9;2513x;2500y,y=0,1.
  140. Diabetes mellitus with ketoacidosis:250yx,y=1,2,3.
  141. Uncontrolled diabetes without ketoacidosis:250y2,y=0,4,5,6,7,8,9;  
250y3,y=0,4,5,6,7,8,9.
  142. Uncontrolled diabetes mellitus/ketoacidosis:250yx,y=1,2,3;  
250y2,y=0,4,5,6,7,8,9;250y3,y=0,4,5,6,7,8,9.
  143. Hypoglycemia:251yx,y=0,1,2;9623x.
  144. Diabetes mellitus, control unspecified:250y0,y=4,5,6,7,8,9;  
250y1,y=4,5,6,7,8,9;2513x.
  145. Diabetes, uncontrolled/unspecified/ketoacidosis:250yx,y=1,2,3;

- 250y2,y=0,4,5,6,7,8,9;250y3,y=0,4,5,6,7,8,9;250y0,y=4,5,6,7,8,9;  
250y1,y=4,5,6,7,8,9;2513x.
146. Controlled diabetes mellitus:2500y,y=0,1.
  147. Non-diabetic/non-hypoglycemic endocrine disorders:2273x;251yx,y=4,5,8,9;  
25yxx,y=2,5;253yx,y=0,1,2,3,4,6,7,8,9;2754x.
  148. Malnutrition/vitamin deficiency:26yxx,y=0,1,2,7,8,9;263yx,y=0,1,8,9;  
265xx;266xx;7994x.
  149. Severe Malnutrition:26yxx,y=0,1,2;7994x.
  150. Moderate risk metabolic deficiency disorders:26yxx,y=7,9;263yx,y=0,1,8,9;  
2651x;266yx,y=0,2;2682x.
  151. Hypernatremia/hypovolemia:2535x;276yx,y=0,5;9923x.
  152. Hyponatremia/hyposmolality/hypervolemia:276yx,y=1,6.
  153. Hyperkalemia:2767x.
  154. Hypokalemia:2768x.
  155. Sodium/volume derangements:2535x;276yx,y=0,5;9923x;276yx,y=1,6.
  156. Acidosis/alkalosis:276yx,y=2,3,4.
  157. Acidosis/mixed acid base disorders:276yx,y=2,4.
  158. Alkalosis:2763x:
  159. Renal failure:403x1;404xy,y=2,3;580xx;582xx;583xx;58yxx,y=4,5,6;  
63y3x,y=4,5,6,7,8,9;7885x;9585x;961yx,y=1,2;9850x;9892x.
  160. Acute renal failure:584xx;63y3x,y=4,5,6,7,8,9;7885x;9585x;961yx,y=1,2;9850x;  
9892x.
  161. Chronic renal failure:403x1;404xy,y=2,3;580xx;582xx;583xx;58yxx,y=5,6.
  162. Renal/urinary tract infection:590xx;59y0x,y=5,9.
  163. Urinary retention/incontinence:596yx,y=0,4,5,6;7882x;7883y,y=0,1.
  164. Moderate risk GU and gynecological disorders:2394x;59582;596yx,y=4,6;  
600xx;6021x;619xx;7882x;7883y,y=0,1.
  165. Benign prostatic disease:600xx;6021x.
  166. Toxic and anoxic brain damage/coma:2903x;291yx,y=0,1,2,8,9;292yx,y=0,9;  
29212;2928y,y=1,4,5,9;283yx,y=0,8,9;3314x;348yx,y=1,3;34982;4372x;  
7800y,y=1,3,9;9580x.
  167. Anoxic brain damage/coma:3481x;7800y,y=1,3.
  168. Toxic brain damage/delirium:2930x;3483x;34982;291xx.
  169. Toxic brain damage/coma:3481x;7800y,y=1,3;9580x;291yx,y=0,1,2,8;  
2930x;3483x;34982.
  170. Moderate risk encephalopathies:2903x;2919x;2920x;29212;2928y,y=1,4,5,9;  
2929x;293yx,y=1,8,9;323yx,y=8,9;3314x;4372x;78009.
  171. Cerebrovascular disease/hemorrhage:43yxx,y=0,1,4,6;432yx,y=0,9;  
433x1;437yx,y=0,1,3,8,9.
  172. Ischemic cerebrovascular disease:433x1;43yxx,y=4,6;437yx,y=0,1,3,8,9.
  173. Cerebral hemorrhage:43yxx,y=0,1;432yx,y=0,9.
  174. Late effects of stroke/paralysis/aphasia:34yxx,y=2,4;438xx;7843x.
  175. Convulsions/epilepsy:345yx,y=1,3,4,5,7,8,9,7803x.
  176. Cerebral/spinal degenerative disorders:331yx,y=2,3;33yxx,y=2,3,4,5,6;340xx.
  177. Dementia/chronic brain syndrome:290xx;294xx;310yx,y=8,9;331yx,y=0,2.
  178. Coagulopathy/platelet disorder:286xx;287xx.

179. Acquired/unspecified clotting disorders:286yx,y=5,6,7,9.
180. Platelet disorders:287yx,y=0,1,2,3,4,5.
181. Platelet and other clotting disorders:287xx;286yx,y=0,1,2,3,4;2879x.
182. Other clotting disorders:286yx,y=0,1,2,3,4;2879x.
183. Acute blood loss anemia:2851x.
184. Anemia:28yxx,y=0,1,2,3,4,5.
185. Aplastic/acquired hemolytic anemia:28yxx,y=3,4;2850x.
186. Chronic anemia:280yx,y=0,8,9;281,yx,y=0,1,2,5,6,7,9;282yx,y=0,2,4,5,9;  
2826y,y=0,1,2,4,8;285yx,y=8,9.
187. Aplastic/acquired hemolytic anemia/chronic anemias:28yxx,y=3,4;2850x;  
280yx,y=0,8,9;281,yx,y=0,1,2,5,6,7,9;282yx,y=0,2,4,5,9;  
2826y,y=0,1,2,4,8;285yx,y=8,9.
188. Cancer:141yx,y=0,8,9;145yx,y=2,6,9;147xx;148yx,y=1,9;150yx,y=4,5,8,9;  
151yx,y=0,5,8,9;1522x;153yx,y=1,2,3,8,9;154yx,y=0,1;1609x;  
161yx,y=0,1,9;162yx,y=2,3,4,5,8,9;164yx,y=0,9;170yx,y=0,1,6;  
171yx,y=4,5,9;172xx;173yx,y=1,2,3,6,7,9;174yx,y=8,9;1759x;18y0x,y=2,9;  
184yx,y=0,4;185xx;188yx,y=2,8,9;191yx,y=1,2,3,5,7;1921x;193xx;  
1940x;195yx,y=0,1;196xx;197yx,y=0,1,3,6,7,8;198yx,y=0,1,2,5;  
1988y,y=2,9;2000y,y=0,1,3,8;2001y,y=0,2,4,6,8;20028;2008x;2028y,y=1,2,3,8;  
203y0,y=0,8;20y01,y=3,4;2041y,y=0,1;20y10,y=5,6,8;208y0,y=8,9;238yx,y=4,7.
189. Very high risk cancer:150yx,y=4,5,8,9;151yx,y=0,5,8,9;1522x 153yx,y=1,2,3,8,9;  
154yx,y=0,1;162yx,y=2,3,4,5,8,9;1700x;1759x;185xx;1890x;191yx,y=1,2,3,5,7;  
1921x;197yx,y=0,1,3,6,7,8;198yx,y=0,1,2,5;19889;20028;2028y,y=1,2,3,8;  
203y0,y=0,8;2041y,y=0,1;20y10,y=5,6;208y0,y=1,8,9;2387x.
190. High risk cancer:141yx,y=0,8,9;145yx,y=2,6,9;147xx;148yx,y=1,9;1609x;  
161yx,y=0,1,9;164yx,y=0,9;170yx,y=1,6;171yx,y=4,5,9;172xx;  
173yx,y=1,2,3,6,7,9;174yx,y=8,9;18y0x,y=2,4;1844x;188yx,y=2,8,9;193xx;  
19y0x,y=4,5;1951x;196xx;19882;2000y,y=0,1,3,8;2001y,y=0,2,4,6,8;2008x;  
20y01,y=3,4;20411;2384x.
191. Depression:2962y,y=0,1,2,3,4,5;2963y,y=0,1,2,3,4,5;311xx.
192. Schizophrenia and other psychoses:29500;29512;2952y,y=0,2;2953y,y=0,1,2;  
29540;2956y,y=0,2,4;2957y,y=0,2,4;2958y,y=0,2,4;2959y,y=0,2,4;2989x.
193. CNS & internal organ trauma:4321x;800y3,y=1,2,3,4,6,7,8,9;  
801y3,y=1,2,3,4,6,7,8,9;803y3,y=1,2,3,4,6,7,8,9;804y3,y=1,2,3,4,6,7,8,9;  
800y4,y=1,2,3,4,6,7,8,9;801y4,y=1,2,3,4,6,7,8,9;803y4,y=1,2,3,4,6,7,8,9;  
804y4,y=1,2,3,4,6,7,8,9;805yx5,y=0,1,3,4;800y6,y=1,2,3,4,6,7,8,9;  
801y6,y=1,2,3,4,6,7,8,9;803y6,y=1,2,3,4,6,7,8,9;804y6,y=1,2,3,4,6,7,8,9;  
806yx,y=0,1,2,4;8070y,y=4,5,6,7,8,9;8074x;850yx,y=3,4;851xy,y=3,4,5,6;  
852xy,y=0,1,2,3,4,5,6;853xy,y=0,1,2,3,4,5,6;854xy,y=3,4,5;860yx,y=0,2,4;  
86yxx,y=1,3;862yx,y=0,1;86401;864xy,y=3,4,5;865xy,y=0,3,4,9;866x3;86800;  
8681y,y=4,9;90003;901yx,y=0,1;902yx,y=0,1;9331x;952yx,y=0,8.
194. High risk musculoskeletal trauma:802yx,y=0,4,8;8023y,y=6,8,9;8052x;8064x;  
80660;8070y,y=0,1,2,3;808yx,y=1,2;8084y,y=2,9;8088x;8100y,y=0,2;  
8110y,y=0,3;812yx,y=0,2;8130y,y=1,8;8134y,y=1,2;81400;81602;820xx;8210x;  
82121;82300;82382;8242x;82525;8260x;8361x.
195. Decubitus ulcer:7070x.

196. Soft tissue disorder:035xx;6802x;6810y,y=0,2;6811x;68yxx,y=2,3,4;686yx,y=0,1,9;692yx,y=3,6,9;69271;6928y,y=2,9;707xx.
197. Chronic leg ulcer:7071x.
198. Decubitus ulcer & other skin disorders:7070x;035xx;6802x;6810y,y=0,2;6811x;68yxx,y=2,3,4;686yx,y=0,1,9;692yx,y=3,6,9;69271;6928y,y=2,9;707yx,y=8,9.
199. Moderately severe malnutrition:26yxx,y=7,8,9;263yx,y=0,1,8,9;265xx;266xx;2682x.

Final risk-adjustment models for 30-day mortality are shown below:

### MORTALITY MODELS

D1 Acute Myocardial Infarction (including AMI with PTCA or CABG)

TOTAL	1,045,469	
c-statistic	0.818	
	<b>Cases</b>	<b>OR</b>
Intercept		0.053
Age 75 to 84	375,348	1.965
Age greater than 84	233,177	4.114
Anterolateral AMI	23,954	1.057
Subendocardial AMI	661,208	0.567
Congestive heart failure	437,283	1.623
Cardiac arrest/ventricular fibrillation	42,051	5.082
Cardiogenic shock	46,335	3.982
Non-cardiogenic shock	8,314	2.569
Thrombosis/embolus/gangrene	7,181	1.842
Hypertension	507,068	0.771
Hypotension	52,178	1.856
Respiratory failure/respiratory arrest	95,110	1.247
High risk pulmonary conditions	107,247	1.662
Moderate risk pneumonia	87,580	1.454
Septicemia	26,419	2.079
Ascites	1,664	3.065
Diabetes mellitus with ketoacidosis	4,493	1.267
Severe Malnutrition	3,702	2.605
Hypernatremia/hypovolemia	62,392	1.882
Acidosis/mixed acid base disorders	27,833	2.187
Hyperkalemia	32,823	1.744
Chronic renal failure	145,291	1.476
Anoxic brain damage/coma	13,675	6.762
Ischemic cerebrovascular disease	25,211	2.794
CNS & internal organ trauma	2,031	2.438
Decubitus ulcer	13,170	1.764

D2 Obstructive Pulmonary Disease  
 TOTAL 1,275,493  
 c-statistic 0.754

	<b>Cases</b>	<b>OR</b>
Intercept		0.019
Age 75 to 84	440,465	1.611
Age greater than 84	161,774	2.229
Moderate Risk COPD	58,398	1.742
Emphysematous bleb	5,546	1.604
Congestive heart failure	339,843	1.346
Atrial fibrillation/flutter	185,131	1.629
Pulmonary heart disease	72,398	1.425
Aneurysm	15,080	1.532
Hypertensive heart disease without CHF	16,704	0.689
Respiratory failure/respiratory arrest	62,417	4.547
Very high risk pneumonia	6,519	1.950
High & moderate risk & other pneumonias	84,139	1.632
Moderate risk pulmonary disorders	88,552	1.132
Moderate risk bacterial infections	7,787	2.184
GI Hemorrhage	16,963	1.624
High risk liver disease	2,745	3.419
Malnutrition/vitamin deficiency	35,738	2.503
Hypernatremia/hypovolemia	86,509	1.687
Hyponatremia/hyposmolality/hypervolemia	70,537	1.289
Acidosis/alkalosis	36,280	1.919
Hyperkalemia	30,530	1.685
Chronic renal failure	68,513	1.386
Anoxic brain damage/coma	1,543	12.940
Moderate risk encephalopathies	10,265	1.552
Coagulopathy/platelet disorder	19,872	1.521
Very high risk cancer	49,227	3.456
CNS & internal organ trauma	2,443	2.206
Decubitus ulcer	10,361	2.686

D3 Congestive Heart Failure  
 TOTAL 2,322,422  
 c-statistic 0.749

	<b>Cases</b>	<b>OR</b>
Intercept		0.031

Age 75 to 84	825,605	1.660
Age greater than 84	639,038	2.812
Acute myocardial infarction	57,993	2.195
Cardiogenic shock	8,854	6.290
Ventricular tachycardia	110,404	1.165
Atrial fibrillation/flutter	870,521	1.230
Cardiomyopathy	423,986	1.044
Thrombosis/embolus/gangrene	11,942	2.084
Hypertension	911,692	0.706
Hypotension	58,330	2.053
Pulmonary embolism/infarct	6,263	2.087
Respiratory failure/respiratory arrest	125,242	2.975
Moderate risk & other pneumonias	192,202	1.441
COPD/bronchiectasis	767,094	1.165
Moderate risk pulmonary disorders	170,267	1.204
Other high risk acute GI conditions	3,667	1.711
Hepatic coma/end stage liver disease	4,762	3.305
Ascites	28,741	1.825
Biliary tract disorders	5,521	1.372
Severe Malnutrition	11,062	2.594
Moderately severe malnutrition	44,145	1.896
Hypernatremia/hypovolemia	96,454	1.921
Hyponatremia/hyposmolality/hypervolemia	134,961	1.395
Acidosis/alkalosis	58,139	1.464
Hyperkalemia	117,910	1.575
Acute renal failure	190,340	1.742
Chronic renal failure	539,931	1.245
Anoxic brain damage/coma	4,745	5.270
Toxic brain damage/coma	19,483	1.809
Moderate risk encephalopathies	11,616	1.540
Ischemic cerebrovascular disease	21,658	2.190
Convulsions/epilepsy	48,668	1.320
Dementia/chronic brain syndrome	158,911	1.686
Coagulopathy/platelet disorder	63,408	1.467
Cancer	83,071	2.168
Decubitus ulcer	41,368	2.446

D4 Primary Pneumonia (including aspiration)  
TOTAL 2,341,325  
c-statistic 0.795

	<b>Cases</b>	<b>OR</b>
Intercept		0.036
Age 75 to 84	821,936	1.647

Age greater than 84	688,645	2.617
Aspiration pneumonia	387,823	2.276
Moderate risk non-bacterial pneumonia	10,526	0.559
Staph pneumonia	82,330	1.323
Congestive heart failure	761,520	1.353
Non-cardiogenic shock	21,006	2.000
Atrial fibrillation/flutter	487,453	1.317
Thrombosis/embolus/gangrene	7,830	1.969
Hypertension	958,945	0.793
Hypotension	61,418	1.468
Pulmonary embolism/infarct	10,533	1.694
Respiratory failure/respiratory arrest	189,050	2.917
High risk pulmonary conditions	278,453	1.198
COPD/bronchiectasis	1,030,642	0.921
Bronchitis/asthma	90,941	0.468
Septicemia	98,006	2.006
GI Hemorrhage	58,911	1.208
High risk liver disease	11,573	2.895
Diabetes mellitus with ketoacidosis	3,655	1.180
Hypoglycemia	2,773	1.717
Severe Malnutrition	29,870	2.438
Moderately severe malnutrition	118,044	1.484
Hypernatremia/hypovolemia	473,017	1.536
Acidosis/mixed acid base disorders	44,345	1.759
Hyperkalemia	66,754	1.489
Acute renal failure	136,635	1.615
Chronic renal failure	229,577	1.219
Anoxic brain damage/coma	12,658	3.172
Ischemic cerebrovascular disease	38,448	1.850
Cerebral hemorrhage	1,444	4.114
Dementia/chronic brain syndrome	376,456	1.722
Acquired/unspecified clotting disorders	14,563	1.536
Very high risk cancer	157,589	3.436
Decubitus ulcer	103,255	1.668

D5 Septicemia

TOTAL 903,860

c-statistic 0.760

	<b>Cases</b>	<b>OR</b>
Intercept		0.073
Age 75 to 84	304,804	1.699
Age greater than 84	240,042	2.946
Coronary artery disease	112,036	1.046
Congestive heart failure	250,672	1.213

Cardiogenic shock	4,794	3.348
Non-cardiogenic shock	145,753	2.010
Complete AV Block	1,755	1.455
Atrial fibrillation/flutter	189,395	1.285
Other moderate risk dysrhythmia	21,321	1.112
Thrombosis/embolus/gangrene	20,718	1.758
Other moderate risk vascular disease	15,558	1.411
Hypertension	199,137	0.830
Hypotension	43,993	1.596
Pulmonary embolism/infarct	6,067	1.452
Respiratory failure/respiratory arrest	144,633	2.722
Pneumonia	287,600	1.442
GI Perforation/peritonitis	12,974	1.735
Other high risk acute GI conditions	6,866	2.258
GI Hemorrhage	40,684	1.405
High risk liver disease	23,894	2.777
Diabetes mellitus with ketoacidosis	6,124	1.155
Hypoglycemia	1,244	2.652
Severe Malnutrition	16,085	2.008
Hypernatremia/hypovolemia	310,173	1.288
Acidosis/mixed acid base disorders	67,982	1.931
Hyperkalemia	53,755	1.515
Acute renal failure	218,419	1.436
Chronic renal failure	179,830	1.424
Anoxic brain damage/coma	11,662	3.043
Cerebrovascular disease/hemorrhage	20,188	2.342
Acquired/unspecified clotting disorders	21,048	1.982
Aplastic/acquired hemolytic anemia	25,011	1.227
Very high risk cancer	67,493	2.521
High risk cancer	12,739	1.402
Decubitus ulcer	118,564	1.481

D6 Cerebrovascular Accident (ischemic and hemorrhagic)

TOTAL	939,906
c-statistic	0.772

	<b>Cases</b>	<b>OR</b>
Intercept		0.057
Age 75 to 84	363,442	1.582
Age greater than 84	248,999	3.011
Intracranial/cerebral hemorrhage	121,923	2.251
Low risk precerebral occlusion	54,932	0.830
Subarachnoid hemorrhage	25,308	2.034
Subdural hemorrhage	44,129	0.867
Acute myocardial infarction	15,224	2.633
Congestive heart failure	150,092	1.539

Atrial fibrillation/flutter	227,067	1.639
Thrombosis/embolus/gangrene	3,541	1.880
Hypotension	15,063	1.473
Other high risk pulmonary conditions	3,931	2.115
Moderate risk pneumonia	37,348	1.822
COPD/bronchiectasis	126,387	1.140
GI Hemorrhage	16,275	1.537
Severe Malnutrition	3,451	1.989
Acidosis/alkalosis	11,208	2.222
Hyperkalemia	14,183	1.301
Renal failure	92,514	1.768
Anoxic brain damage/coma	17,583	23.143
Moderate risk encephalopathies	27,612	1.676
Cerebral hemorrhage	144,604	2.043
Acquired/unspecified clotting disorders	7,858	1.605
Aplastic/acquired hemolytic anemia	3,962	1.279
Cancer	35,666	2.341
CNS & internal organ trauma	46,685	1.773

D7 Non-Surgical Gastrointestinal hemorrhage

TOTAL	893,571
c-statistic	0.792

	<b>Cases</b>	<b>OR</b>
Intercept		0.020
Age 75 to 84	339,193	1.406
Age greater than 84	240,249	2.535
Diverticulosis with hemorrhage	160,244	0.496
Hematemesis/esophageal varices	33,683	1.971
Ulcer with obstruction	2,773	1.200
Congestive heart failure	190,682	1.525
Non-cardiogenic shock	10,690	4.504
Complete AV Block	1,180	1.670
Atrial fibrillation/flutter	179,726	1.346
Cardiomyopathy	26,743	1.163
Diseases of arteries & large veins	60,761	1.278
Hypertension	414,619	0.710
Hypotension	43,705	1.764
Pulmonary embolism/infarct	2,149	2.530
Other high risk pulmonary conditions	3,330	2.209
Moderate risk pneumonia	25,026	2.007
COPD/bronchiectasis	175,418	1.325
Moderate risk pulmonary disorders	24,156	1.554
Septicemia	9,525	4.512

Acute abdomen	2,899	1.673
Hepatic coma/end stage liver disease	4,065	3.671
Other high risk liver disorders	31,563	1.943
Malnutrition/vitamin deficiency	28,468	2.112
Hypernatremia/hypovolemia	101,769	1.513
Acidosis/mixed acid base disorders	11,574	2.731
Hyperkalemia	24,623	1.432
Acute renal failure	42,212	1.740
Chronic renal failure	103,862	1.391
Moderate risk encephalopathies	4,385	1.306
Dementia/chronic brain syndrome	91,379	1.996
Acquired/unspecified clotting disorders	20,838	1.702
Very high risk cancer	41,804	4.275
Decubitus ulcer	17,631	2.591

D8 Fluid, Electrolyte, & Acid-Base Disorders

TOTAL	783,764
c-statistic	0.775

	<b>Cases</b>	<b>OR</b>
Intercept		0.033
Age 75 to 84	267,736	1.585
Age greater than 84	221,110	2.709
Female	505,430	0.786
Acidosis	19,939	1.660
Hyperosmolarity	33,419	3.653
Hypopotassemia	134,739	0.795
Hypovolemia	526,934	1.409
Congestive heart failure	155,116	1.369
Non-cardiogenic shock	2,555	3.819
Atrial fibrillation/flutter	122,199	1.265
Thrombosis/embolus/gangrene	3,107	2.160
Hypertension	349,857	0.687
Hypotension	67,102	0.792
Other high risk pulmonary conditions	4,195	1.933
Moderate risk pneumonia	24,112	1.893
COPD/bronchiectasis	142,883	1.158
Septicemia	8,072	3.323
GI Hemorrhage	16,366	1.395
High risk liver disease	7,344	4.251
Hypoglycemia	1,753	1.804
Malnutrition/vitamin deficiency	67,696	2.022
Hyperkalemia	84,538	1.042
Acute renal failure	46,238	1.472
Anoxic brain damage/coma	1,701	10.816

Acquired/unspecified clotting disorders	4,120	1.623
Cancer	84,339	4.275
High risk musculoskeletal trauma	7,798	1.169
Decubitus ulcer	28,054	2.069

D9 Respiratory Failure & Arrest

TOTAL	568,872	
c-statistic	0.729	

	<b>Cases</b>	<b>OR</b>
Intercept		0.199
Age 75 to 84	185,922	1.856
Age greater than 84	91,515	3.064
Post-traumatic respiratory insufficiency	7,041	0.775
Respiratory arrest	3,268	1.992
Acute myocardial infarction	38,056	1.322
Shock	179	1.651
Complete AV Block	1,651	1.219
Atrial fibrillation/flutter	134,800	1.326
Diseases of arteries & large veins	32,526	1.029
Hypertension	173,144	0.798
Hypotension	20,729	1.927
Moderate risk pneumonia	183,639	1.110
COPD/bronchiectasis	376,595	0.712
Bronchitis/asthma	12,804	0.415
Septicemia	60,482	2.124
GI Hemorrhage	20,521	1.200
High risk liver disease	7,210	2.059
Severe Malnutrition	9,533	2.011
Acidosis/alkalosis	75,818	1.226
Hyperkalemia	36,301	1.302
Acute renal failure	73,946	1.574
Anoxic brain damage/coma	19,532	6.268
Acquired/unspecified clotting disorders	6,350	1.795
Platelet disorders	18,217	1.197
Cancer	39,519	3.184
High risk musculoskeletal trauma	3,205	1.212
Decubitus ulcer	23,868	1.152

D10 Respiratory Failure & Arrest

TOTAL	724,144	
c-statistic	0.738	

**Cases OR**

Intercept		0.044
Age 75 to 84	231,152	2.006
Age greater than 84	161,055	3.950
Female	377,318	0.920
Hemodialysis	33,808	0.811
Congestive heart failure	295,419	1.440
Shock	87	2.649
Ventricular tachycardia	12,067	1.638
Thrombosis/embolus/gangrene	5,748	2.256
Hypotension	39,357	1.309
Other high risk pulmonary conditions	6,097	1.767
Moderate risk pneumonia	50,938	1.695
COPD/bronchiectasis	147,669	1.200
Septicemia	23,264	3.714
Other high risk acute GI conditions	2,186	2.021
GI Hemorrhage	34,807	1.388
Hepatic coma/end stage liver disease	6,160	4.996
Ascites	11,416	2.743
Malnutrition/vitamin deficiency	47,887	1.807
Acidosis/mixed acid base disorders	84,140	1.394
Hyperkalemia	168,057	1.141
Acute renal failure	544,235	1.104
Ischemic cerebrovascular disease	10,556	2.317
Platelet disorders	27,104	1.459
Very high risk cancer	44,933	2.879
Decubitus ulcer	28,790	1.987

P1 Coronary Artery Bypass Graft Surgery (not post-acute myocardial infarction)

TOTAL	355,598
c-statistic	0.795

	<b>Cases</b>	<b>OR</b>
Intercept		0.025
Age 75 to 84	134,476	1.540
Age greater than 84	15,422	2.334
Female	116,732	1.513
Valvuloplasty with valve replacement	16,344	1.462
Aortic valve replacement	100	3.219
Mitral valve replacement	11,661	1.396
Aortic & mitral valve replacement	58,245	1.576
Repeat CABG	18,617	1.766
Associated carotid endarterectomy	6,047	1.152
Associated PTCA	4,540	2.498
Congestive heart failure	81,835	1.631
Thrombosis/embolus/gangrene	2,235	2.606

Hypertension	208,018	0.332
COPD/bronchiectasis	69,829	1.167
High risk liver & biliary tract disorders	2,266	1.766
Chronic renal failure	29,023	1.288

P2 Cholecystectomy (open and laparoscopic)

TOTAL	329,704
c-statistic	0.808

	<b>Cases</b>	<b>OR</b>
Intercept		0.008
Age 75 to 84	113,250	1.872
Age greater than 84	40,934	4.093
Abdominal cholecystectomy	72,404	1.523
Common duct procedure	13,444	1.114
Atrial fibrillation/flutter	41,608	1.973
Cardiomyopathy	6,957	1.613
Hypertension	171,142	0.462
Septicemia	9,111	5.597
GI Perforation/peritonitis	4,677	2.008
Ascites	2,886	3.086
Other high risk liver disorders	30,042	1.123
Uncontrolled diabetes mellitus/ketoacidosis	5,759	1.206
Malnutrition/vitamin deficiency	8,126	1.920
Hyperkalemia	3,770	2.574
Chronic renal failure	19,542	2.329
Cancer	9,065	2.708

P3 Total Knee Replacement (primary)

TOTAL	699,325
c-statistic	0.674

	<b>Cases</b>	<b>OR</b>
Intercept		0.003
Age 75 to 84	267,179	1.754
Age greater than 84	39,501	3.338
	459,802	0.507
Congestive heart failure	30,756	4.430

P4 Total Hip Replacement (primary)

TOTAL	310,978
c-statistic	0.770

	<b>Cases</b>	<b>OR</b>
Intercept		0.002
Age 75 to 84	126,609	2.311
Age greater than 84	31,376	7.181
Pre-op hip complication	8,409	1.841
Atrial fibrillation/flutter	28,163	2.355
Chronic renal failure	7,586	4.598
Dementia/chronic brain syndrome	7,665	3.805

P5 Large Bowel Resection

TOTAL	349,476
c-statistic	0.814

	<b>Cases</b>	<b>OR</b>
Intercept		0.020
Age 75 to 84	138,792	1.750
Age greater than 84	52,234	3.342
Female	197,795	0.915
Acute vascular insufficiency	12,751	3.404
Diverticulosis without hemorrhage	83,929	0.673
High risk GI disorders	14,211	1.669
Associated small bowel surgery	14,431	1.753
Associated splenectomy	1,967	2.092
Partial large bowel resection	291,922	1.485
Total large bowel resection	9,735	2.662
Congestive heart failure	44,049	1.595
Atrial fibrillation/flutter	54,743	1.547
Thrombosis/embolus/gangrene	1,271	2.104
Hypertension	157,804	0.417
COPD/bronchiectasis	58,298	1.414
GI Perforation/peritonitis	33,587	3.015
Ascites	3,755	2.267
Liver/biliary/pancreatic disorders	20,182	1.116
Malnutrition/vitamin deficiency	21,357	1.342
Hypernatremia/hypovolemia	28,930	1.670
Chronic renal failure	16,308	1.817
Aplastic/acquired hemolytic anemia	1,241	1.992
Decubitus ulcer	3,427	1.287

P6 Simple Prostatectomy

TOTAL	167,367
c-statistic	0.723

	<b>Cases</b>	<b>OR</b>
Intercept		0.003
Age 75 to 84	72,556	2.096
Age greater than 84	21,888	5.411
Supra & retropubic prostatectomy	7,938	1.461
COPD/bronchiectasis	22,070	1.651
Renal failure	8,059	5.243

P7 Laminectomy		
TOTAL	203,601	
c-statistic	0.691	

	<b>Cases</b>	<b>OR</b>
Intercept		0.002
Age 75 to 84	47,796	2.035
Age greater than 84	5,221	6.140
Pre-op myelopathy	27,831	3.340
COPD/bronchiectasis	21,800	2.254

P8 Carotid Endarterectomy		
TOTAL	230,052	
c-statistic	0.606	

	<b>Cases</b>	<b>OR</b>
Intercept		0.006
Multiartery disease	35,815	1.314
Congestive heart failure	16,619	3.478
COPD/bronchiectasis	43,083	1.363

P9 Repair of Abdominal Aortic & Iliac Aneurysms		
TOTAL	31,292	
c-statistic	0.648	

	<b>Cases</b>	<b>OR</b>
Intercept		0.029
Age 75 to 84	13,804	1.964
Age greater than 84	1,769	4.039
Iliac disease	5,160	0.741
Thrombosis/embolus/gangrene	2,338	1.932
Hypertensive heart disease without CHF	395	0.696
Chronic renal failure	2,219	2.266

P10 Herniorrhaphy

TOTAL	53,222
c-statistic	0.757

	<b>Cases</b>	<b>OR</b>
Intercept		0.009
Age 75 to 84	22,402	2.052
Age greater than 84	13,319	4.281
Associated high risk abdominal surgery	7,877	4.209
Hypernatremia/hypovolemia	4,888	1.886
Chronic renal failure	2,828	2.853

P11 Hysterectomy for Benign Disease

TOTAL	104,885
c-statistic	0.705

	<b>Cases</b>	<b>OR</b>
Intercept		0.003
Age 75 to 84	24,338	2.102
Age greater than 84	2,924	8.932
Vaginal procedure	59,785	0.281

- For each acute care hospital with more than 8 observed deaths or more than 4.5 predicted deaths, a z-statistic was calculated as the difference between observed and predicted number of deaths divided by the standard deviation of the binomial distribution of predicted values. This standard deviation was computed as the square root of the sum for all patients of the products of each patient's predicted mortality and the quantity one minus that patient's predicted mortality, i.e.:

$$Z\text{-statistic} = \text{sqrt} \{ \sum (p_i * [1 - p_i]) \}.$$

Z-statistics greater than 1.96 or less than -1.96 were considered statistically significant.

- To examine the difference between analyses in which risk factors are clearly distinguished from inpatient complications and analyses in which careful selection of independent variables is used to limit improper designation and weighting of independent variables, two sets of risk adjustment equations were derived using California data in which complications were explicitly distinguished from valid risk factors. One set of equations was derived using only valid risk factors. The other was derived using independent variables selected using methods described above for this study. Correlation coefficients between predicted mortality rates for each category are shown below, both for individual patients (average = 0.77) and for individual hospitals (average = 0.82).

<b>Category</b>	<b>Patient-Level Correlation Coefficient</b>	<b>Hospital-Level Correlation Coefficient</b>
Acute Myocardial Infarction	0.84	0.91
Obstructive Pulmonary Disease	0.70	0.84
Congestive Heart Failure	0.73	0.85
Primary Pneumonia	0.86	0.94
Septicemia	0.86	0.88
Cerebrovascular Accident	0.85	0.92
Non-Surgical Gastrointestinal Hemorrhage	0.73	0.86
Fluid, Electrolyte, & Acid-Base Disorders	0.70	0.73
Respiratory Failure & Arrest	0.93	0.95
Renal Failure	0.73	0.79
Coronary Artery Bypass Graft Surgery	0.71	0.75
Cholecystectomy	0.61	0.77
Total Knee Replacement	0.91	0.93
Total Hip Replacement	0.57	0.78
Large Bowel Resection	0.82	0.83
Simple Prostatectomy	0.97	0.99
Laminectomy	0.86	0.84
Carotid Endarterectomy	0.88	0.89
Repair of Abdominal Aortic & Iliac Aneurysms	0.67	0.77
Herniorrhaphy	0.78	0.70
Hysterectomy for Benign Disease	0.53	0.38

7. Inpatient adverse outcomes in patients who did not die within 30 days of admission were identified based on prolongation of risk-adjusted hospital lengths of stay. (Examination of medical records of patients with prolonged risk-adjusted hospital lengths of stay has shown that 90 percent of these prolonged lengths of stay are associated with important clinical complications.) In order to ensure sufficient data for determination of a standard risk-adjusted hospital length of stay for each combination of acute care hospital and medical or surgical category, only patients in categories with at least 15 cases treated at their hospital during 2004, 2005 or 2006 were included in this analysis.
  
8. A standardized (i.e., risk-adjusted) length of stay was computed for each patient by subtracting the predicted length of stay computed using predictive models derived previously using 1997, 1998, and 1999 MedPar data from the actual length of stay. An individual value control chart of standardized lengths of stay was created for all patients in each category at each hospital. Patients with standardized hospital lengths of stay longer than the maximum of the mean plus 2 days and the computed 3 sigma upper control limit were removed from the data set, and a new control chart was created. This process was repeated until all standardized lengths of stay were shorter than the upper control limit.
  
9. A new database was created containing only patients who had not died within 30 days of hospitalization and whose standardized lengths of stay were shorter than the final upper

control limit for their medical or surgical category at their hospital. New predictive equations for risk-adjusted length of stay for each category were derived using linear regression on 2004, 2005, and 2006 MedPar data to recalibrate independent variables selected using 1997 MedPar data. Independent variables included age, sex, selected principal and secondary diagnostic codes, and selected procedure codes. Because secondary diagnoses might be indicative of hospital-acquired complications rather than of valid risk factors present on admission, a secondary diagnosis was used as a candidate independent variable only when it met the same two criteria used to select candidate variables to predict 30-day mortality.

Final risk-adjustment models for routine hospital length of stay are shown below:

### Routine Hospital Length of Stay

D1 Acute Myocardial Infarction (including AMI with PTCA or CABG)

TOTAL	901,519
r-square	0.4520

	<b>Cases</b>	<b>Coef</b>
Intercept		2.8053
Female	430,580	0.3460
Associated CABG	73,314	5.6286
Anterolateral AMI	18,952	0.3334
Subendocardial AMI	588,232	0.0456
Congestive heart failure	353,894	1.2008
Cardiac arrest/ventricular fibrillation	17,828	0.9468
Cardiogenic shock	20,201	1.6604
Non-cardiogenic shock	3,621	1.2328
Complete AV Block	10,645	1.1909
Ventricular tachycardia	47,163	1.0110
Atrial fibrillation/flutter	190,809	0.7975
Mitral valve disorder	103,425	0.4050
Pulmonary heart disease	18,415	0.1297
Thrombosis/embolus/gangrene	4,995	1.6821
Aneurysm	11,255	0.1343
Hypertension	468,181	-0.2429
Hypotension	41,091	0.3304
Respiratory failure/respiratory arrest	52,010	2.2904
Other high risk pulmonary conditions	7,441	0.1089
Moderate risk pneumonia	67,307	1.3965
COPD/bronchiectasis	190,734	0.3130
Septicemia	14,565	2.7339
Moderate risk bacterial infections	4,605	2.4733
Moderate risk non-bacterial infections	6,284	1.6933
GI Hemorrhage	37,353	1.7894
Other high risk liver disorders	5,543	0.3473
Biliary tract disorders	2,711	2.0047

Pancreatic disease	2,928	1.2217
Inflammatory/functional GI disorder	21,965	0.3575
Diabetes mellitus with ketoacidosis	3,545	0.8959
Uncontrolled diabetes without ketoacidosis	29,541	0.8364
Diabetes mellitus, control unspecified	33,961	0.1983
Non-diabetic endocrine disorders	7,526	0.5025
Malnutrition/vitamin deficiency	13,836	1.4313
Sodium/volume derangements	81,396	1.0420
Hyperkalemia	23,688	0.9143
Chronic renal failure	115,671	0.7555
Urinary retention/incontinence	12,890	1.1395
Anoxic brain damage/coma	3,637	2.3010
Moderate risk encephalopathies	5,848	0.9307
Ischemic cerebrovascular disease	17,956	1.8656
Late effects of stroke/paralysis/aphasia	21,109	0.4128
Platelet disorders	23,245	0.8927
Aplastic/acquired hemolytic anemia	3,643	1.1385
Chronic anemia	96,794	0.4687
Depression	25,715	0.0532
High risk musculoskeletal trauma	4,272	1.8976
Soft tissue disorder	26,663	1.3674

D2 Obstructive Pulmonary Disease

TOTAL	1,195,535
r-square	0.1493

	<b>Cases</b>	<b>Coef</b>
Intercept		3.4164
Female	693,597	0.4315
Moderate Risk COPD	53,356	-0.3405
Emphysematous bleb	4,790	0.9027
Congestive heart failure	309,967	0.3224
Ventricular tachycardia	10,979	1.3720
Atrial fibrillation/flutter	165,618	0.5395
Other moderate risk dysrhythmia	60,430	0.4420
Cardiac valve disease	56,806	0.3164
Pulmonary heart disease	67,160	0.4638
Venous disease	3,681	1.9616
Hypertensive heart disease without CHF	16,077	0.4991
Respiratory failure/respiratory arrest	44,242	2.0142
Very high risk pneumonia	4,122	4.9230
High & moderate risk & other pneumonias	71,876	1.0177
Moderate risk pulmonary disorders	79,650	0.5207

Moderate risk bacterial infections	5,477	2.2763
Moderate risk non-bacterial infections	36,498	1.9969
GI Hemorrhage	13,895	1.8458
Other high risk liver disorders	10,627	0.1235
Biliary tract disorders	1,692	1.6661
Pancreatic disease	3,121	0.5814
Esophageal disease	213,426	0.1566
Inflammatory/functional GI disorder	67,590	0.5795
Uncontrolled diabetes mellitus/ketoacidosis	42,781	1.0131
Diabetes mellitus, control unspecified	23,368	0.2489
Controlled diabetes mellitus	238,484	0.0659
Non-diabetic endocrine disorders	39,349	0.6876
Moderate risk metabolic deficiency disorders	20,512	0.8281
Sodium/volume derangements	135,267	0.4574
Acidosis/alkalosis	30,338	0.6613
Hyperkalemia	26,135	0.8543
Chronic renal failure	61,416	0.2656
Urinary retention/incontinence	18,739	0.7423
Toxic and anoxic brain damage/coma	15,905	0.9778
Ischemic cerebrovascular disease	6,616	0.5501
Aplastic/acquired hemolytic anemia	4,229	0.6793
Chronic anemia	113,940	0.2187
Schizophrenia and other psychoses	22,339	0.0611
Depression	87,817	0.0840
Soft tissue disorder	29,243	0.8131

### D3 Congestive Heart Failure

TOTAL	2,150,364
r-square	0.2530

	<b>Cases</b>	<b>Coef</b>
Intercept		2.6771
Age greater than 74	1,348,661	0.1822
Female	1,181,044	0.2840
Acute myocardial infarction	45,729	0.9929
Coronary artery disease	1,086,889	0.0265
Cardiogenic shock	3,940	2.1200
Pericardial disease	8,054	0.7877
Complete AV Block	11,453	0.3489
Ventricular tachycardia	98,486	1.0572
Atrial fibrillation/flutter	793,660	0.5597
Other moderate risk dysrhythmia	143,827	0.3320
Cardiomyopathy	389,667	0.3970

Cardiac valve disease	501,182	0.2825
Pulmonary heart disease	158,837	0.3606
Thrombosis/embolus/gangrene	9,461	1.5607
Venous disease	12,103	1.8959
Uncomplicated hypertension	858,480	-0.1897
Hypertension & renal disease without CRF	10,224	0.2861
Hypotension	50,592	0.6186
Pulmonary embolism/infarct	4,892	2.2473
Respiratory failure/respiratory arrest	88,089	1.6210
Moderate risk & other pneumonias	165,438	1.2305
COPD/bronchiectasis	704,216	0.5371
Moderate risk pulmonary disorders	148,713	1.1118
Endocarditis/osteomyelitis/other specified infections	17,923	2.4772
Non-specific bacterial infections	217,298	1.3131
Moderate risk non-bacterial infections	19,736	1.3066
Other high risk acute GI conditions	2,981	0.7032
GI Hemorrhage	44,643	1.4538
High risk liver disease	27,584	1.4041
Other high risk liver disorders	26,062	0.3649
Biliary tract disorders	4,602	2.3399
Pancreatic disease	4,692	0.8303
Inflammatory/functional GI disorder	64,854	0.4933
Diabetes,uncontrolled/unspecified/ketoacidosis	211,654	0.6413
Controlled diabetes mellitus	600,199	0.1323
Non-diabetic endocrine disorders	24,033	0.4556
Malnutrition/vitamin deficiency	44,278	1.0015
Sodium/volume derangements	191,698	1.0292
Acidosis/mixed acid base disorders	32,202	0.7319
Alkalosis	14,954	1.4734
Hyperkalemia	100,745	0.5442
Hypokalemia	123,479	0.3519
Acute renal failure	154,070	2.4507
Chronic renal failure	484,224	0.2590
Benign prostatic disease	52,297	0.1468
Urinary retention/incontinence	34,890	0.8791
Toxic and anoxic brain damage/coma	20,706	1.3293
Ischemic cerebrovascular disease	17,455	1.2160
Late effects of stroke/paralysis/aphasia	42,960	0.2525
Cerebral/spinal degenerative disorders	34,801	0.1598
Dementia/chronic brain syndrome	146,888	0.0833
Coagulopathy/platelet disorder	53,771	0.7132
Aplastic/acquired hemolytic anemia	15,958	0.6978
Acute blood loss anemia	8,439	1.2546
Chronic anemia	319,014	0.2639
Cancer	73,917	0.2927

Schizophrenia and other psychoses	19,240	0.3949
Depression	84,631	0.1215
High risk musculoskeletal trauma	7,198	1.1791
Soft tissue disorder	136,897	1.2639

#### D4 Primary Pneumonia (including aspiration)

TOTAL	2,099,074
r-square	0.2667

	<b>Cases</b>	<b>Coef</b>
Intercept		3.1410
Age 75 to 84	737,633	0.1717
Age greater than 84	597,928	0.2869
Female	1,118,454	0.3279
Aspiration pneumonia	307,370	1.0790
High risk gram negative pneumonia	95,565	0.4319
Moderate risk bacterial/nonbacterial pneumonia	84,575	0.3071
Staph pneumonia	66,238	1.1120
Congestive heart failure	659,612	0.7450
Non-cardiogenic shock	8,985	1.9899
Pericardial disease	4,179	0.6362
Complete AV Block	2,031	0.7452
Ventricular tachycardia	19,964	1.4012
Atrial fibrillation/flutter	417,396	0.4801
Other moderate risk dysrhythmia	81,670	0.3536
Cardiomyopathy	67,998	0.3137
Cardiac valve disease	133,763	0.3516
Pulmonary heart disease	46,539	0.2712
Thrombosis/embolus/gangrene	5,793	1.7579
Venous disease	12,790	2.2673
Uncomplicated hypertension	873,372	-0.1663
Hypertensive heart disease without CHF	18,585	0.5421
Pulmonary embolism/infarct	7,701	2.5025
Respiratory failure/respiratory arrest	113,252	2.5239
Very high risk pneumonia	115,062	1.7992
High & moderate risk & other pneumonias	1,712,713	0.1380
COPD/bronchiectasis	936,391	0.5291
Moderate risk pulmonary disorders	231,039	1.2360
Septicemia	58,076	1.9154
Pulmonary tuberculosis	596	1.4110
Endocarditis/osteomyelitis/other specified infections	34,578	2.8359
Non-specific bacterial infections	295,242	1.0912
Moderate risk non-bacterial infections	64,981	1.7986

GI Hemorrhage	47,493	1.4458
High risk liver disease	8,181	1.2071
Other high risk liver disorders	23,989	0.0837
Biliary tract disorders	6,044	2.1717
Pancreatic disease	7,343	0.8691
Esophageal disease	328,577	0.1124
Inflammatory/functional GI disorder	105,669	0.3146
Diabetes mellitus with ketoacidosis	2,954	1.0123
Uncontrolled diabetes without ketoacidosis	58,834	0.9603
Diabetes mellitus, control unspecified	62,023	0.1904
Controlled diabetes mellitus	391,844	0.0180
Non-diabetic endocrine disorders	49,499	0.4976
Malnutrition/vitamin deficiency	114,690	1.2784
Sodium/volume derangements	542,831	0.4273
Acidosis/alkalosis	39,796	0.9510
Hyperkalemia	53,230	0.6547
Hypokalemia	150,938	0.2865
Acute renal failure	99,397	1.4099
Chronic renal failure	196,917	0.2064
Renal/urinary tract infection	268,959	-0.4032
Urinary retention/incontinence	51,939	0.5792
Toxic brain damage/coma	41,613	1.0402
Moderate risk encephalopathies	25,053	0.4538
Cerebrovascular disease/hemorrhage	30,717	0.7958
Late effects of stroke/paralysis/aphasia	99,167	0.2364
Cerebral/spinal degenerative disorders	91,514	0.2089
Dementia/chronic brain syndrome	333,424	0.0842
Coagulopathy/platelet disorder	57,609	0.6057
Aplastic/acquired hemolytic anemia	22,016	1.0880
Acute blood loss anemia	8,009	1.5036
Chronic anemia	313,732	0.3290
Cancer	146,223	0.4783
Schizophrenia and other psychoses	45,236	0.3123
CNS & internal organ trauma	6,014	0.9362
Soft tissue disorder	128,367	1.0293

D5 Septicemia

TOTAL	689,188
r-square	0.2443

	<b>Cases</b>	<b>Coef</b>
Intercept		4.5539
Anaerobic & staph septicemia	90,971	1.7902
Congestive heart failure	180,192	0.8260
Shock	142	3.4098

Complete AV Block	1,001	1.5950
Atrial fibrillation/flutter	133,980	0.6230
Thrombosis/embolus/gangrene	13,790	2.9239
Venous disease	9,145	3.3030
Hypertensive heart disease without CHF	4,281	0.4680
Respiratory failure/respiratory arrest	66,918	3.4755
Very high risk & aspiration pneumonia	56,192	2.5750
High & moderate risk & other pneumonias	149,596	0.7870
Moderate risk pulmonary disorders	43,493	1.8725
Osteomyelitis/other specified infections	43,754	2.7480
Moderate risk non-bacterial infections	24,679	1.7732
GI Perforation/peritonitis	6,607	3.7548
Other high risk acute GI conditions	2,702	2.6884
GI Hemorrhage	26,784	1.6612
Ascites	6,445	1.0936
Other high risk liver disorders	24,546	0.0870
Biliary tract disorders	20,500	2.1184
Pancreatic disease	7,911	1.4119
Inflammatory/functional GI disorder	25,761	0.2499
Diabetes mellitus with ketoacidosis	4,402	1.3412
Uncontrolled diabetes without ketoacidosis	33,338	0.8043
Non-diabetic endocrine disorders	15,242	0.2893
Malnutrition/vitamin deficiency	63,690	1.6711
Sodium/volume derangements	283,725	0.2049
Acidosis/alkalosis	38,646	0.9129
Acute renal failure	139,118	1.4381
Chronic renal failure	129,657	0.5616
Renal/urinary tract infection	362,010	0.2036
Toxic and anoxic brain damage/coma	29,226	0.8602
Cerebrovascular disease/hemorrhage	13,105	1.2904
Coagulopathy/platelet disorder	46,707	1.0465
Aplastic/acquired hemolytic anemia	17,804	1.3905
Acute blood loss anemia	6,759	1.9049
Chronic anemia	78,517	0.2284
Cancer	53,112	0.4771
High risk musculoskeletal trauma	2,903	1.2297
Soft tissue disorder	141,332	1.6273

D6 Cerebrovascular Accident (ischemic and hemorrhagic)

TOTAL	819,545
r-square	0.2894

**Cases Coef**

Intercept		3.0787
Intracranial/cerebral hemorrhage	80,069	-0.3355
Low risk precerebral occlusion	50,543	0.8529
Subarachnoid hemorrhage	15,531	2.2493
Subdural hemorrhage	35,817	0.4622
Acute myocardial infarction	10,091	1.9466
Congestive heart failure	122,975	0.5216
Atrial fibrillation/flutter	188,486	0.7756
Other moderate risk dysrhythmia	47,716	0.5198
Cardiac valve disease	72,224	0.2408
Thrombosis/embolus/gangrene	2,639	2.3313
Venous disease	5,075	4.1910
Hypertensive heart disease without CHF	16,544	0.6253
Hypertension & renal disease without CRF	2,270	0.6231
Hypotension	11,750	0.5224
Moderate risk pneumonia	27,824	2.4754
Aspiration pneumonia	26,168	4.6767
Moderate risk pulmonary disorders	21,281	1.9638
Endocarditis/osteomyelitis/other specified infections	5,311	4.0091
Non-specific bacterial infections	119,746	1.8155
Moderate risk non-bacterial infections	8,430	2.0802
GI Hemorrhage	12,560	2.4602
Liver/biliary/pancreatic disorders	7,404	0.8070
Esophageal disease	138,322	0.6898
Uncontrolled diabetes mellitus/ketoacidosis	24,279	0.9745
Non-diabetic endocrine disorders	11,311	0.9246
Moderate risk metabolic deficiency disorders	23,123	2.2030
Hypernatremia/hypovolemia	60,991	0.5721
Hyponatremia/hyposmolality/hypervolemia	34,985	1.3897
Hypokalemia	42,917	0.3550
Acute renal failure	21,949	2.3287
Chronic renal failure	59,282	0.5895
Toxic and anoxic brain damage/coma	34,452	1.7426
Ischemic cerebrovascular disease	700,377	0.2565
Cerebral hemorrhage	94,342	2.1120
Late effects of stroke/paralysis/aphasia	285,839	0.6753
Convulsions/epilepsy	59,030	0.8243
Coagulopathy/platelet disorder	18,504	0.9836
Aplastic/acquired hemolytic anemia	3,194	0.2692
Chronic anemia	62,225	0.2296
Cancer	29,577	0.2287
CNS & internal organ trauma	37,754	1.1894
High risk musculoskeletal trauma	5,719	1.0547
Soft tissue disorder	23,991	1.6113

D7 Non-Surgical Gastrointestinal Hemorrhage

TOTAL 829,313  
r-square 0.2152

	<b>Cases</b>	<b>Coef</b>
Intercept		2.4995
Age 75 to 84	316,120	0.1082
Age greater than 84	220,496	0.2020
Female	466,793	0.1208
Diverticulosis with hemorrhage	153,695	0.1759
Hematemesis/esophageal varices	29,869	-0.2829
Ulcer with obstruction	2,443	0.5973
Coronary artery disease	228,396	0.0599
Congestive heart failure	168,671	0.5848
Non-cardiogenic shock	6,898	1.0153
Atrial fibrillation/flutter	161,445	0.4878
Other moderate risk dysrhythmia	28,425	0.4684
Cardiomyopathy	23,873	0.2897
Mitral valve disorder	34,729	0.3256
Pulmonary heart disease	8,413	0.1567
Thrombosis/embolus/gangrene	2,591	1.7457
Aneurysm	8,609	0.1645
Venous disease	5,469	2.0936
Hypertensive heart disease without CHF	9,218	0.4814
Moderate risk pneumonia	20,260	2.0492
COPD/bronchiectasis	159,515	0.3093
Moderate risk pulmonary disorders	20,184	1.1622
Septicemia	5,305	4.2999
Moderate risk bacterial infections	6,968	1.4194
Moderate risk non-bacterial infections	11,039	0.8205
Acute abdomen	2,514	0.2802
High risk liver disease	9,095	1.0877
Other high risk liver disorders	28,165	0.1161
Biliary tract disorders	2,684	1.9291
Pancreatic disease	5,466	0.6914
Esophageal disease	226,305	0.0374
Inflammatory/functional GI disorder	123,667	0.2428
Uncontrolled diabetes mellitus/ketoacidosis	14,169	0.8979
Diabetes mellitus, control unspecified	24,702	0.2588
Controlled diabetes mellitus	163,002	0.0445
Non-diabetic endocrine disorders	9,681	0.3870
Malnutrition/vitamin deficiency	23,341	0.8887
Sodium/volume derangements	115,557	0.4628
Acidosis/alkalosis	9,344	1.0497

Hypokalemia	51,496	0.5726
Acute renal failure	34,231	1.0318
Chronic renal failure	92,172	0.4647
Renal/urinary tract infection	76,001	1.0616
Urinary retention/incontinence	13,376	0.5892
Cerebrovascular disease/hemorrhage	7,395	0.8313
Late effects of stroke/paralysis/aphasia	25,410	0.3027
Cerebral/spinal degenerative disorders	18,638	0.1596
Dementia/chronic brain syndrome	84,836	0.1283
Coagulopathy/platelet disorder	41,117	0.6900
Aplastic/acquired hemolytic anemia	9,442	0.8444
Acute blood loss anemia	178,351	0.6019
Chronic anemia	371,798	0.4691
Very high risk cancer	36,540	0.2609
Schizophrenia and other psychoses	9,700	0.4838
High risk musculoskeletal trauma	3,064	1.4130
Soft tissue disorder	30,682	1.0335

D8 Fluid, Electrolyte, & Acid-Base Disorders

TOTAL	732,260
r-square	0.2139

	<b>Cases</b>	<b>Coef</b>
Intercept		1.9430
Age 75 to 84	249,937	0.2306
Age greater than 84	205,088	0.3555
Female	474,865	0.1119
Hyperosmolarity	29,311	0.7388
Hypopotassemia	127,752	0.2105
Congestive heart failure	141,037	0.4825
Ventricular tachycardia	5,648	1.1223
Atrial fibrillation/flutter	111,043	0.3620
Cardiac valve disease	41,552	0.2694
Thrombosis/embolus/gangrene	2,471	1.5833
Venous disease	4,123	2.6652
Hypertensive heart disease without CHF	8,032	0.5138
Moderate risk pneumonia	19,755	1.7904
COPD/bronchiectasis	131,638	0.2926
Moderate risk pulmonary disorders	21,287	0.9216
Septicemia	4,680	3.7506
Endocarditis/osteomyelitis/other specified infections	16,852	1.6806
Non-specific bacterial infections	119,538	1.4254
Moderate risk non-bacterial infections	17,829	0.9271
Other high risk acute GI conditions	2,432	0.3117
GI Hemorrhage	13,961	1.1935

High risk liver disease	6,079	0.9336
Biliary tract disorders	2,873	1.5896
Pancreatic disease	5,074	0.6323
Esophageal disease	101,008	0.2776
Diabetes mellitus with ketoacidosis	2,051	0.6214
Uncontrolled diabetes without ketoacidosis	21,447	0.6121
Non-diabetic endocrine disorders	24,126	0.4473
Malnutrition/vitamin deficiency	57,905	1.3354
Hypernatremia/hypovolemia	508,704	0.3781
Hyponatremia/hyposmolality/hypervolemia	182,155	0.4421
Acidosis/mixed acid base disorders	17,414	0.6340
Acute renal failure	39,706	0.8471
Chronic renal failure	104,153	0.1718
Renal/urinary tract infection	114,600	-0.4168
Benign prostatic disease	16,733	0.0513
Urinary retention/incontinence	21,884	0.6257
Toxic and anoxic brain damage/coma	25,184	0.8403
Ischemic cerebrovascular disease	10,390	0.6656
Late effects of stroke/paralysis/aphasia	25,283	0.3995
Cerebral/spinal degenerative disorders	26,213	0.2538
Dementia/chronic brain syndrome	120,763	0.3740
Coagulopathy/platelet disorder	18,596	0.6449
Aplastic/acquired hemolytic anemia	9,544	1.1075
Acute blood loss anemia	2,227	1.4866
Chronic anemia	103,600	0.3647
Cancer	74,378	0.5958
Schizophrenia and other psychoses	22,858	0.3788
Depression	56,074	0.1893
High risk musculoskeletal trauma	7,119	1.0230
Soft tissue disorder	43,134	1.0585

D9 Respiratory Failure & Arrest

TOTAL	432,182
r-square	0.2791

	<b>Cases</b>	<b>Coef</b>
Intercept		3.9177
Female	241,897	0.3039
Post-traumatic respiratory insufficiency	4,729	0.5433
Respiratory arrest	1,846	-0.4611
Acute myocardial infarction	24,613	1.5919
Congestive heart failure	200,966	0.5516
Non-cardiogenic shock	10,957	1.4095
Complete AV Block	1,023	1.8379

Ventricular tachycardia	10,104	1.7713
Atrial fibrillation/flutter	95,117	0.9659
Other moderate risk dysrhythmia	21,762	0.5368
Cardiomyopathy	27,722	0.3549
Very high risk pneumonia	22,628	5.5779
High & moderate risk & other pneumonias	145,384	1.5199
Aspiration pneumonia	37,357	2.6490
COPD/bronchiectasis	304,057	0.6743
Moderate risk pulmonary disorders	54,593	1.7452
Septicemia/bacterial endocarditis	31,100	3.9861
Non-specific bacterial infections	53,796	1.2737
Moderate risk non-bacterial infections	13,605	2.8129
GI Hemorrhage	13,406	2.7888
Other high risk liver disorders	4,929	0.2362
Biliary tract disorders	1,161	1.7810
Pancreatic disease	1,612	1.9915
Uncontrolled diabetes mellitus/ketoacidosis	18,604	0.6958
Non-diabetic endocrine disorders	13,135	0.7224
Moderate risk metabolic deficiency disorders	23,705	2.4950
Sodium/volume derangements	74,020	0.8327
Acidosis/alkalosis	53,887	0.7330
Acute renal failure	44,177	2.3775
Toxic and anoxic brain damage/coma	20,619	1.8166
Acquired/unspecified clotting disorders	3,306	1.6061
Platelet disorders	12,019	1.8133
Aplastic/acquired hemolytic anemia	2,688	1.2719
Chronic anemia	42,277	0.1724
Soft tissue disorder	27,730	2.0387

D10 Renal Failure

TOTAL	645,514
r-square	0.2199

	<b>Cases</b>	<b>Coef</b>
Intercept		2.2772
Age greater than 74	342,527	0.1675
Female	337,311	0.1337
Hemodialysis	31,322	-0.1727
Congestive heart failure	257,268	0.7027
Complete AV Block	2,068	0.8874
Ventricular tachycardia	9,649	1.7726
Atrial fibrillation/flutter	121,106	0.6039
Other moderate risk dysrhythmia	27,754	0.1923
Cardiomyopathy	46,302	0.3442
Mitral valve disorder	39,968	0.5002

Pulmonary heart disease	12,279	0.1620
Thrombosis/embolus/gangrene	4,415	2.1827
Aneurysm	5,723	0.1468
Venous disease	5,738	3.0765
Moderate risk pneumonia	41,423	1.6886
COPD/bronchiectasis	129,216	0.3848
Moderate risk pulmonary disorders	28,162	1.5036
Septicemia	14,138	4.2860
Moderate risk bacterial infections	14,931	2.4135
Moderate risk non-bacterial infections	13,160	1.4726
Acute abdomen	1,266	1.1439
GI Hemorrhage	28,925	1.5891
High risk liver disease	12,108	1.2744
Biliary tract disorders	3,424	2.3352
Pancreatic disease	8,374	1.0992
Inflammatory/functional GI disorder	34,680	0.0591
Uncontrolled diabetes without ketoacidosis	28,890	0.7074
Non-diabetic endocrine disorders	23,145	0.4026
Moderate risk metabolic deficiency disorders	32,700	1.7162
Hyponatremia/hyposmolality/hypervolemia	68,665	0.4500
Acidosis/alkalosis	75,337	0.9374
Hypokalemia	38,741	0.2257
Acute renal failure	481,398	1.2051
Chronic renal failure	393,449	0.7485
Renal/urinary tract infection	147,110	1.1775
Benign prostatic disease	23,717	0.3487
Toxic brain damage/delirium	14,602	1.4307
Ischemic cerebrovascular disease	8,374	1.5450
Late effects of stroke/paralysis/aphasia	16,751	0.3680
Coagulopathy/platelet disorder	28,455	1.1987
Aplastic/acquired hemolytic anemia	9,178	1.2233
Chronic anemia	117,703	0.2956
Very high risk cancer	37,369	0.8540
Schizophrenia and other psychoses	11,096	0.4623
High risk musculoskeletal trauma	3,556	1.0019
Decubitus ulcer & other skin disorders	42,036	1.5950

P1 Coronary Artery Bypass Graft Surgery (not post-acute myocardial infarction)

TOTAL	323,586
r-square	0.2061

**Cases      Coef**

Intercept		6.5166
Age 75 to 84	120,127	0.7458
Age greater than 84	13,203	1.6658
Female	103,881	0.7106
Valvuloplasty w/o valve replacement	13,037	1.0915
Aortic valve replacement	48	1.6414
Mitral valve replacement	9,164	1.6930
Aortic & mitral valve replacement	49,702	0.6228
Associated carotid endarterectomy	5,386	1.6626
Associated PTCA	3,840	1.0636
Repeat CABG	16,612	0.2678
Congestive heart failure	66,764	2.3451
Cardiomyopathy	11,212	0.7134
Cardiac valve disease	85,190	0.3780
Thrombosis/embolus/gangrene	1,657	1.8776
COPD/bronchiectasis	61,387	0.9878
Other high risk liver disorders	1,342	0.9981
Biliary tract disorders	523	4.6311
Uncontrolled diabetes without ketoacidosis	9,417	1.2671
Diabetes mellitus, control unspecified	10,757	0.1284
Severe Malnutrition	233	2.7728
Chronic renal failure	23,799	2.2389
Cerebral/spinal degenerative disorders	2,919	0.1988
Dementia/chronic brain syndrome	2,258	0.7378
Other clotting disorders	296	1.1292
Aplastic/acquired hemolytic anemia	775	2.0796
Cancer	6,195	0.1022
Chronic leg ulcer	1,399	1.6125

P2 Cholecystectomy (open and laparoscopic)

TOTAL	308,053
r-square	0.4169

	<b>Cases</b>	<b>Coef</b>
Intercept		2.0246
Age 75 to 84	105,578	0.3672
Age greater than 84	37,158	0.9663
Female	176,115	-0.0525
High & moderate risk gall bladder disorders	201,335	1.0553
Abdominal cholecystectomy	64,627	2.1448
Common duct procedure	11,924	1.4411
Congestive heart failure	34,334	1.4697
Atrial fibrillation/flutter	36,996	1.2796

Cardiomyopathy	6,281	0.5598
COPD/bronchiectasis	46,385	0.6695
Septicemia	6,083	3.2435
Non-specific bacterial infections	22,869	1.1620
GI Perforation/peritonitis	3,445	2.5750
GI Hemorrhage	3,287	2.5631
Ascites	2,331	1.9741
Other high risk liver disorders	27,571	0.5992
Biliary tract disorders	272,104	0.0389
Pancreatic disease	51,183	1.6047
Esophageal disease	56,472	0.0377
Inflammatory/functional GI disorder	18,343	0.6967
Uncontrolled diabetes mellitus/ketoacidosis	5,164	1.5812
Diabetes mellitus, control unspecified	6,595	0.6446
Controlled diabetes mellitus	60,459	0.1206
Malnutrition/vitamin deficiency	6,517	2.9612
Sodium/volume derangements	35,694	1.4800
Hypokalemia	20,056	0.8454
Chronic renal failure	17,021	1.1965
Renal/urinary tract infection	17,804	0.5302
Benign prostatic disease	10,780	0.0649
Cerebral/spinal degenerative disorders	5,765	0.4441
Dementia/chronic brain syndrome	11,056	0.8417
Coagulopathy/platelet disorder	7,064	1.2534
Aplastic/acquired hemolytic anemia	1,195	1.7712
Chronic anemia	22,366	0.8535
Cancer	8,268	0.5627
Depression	12,748	0.1631
Decubitus ulcer	1,531	3.2518
Chronic leg ulcer	989	1.6875

P3 Total Knee Replacement (primary)  
TOTAL 651,960  
r-square 0.0261

	<b>Cases</b>	<b>Coef</b>
Intercept		3.4869
Age 75 to 84	247,056	0.0632
Age greater than 84	35,788	0.0939
Congestive heart failure	25,507	0.3679
Complete AV Block	257	0.3735
Atrial fibrillation/flutter	48,085	0.2172
Other moderate risk dysrhythmia	24,467	0.1151
Non-mitral valve disorder	11,146	0.1228

Hypertensive heart disease without CHF	7,446	0.1151
COPD/bronchiectasis	52,585	0.1115
Inflammatory/functional GI disorder	37,207	0.1902
Uncontrolled diabetes without ketoacidosis	3,812	0.3378
Chronic renal failure	10,893	0.3291
Dementia/chronic brain syndrome	7,001	0.2703
Aplastic/acquired hemolytic anemia	569	0.6465
Chronic anemia	96,109	0.2584
Decubitus ulcer	761	1.4800

P4 Total Hip Replacement (primary)

TOTAL	287,192
r-square	0.1443

	<b>Cases</b>	<b>Coef</b>
Intercept		3.5185
Age 75 to 84	116,708	0.0809
Age greater than 84	27,158	0.1843
Closed fracture	16,445	1.3647
Pre-op hip complication	6,593	0.6726
Coronary artery disease	54,887	0.0244
Congestive heart failure	12,965	0.4724
Atrial fibrillation/flutter	23,986	0.3160
Other moderate risk dysrhythmia	11,410	0.1499
Cardiac valve disease	14,441	0.1105
COPD/bronchiectasis	31,273	0.1706
Non-specific bacterial infections	11,858	0.8080
Inflammatory/functional GI disorder	16,801	0.1799
Chronic renal failure	6,207	0.5123
Dementia/chronic brain syndrome	6,478	0.2423
Aplastic/acquired hemolytic anemia	402	0.8929
Chronic anemia	51,163	0.1791
Cancer	5,067	0.1718
Decubitus ulcer	1,135	1.4538
Chronic leg ulcer	380	0.4797

P5 Large Bowel Resection

TOTAL	305,256
r-square	0.3172

	<b>Cases</b>	<b>Coef</b>
Intercept		5.7798
Age 75 to 84	120,718	0.4805

Age greater than 84	42,901	1.1635
Acute vascular insufficiency	7,516	1.7666
Diverticulosis without hemorrhage	74,999	0.4438
High risk GI disorders	11,159	1.7337
Moderate risk GI disorder	63,967	1.9152
Associated small bowel surgery	10,196	1.7525
Associated splenectomy	1,364	2.2214
Total large bowel resection	7,059	1.3853
Congestive heart failure	33,908	2.1081
Atrial fibrillation/flutter	43,339	1.3433
Cardiomyopathy	5,396	0.3269
Thrombosis/embolus/gangrene	800	3.5800
Hypertensive heart disease without CHF	2,890	0.5762
COPD/bronchiectasis	48,394	0.8926
GI Perforation/peritonitis	22,779	2.7215
GI Hemorrhage	26,060	1.6198
Ascites	2,688	2.9532
Uncontrolled diabetes without ketoacidosis	3,094	1.9411
Malnutrition/vitamin deficiency	15,738	3.8965
Hypernatremia/hypovolemia	21,979	2.3818
Chronic renal failure	12,148	1.6472
Dementia/chronic brain syndrome	9,408	0.5129
Acute blood loss anemia	25,277	1.2063
Chronic anemia	58,664	1.0030
Very high risk cancer	108,320	1.0532
Decubitus ulcer	2,400	5.1867
Chronic leg ulcer	823	2.1588

P6 Simple Prostatectomy

TOTAL	152,869
r-square	0.3108

	<b>Cases</b>	<b>Coef</b>
Intercept		1.5369
Age 75 to 84	66,012	0.1391
Age greater than 84	19,231	0.4273
Acute prostatitis/retention	18,379	0.3002
Supra & retropubic prostatectomy	6,925	2.3926
Congestive heart failure	8,329	0.4549
Atrial fibrillation/flutter	12,825	0.1644
Other moderate risk dysrhythmia	4,935	0.1102
Hypertensive heart disease without CHF	1,098	0.5242
COPD/bronchiectasis	19,663	0.1433
Inflammatory/functional GI disorder	3,879	0.4946

Uncontrolled diabetes without ketoacidosis	609	1.4313
Diabetes mellitus, control unspecified	1,806	0.2146
Controlled diabetes mellitus	26,638	0.0233
Hypernatremia/hypovolemia	1,322	2.4720
Hyponatremia/hyposmolality/hypervolemia	2,355	1.1593
Hypokalemia	1,395	1.0072
Acute renal failure	2,237	3.1542
Chronic renal failure	5,037	0.4323
Renal/urinary tract infection	7,419	1.1664
Moderate risk GU and gynecological disorders	141,032	0.1820
Cerebral/spinal degenerative disorders	3,557	0.1771
Dementia/chronic brain syndrome	4,618	0.6381
Coagulopathy/platelet disorder	1,244	1.1020
Aplastic/acquired hemolytic anemia	185	0.9835
Chronic anemia	7,488	0.7875
Very high risk cancer	30,024	0.0808
Depression	3,489	0.0610

P7 Laminectomy

TOTAL	187,033
r-square	0.1821

	<b>Cases</b>	<b>Coef</b>
Intercept		2.7323
Age 75 to 84	43,272	0.3192
Age greater than 84	4,545	0.7142
Female	102,208	0.3803
Cervical disease without myelopathy	45,348	-1.4580
Lumbosacral disc displacement without myelopathy	85,778	-0.7823
Coronary artery disease	32,021	0.0681
Congestive heart failure	5,181	0.8893
Atrial fibrillation/flutter	7,161	0.6812
COPD/bronchiectasis	19,338	0.2414
Uncontrolled diabetes without ketoacidosis	1,216	1.4706
Diabetes mellitus, control unspecified	3,042	0.8285
Controlled diabetes mellitus	34,799	0.1222
Benign prostatic disease	6,413	0.2328
Late effects of stroke/paralysis/aphasia	4,134	1.1848
Cerebral/spinal degenerative disorders	4,874	0.3239
Aplastic/acquired hemolytic anemia/chronic anemias	8,527	1.3341
Cancer	1,974	0.3099

P8 Carotid Endarterectomy

TOTAL 206,587  
 r-square 0.1483

	<b>Cases</b>	<b>Coef</b>
Intercept		1.3130
Age 75 to 84	88,723	0.0695
Age greater than 84	17,431	0.2848
Female	88,830	0.1570
Multiartery disease	31,163	0.1735
TIA	4,649	1.8694
Coronary artery disease	91,790	0.0518
Congestive heart failure	13,173	0.4724
Complete AV Block	216	1.4083
Second degree & fascicular block	3,212	0.2077
Atrial fibrillation/flutter	16,955	0.4569
Cardiac valve disease	10,806	0.2120
Thrombosis/embolus/gangrene	1,049	0.3712
Hypertensive heart disease without CHF	3,050	0.3788
COPD/bronchiectasis	37,336	0.1917
Inflammatory/functional GI disorder	3,270	0.2916
Uncontrolled diabetes without ketoacidosis	1,078	1.6013
Diabetes mellitus, control unspecified	3,866	0.3209
Controlled diabetes mellitus	53,081	0.0256
Chronic renal failure	7,156	0.4391
Benign prostatic disease	7,917	0.1075
Late effects of stroke/paralysis/aphasia	10,378	0.4753
Dementia/chronic brain syndrome	2,874	0.7609
Aplastic/acquired hemolytic anemia	178	1.1285
Acute blood loss anemia	2,251	1.2504
Chronic anemia	8,022	0.6973
Cancer	3,355	0.0983
Depression	5,093	0.1012

P9 Repair of Abdominal Aortic & Iliac Aneurysms

TOTAL 21,285  
 r-square 0.0844

	<b>Cases</b>	<b>Coef</b>
Intercept		5.5197
Age 75 to 84	9,283	0.6681
Age greater than 84	1,132	1.6268
Female	5,275	0.4152

Congestive heart failure	2,168	2.1754
Cardiac valve disease	1,258	0.4496
Thrombosis/embolus/gangrene	1,482	0.6052
Aneurysm	20,900	1.1506
COPD/bronchiectasis	7,895	0.8798
Biliary tract disorders	379	1.1661
Chronic renal failure	1,359	1.7696
Aplastic/acquired hemolytic anemia	38	2.4657

P10 Herniorrhaphy

TOTAL	36,534
r-square	0.3679

	<b>Cases</b>	<b>Coef</b>
Intercept		2.1689
Age 75 to 84	15,618	0.1671
Age greater than 84	8,957	0.5590
Female	10,752	0.2232
Femoral procedure	6,014	0.2741
Associated high risk abdominal surgery	4,605	4.0820
Congestive heart failure	4,990	1.2304
Atrial fibrillation/flutter	6,699	1.0209
COPD/bronchiectasis	6,981	0.5289
GI Perforation/peritonitis	414	3.3984
Inflammatory/functional GI disorder	2,353	0.6177
Diabetes,uncontrolled/unspecified/ketoacidosis	483	1.1004
Hypernatremia/hypovolemia	2,997	2.6117
Hypokalemia	1,515	1.1989
Dementia/chronic brain syndrome	2,280	0.5721
Aplastic/acquired hemolytic anemia/chronic anemias	2,204	1.0413

P11 Hysterectomy for Benign Disease

TOTAL	90,770
r-square	0.2113

	<b>Cases</b>	<b>Coef</b>
Intercept		2.8814
Age 75 to 84	21,104	0.3013
Age greater than 84	2,368	0.6755
Vaginal procedure	53,607	-0.9428
Atrial fibrillation/flutter	2,635	0.6058
COPD/bronchiectasis	5,142	0.2142
Inflammatory/functional GI disorder	3,904	0.1111
Diabetes mellitus	12,062	0.1367

Aplastic/acquired hemolytic anemia/chronic anemias 7,359 0.2479

10. A new standardized (i.e., risk-adjusted) length of stay was computed for each patient discharged alive by subtracting the predicted length of stay computed using predictive models derived using 2004, 2005, and 2006 MedPar data from the actual length of stay. An individual value control chart of standardized lengths of stay was created for all patients in each category at each hospital. Patients with standardized hospital lengths of stay longer than the maximum of the mean plus 2 days and the computed 3 sigma upper control limit were removed from the data set, and a new control chart was created. This process was continued until all standardized lengths of stay were shorter than the upper control limit. Patients discharged alive who were found to have standardized lengths of stay that exceeded the maximum of the mean plus 2 days and the 3 sigma upper control limit for a condition/procedure at the hospital from which the patient was discharged were classified as having had prolongation of their standardized hospital length of stay. For a hospital with fewer than 15 discharges for a condition or procedure, the maximum of the mean plus two days and the mean plus the median of computed 3 sigmas for all hospitals for that condition or procedure was used as that hospital's upper control limit for that condition or procedure.
11. For each medical and surgical category, an equation was derived to predict prolonged standardized hospital length of stay using stepwise logistic regression. Independent variables included age, sex, selected principal and secondary diagnostic codes, and selected procedure codes. The same procedures were used as were used to derive predictive equations for 30-day mortality.

Final risk-adjustment models for prolonged standardized hospital length of stay are shown below:

### **Prolongation of Standardized Hospital Length of Stay**

D1 Acute Myocardial Infarction (including AMI with PTCA or CABG)

TOTAL	892,653
c-statistic	0.754

	<b>Cases</b>	<b>OR</b>
Intercept		0.043
Age greater than 74	494,401	1.129
Congestive heart failure	347,331	1.797
Hypertension	459,873	0.385
Respiratory failure/respiratory arrest	56,889	4.618
Moderate risk metabolic deficiency disorders	11,398	2.821
Chronic renal failure	114,482	1.300
Soft tissue disorder	26,637	2.150

D2 Obstructive Pulmonary Disease

TOTAL 1,204,906  
 c-statistic 0.650

	<b>Cases</b>	<b>OR</b>
Intercept		0.032
Moderate Risk COPD	52,882	1.057
Emphysematous bleb	5,065	2.486
Atrial fibrillation/flutter	166,333	1.590
Thrombosis/embolus/gangrene	1,506	3.652
Respiratory failure/respiratory arrest	47,601	3.862
Very high & high risk pneumonia	5,757	6.788
Moderate risk pneumonia	72,065	2.147
Moderate risk bacterial infections	6,407	4.282
Moderate risk metabolic deficiency disorders	20,849	2.304
Chronic renal failure	61,901	1.553
Toxic brain damage/delirium	10,072	2.039
Platelet disorders	13,694	2.464
Aplastic/acquired hemolytic anemia/chronic anemias	118,062	1.177
Cancer	48,796	1.373
Decubitus ulcer	8,185	2.901

D3 Congestive Heart Failure

TOTAL 2,100,341  
 c-statistic 0.668

	<b>Cases</b>	<b>OR</b>
Intercept		0.031
Thrombosis/embolus/gangrene	9,535	3.319
Respiratory failure/respiratory arrest	89,097	3.380
Other specified pneumonias	1,885	3.953
Moderate risk pulmonary disorders	147,356	2.000
Moderate risk bacterial infections	13,532	3.415
Moderate risk non-bacterial infections	19,533	2.366
Moderate risk metabolic deficiency disorders	33,509	2.437
Hyperkalemia	97,022	1.573
Renal failure	531,438	2.110
High risk cancer	13,334	1.523
CNS & internal organ trauma	1,854	3.178
Decubitus ulcer	30,497	2.667

D4 Primary Pneumonia (including aspiration)  
 TOTAL 2,003,256  
 c-statistic 0.735

	<b>Cases</b>	<b>OR</b>
Intercept		0.023
Female	1,071,729	0.959
Aspiration pneumonia	267,726	2.009
Moderate risk bacterial pneumonia	33,148	1.563
Staph pneumonia	63,927	1.149
Atrial fibrillation/flutter	391,166	1.432
Venous disease	12,537	2.611
Respiratory failure/respiratory arrest	111,498	4.424
Very high risk pneumonia	112,381	2.258
Moderate risk pulmonary disorders	227,390	1.962
Moderate risk bacterial infections	29,601	2.588
Malnutrition/vitamin deficiency	102,547	2.149
Chronic renal failure	186,334	1.574
Coagulopathy/platelet disorder	55,321	1.844
Decubitus ulcer	70,899	2.058

D5 Septicemia  
 TOTAL 642,137  
 c-statistic 0.740

	<b>Cases</b>	<b>OR</b>
Intercept		0.045
Anaerobic & staph septicemia	86,729	1.695
Atrial fibrillation/flutter	120,940	1.282
Thrombosis/embolus/gangrene	12,906	2.471
Hypertension	162,868	0.292
High risk pulmonary conditions	75,034	3.820
Bacterial endocarditis	4,026	3.608
Pancreatic disease	8,029	1.986
Moderate risk metabolic deficiency disorders	48,605	1.830
Aplastic/acquired hemolytic anemia	16,632	1.552
Acute blood loss anemia	6,742	2.077
Decubitus ulcer	77,544	1.757

D6 Cerebrovascular Accident (ischemic and hemorrhagic)  
 TOTAL 763,401  
 c-statistic 0.699

	<b>Cases</b>	<b>OR</b>
Intercept		0.034
Female	430,174	0.925
Intracranial/cerebral hemorrhage	69,878	1.837
Subarachnoid hemorrhage	14,737	2.552
Subdural hemorrhage	33,940	1.813
Cardiomyopathy	21,757	1.522
Thrombosis/embolus/gangrene	2,459	3.969
Respiratory failure/respiratory arrest	22,174	16.332
Other high risk pulmonary conditions	2,425	1.863
Severe Malnutrition	2,188	2.477
Moderate risk encephalopathies	17,104	2.365
Cancer	24,684	1.467

D7 Non-Surgical Gastrointestinal hemorrhage  
TOTAL 836,178  
c-statistic 0.693

	<b>Cases</b>	<b>OR</b>
Intercept		0.029
Diverticulosis with hemorrhage	155,567	0.789
Congestive heart failure	171,142	1.712
Atrial fibrillation/flutter	163,274	1.421
Cardiac valve disease	60,338	1.268
Thrombosis/embolus/gangrene	2,759	4.081
Pulmonary embolism/infarct	1,723	7.414
Other high risk pulmonary conditions	2,742	2.173
Moderate risk pulmonary disorders	20,966	2.588
Moderate risk bacterial infections	7,911	3.268
Non-specific bacterial infections	104,569	1.886
GI Perforation/peritonitis	887	7.215
Hyponatremia/hyposmolality/hypervolemia	29,918	1.893
Renal failure	113,987	1.904
Toxic brain damage/delirium	7,498	4.182
Aplastic/acquired hemolytic anemia	9,633	1.925
Cancer	38,348	1.571
Decubitus ulcer	13,961	2.354

D8 Fluid, Electrolyte, & Acid-Base Disorders  
TOTAL 708,672  
c-statistic 0.572

	<b>Cases</b>	<b>OR</b>
Intercept		0.041
Hyperosmolarity	24,246	1.917
Hypovolemia	470,455	1.131
Cardiac dysrhythmia/block	144,919	1.341
Pulmonary heart disease	7,462	1.172
Other high risk acute GI conditions	2,478	1.804
Non-diabetic endocrine disorders	23,268	1.377
Renal failure	127,301	1.506
High risk cancer	14,774	1.703

D9 Respiratory Failure & Arrest

TOTAL	405,083	
c-statistic	0.547	

	<b>Cases</b>	<b>OR</b>
Intercept		0.065
Post-traumatic respiratory insufficiency	5,142	2.467
Bacterial endocarditis	408	5.576
Decubitus ulcer	14,862	3.764

D10 Renal Failure

TOTAL	618,597	
c-statistic	0.535	

	<b>Cases</b>	<b>OR</b>
Intercept		0.058
Malnutrition/vitamin deficiency	35,202	2.530

P1 Coronary Artery Bypass Graft Surgery (not post-acute myocardial infarction)

TOTAL	343,074	
c-statistic	0.787	

	<b>Cases</b>	<b>OR</b>
Intercept		0.098
Age greater than 74	142,722	1.293
Valvuloplasty w/o valve replacement	15,080	1.439
Aortic valve replacement	77	4.390
Mitral valve replacement	10,439	1.211
Aortic & mitral valve replacement	54,137	1.355
Associated PTCA	4,194	1.554
Congestive heart failure	76,212	1.974

Thrombosis/embolus/gangrene	1,998	2.738
Hypertension	204,673	0.152
COPD/bronchiectasis	66,755	1.224
Biliary tract disorders	699	3.931
Chronic renal failure	27,028	1.135

P2 Cholecystectomy (open and laparoscopic)

TOTAL	322,909
c-statistic	0.633

	<b>Cases</b>	<b>OR</b>
Intercept		0.038
High risk gall bladder disorders	11,311	1.728
Abdominal cholecystectomy	69,819	1.848
Cardiac valve disease	16,395	1.604
GI Perforation/peritonitis	4,268	4.336
Moderate risk metabolic deficiency disorders	6,810	4.409
Hyperkalemia	3,437	3.040

P3 Total Knee Replacement (primary)

TOTAL	697,037
c-statistic	0.621

	<b>Cases</b>	<b>OR</b>
Intercept		0.047
Age 75 to 84	266,086	1.282
Age greater than 84	39,174	1.602
Female	458,678	0.785
Congestive heart failure	30,327	3.105
COPD/bronchiectasis	58,557	1.636
Other high risk liver disorders	2,811	2.023
Chronic renal failure	12,699	2.413
Decubitus ulcer & other skin disorders	4,700	6.298

P4 Total Hip Replacement (primary)

TOTAL	308,542
c-statistic	0.689

	<b>Cases</b>	<b>OR</b>
Intercept		0.043
Age 75 to 84	125,612	1.225
Age greater than 84	30,403	1.564

Female	194,720	0.743
Closed fracture	19,830	2.558
Pre-op hip complication	8,233	3.520
Congestive heart failure	15,578	2.547
COPD/bronchiectasis	34,861	1.523
Osteomyelitis & other non-specific infections	13,795	2.444
Chronic renal failure	7,302	2.303
Decubitus ulcer	1,485	2.961

P5 Large Bowel Resection

TOTAL	326,800
c-statistic	0.748

	<b>Cases</b>	<b>OR</b>
Intercept		0.087
Acute vascular insufficiency	9,032	1.907
Colonic malignancy	139,246	0.896
Diverticulosis without hemorrhage	80,081	0.691
Moderate risk GI disorder	71,819	1.684
Associated small bowel surgery	12,077	1.899
Total large bowel resection	8,158	1.724
Hypertension	153,566	0.265
COPD/bronchiectasis	52,563	1.220
GI Perforation/peritonitis	27,431	2.799
Moderate risk metabolic deficiency disorders	16,509	1.867
Late effects of stroke/paralysis/aphasia	4,142	1.077

P6 Simple Prostatectomy

TOTAL	166,046
c-statistic	0.683

	<b>Cases</b>	<b>OR</b>
Intercept		0.032
Age 75 to 84	71,981	1.379
Age greater than 84	21,415	1.740
Acute prostatitis/retention	20,383	1.175
Supra & retropubic prostatectomy	7,862	2.317
Congestive heart failure	9,753	2.258
Atrial fibrillation/flutter	14,683	1.888
Mitral valve disorder	3,315	1.421
Moderate risk non-bacterial infections	522	4.197
Malnutrition/vitamin deficiency	792	5.036

Hyperkalemia	1,056	4.818
Dementia/chronic brain syndrome	5,304	2.079
Coagulopathy/platelet disorder	1,524	3.067
Cancer	33,856	1.497
Soft tissue disorder	1,026	4.454

P7 Laminectomy

TOTAL	202,737
c-statistic	0.586

	<b>Cases</b>	<b>OR</b>
Intercept		0.073
Cervical disease without myelopathy	47,898	0.565
Lumbosacral disc displacement without myelopathy	93,151	0.920
Associated myelopathy	27,530	1.529
Osteomyelitis/other specified infections	593	25.757

P8 Carotid Endarterectomy

TOTAL	228,151
c-statistic	0.671

	<b>Cases</b>	<b>OR</b>
Intercept		0.057
Age 75 to 84	98,361	1.199
Age greater than 84	19,990	1.698
Multiartery disease	35,434	1.516
Congestive heart failure	16,204	2.232
Atrial fibrillation/flutter	20,444	2.243
Mitral valve disorder	7,953	1.610
Thrombosis/embolus/gangrene	1,280	1.686
COPD/bronchiectasis	42,588	1.481
Esophageal disease	28,302	1.126
Hypokalemia	2,367	4.148
Chronic renal failure	8,799	2.254
Cerebral/spinal degenerative disorders	2,474	1.894
Platelet and other clotting disorders	1,429	3.570
Soft tissue disorder	1,411	4.139

P9 Repair of Abdominal Aortic & Iliac Aneurysms

TOTAL	51,315
c-statistic	0.606

**Cases OR**

Intercept		0.027
Gangrene	1,446	4.215
Obstruction	31,507	2.471
Femoral procedure	8,695	1.073

P10 Herniorrhaphy		
TOTAL	51,315	
c-statistic	0.606	

	<b>Cases</b>	<b>OR</b>
Intercept		0.027
Gangrene	1,446	4.215
Obstruction	31,507	2.471
Femoral procedure	8,695	1.073

P11 Hysterectomy for Benign Disease		
TOTAL	104,630	
c-statistic	0.729	

	<b>Cases</b>	<b>OR</b>
Intercept		0.072
Age 75 to 84	24,262	1.627
Age greater than 84	2,882	3.010
Vaginal procedure	59,711	0.266
Congestive heart failure	2,662	5.105
COPD/bronchiectasis	6,356	1.860
Chronic renal failure	1,462	2.950

12. Patients were classified as having had an adverse outcome if they died within 30 days of hospitalization or had a prolonged standardized hospital length of stay. Unlike counts of recorded complications, this surrogate for hospital-acquired complications is very reproducible and does not depend upon how secondary diagnoses are coded at different hospitals or by different abstractors.
13. Initial predicted hospital adverse outcome rates were computed for each condition or procedure as the sum of the predicted 30-day mortality rate plus the product of the predicted rate of prolonged standardized hospital lengths of stay and one minus the predicted mortality rate, i.e.,

$$\text{Predicted adverse outcomes} = \text{pmort} + [(1-\text{pmort}) * (\text{plongLOS})].$$

Each initial hospital adverse outcome rate was multiplied by a constant that set the total observed rate of adverse outcome equal to the predicted rate of adverse outcomes for each condition or procedure.

14. For each acute care hospital with more than 8 observed adverse outcomes or more than 4.5 predicted adverse outcomes, a z-statistic was calculated as the difference between observed and predicted number of adverse outcomes divided by the standard deviation of the binomial distribution of predicted values. This standard deviation was computed as the square root of the sum for all patients of the products of each patient's predicted adverse outcome rate and the quantity one minus that patient's predicted adverse outcome rate, i.e.:

$$Z\text{-statistic} = \text{sqrt} \{ \sum (p_i * [1 - p_i]) \}.$$

Z-statistics greater than 1.96 or less than -1.96 were considered statistically significant.