

HealthGrades Seventh Annual  
Patient Safety in  
American Hospitals Study

March 2010





# HEALTHGRADES®

## HealthGrades Seventh Annual Patient Safety in American Hospitals Study March 2010

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Executive Summary .....	2
Summary of Findings .....	3
Methodology Brief .....	5
Detailed Findings .....	6
Patient Safety Events are Common in U.S. Hospitals .....	6
Common Patient Safety Events Cost Lives and Dollars .....	6
Improvement Seen Among Less Common Events .....	7
Post-Operative Sepsis Showed Large Incidence Rate Increase .....	7
Approximately One-in-Ten Medicare Patients with Patient Safety Events Died .....	8
Large Safety Gaps Identified Between Poorest- and Best-Performing Hospitals .....	8
Patient Safety Excellence Award Hospitals Associated with Significantly Fewer Safety Events, Associated Deaths and Cost .....	9
Patient Safety Performance Varies by State.....	9
Thirty-nine States have One or More Patient Safety Excellence Hospitals .....	9
Interpretation of Results .....	12
Acknowledgements .....	13
References.....	13
Appendix A: HealthGrades 2010 Patient Safety Excellence Award™ Recipients.....	14
Appendix B: Patient Safety Indicators Used in this HealthGrades Study .....	24
Appendix C: Patient Safety Incidence Rates and Associated Mortality Among Medicare Beneficiaries (2006 – 2008) .....	25
Appendix D: Comparing Different Performance Categories (2006 – 2008) .....	27
Appendix E: Patient Safety Events and Their Attributable Mortality and Excess Charge Among Medicare Beneficiaries by Patient Safety Indicator (2006 – 2008) .....	28
Appendix F: Patient Safety Observed-to-Expected Incidence Rate by State.....	29
Appendix G: HealthGrades Patient Safety Methodology 2010 .....	34



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## HealthGrades Seventh Annual Patient Safety in American Hospitals Study March 2010

*In this seventh annual study, HealthGrades identifies patient safety incidence rates among Medicare patients at virtually all of the nation's 5,000 nonfederal hospitals. Additionally, HealthGrades identifies the best-performing hospitals to establish a best-practice benchmark against which other hospitals can be evaluated (Appendix A lists these best-performing hospitals). This study also examines trends in important patient safety issues among the nation's hospitals and provides state specific incidence rates (Appendix F shows the top-ten and bottom-ten performing states by patient safety indicator). Specific results for each of the nation's nonfederal hospitals can be found at [www.healthgrades.com](http://www.healthgrades.com).*

### Executive Summary

When you seek treatment at a hospital for one particular medical problem, you don't expect to acquire an additional injury, infection, or other serious condition during your stay. Although some complications may be unavoidable, too often patients suffer from injuries or an illness that could have been prevented if the hospital adopted safe practices and developed better systems that support improved patient safety.

Patient safety is not a new issue. Hospitals have increasingly implemented strategies aimed at reducing preventable patient safety events over the past ten years since the Institute of Medicine published *To Err is Human: Building a Safer Health System*.<sup>1</sup> This landmark report published in 1999 focused the nation's attention on patient safety.

While hospitals have made progress, medical mistakes still occur at an alarming rate. The incidence rate of medical harm occurring is estimated to be over 40,000 per day according to the Institute for Healthcare Improvement.<sup>2</sup> For example, The Joint Commission, a nonprofit agency that certifies health care organizations, reports that only 89% of the facilities surveyed in 2008 met the patient safety goal for following the Centers for Disease Control and Prevention's (CDC) hand hygiene guidelines for preventing the spread of infection.<sup>3</sup>

The federal government is taking steps to make hospitals safer, encouraging hospitals to adopt safe practices by establishing a zero-tolerance policy for preventable hospital-acquired complications. As of October 2008, the Centers for Medicare and Medicaid Services (CMS) no longer reimburses hospitals for the care of hospital-acquired conditions (such as certain infections, advanced bed sores, or fractures) and preventable medical errors that should never happen, such as performing surgery on the wrong body part.<sup>4</sup>

These hospital-acquired conditions can be reasonably prevented through the use of evidence-based guidelines and hospitals are now required to indicate whether these conditions are present at the time of admission. This new reporting requirement has increased the focus on patient safety at hospitals and will enable further analysis when the Medicare 2009 data are available.

The Institute for  
Healthcare  
Improvement  
estimates 40,000  
instances of  
medical harm  
occur in the  
health care  
delivery system  
daily.

With notable emphasis on patient safety in U.S. hospitals, consumers should be encouraged about the steps being taken to prevent medical mistakes. Today it is as important as ever for consumers to become active participants in their health care. HealthGrades independently analyzes U.S. hospitals' historical patient safety performance and makes that information available to patients and their families to consider when making difficult health care decisions.

HealthGrades used patient safety indicators from the Agency for Healthcare Research and Quality (AHRQ)<sup>5</sup> to identify the patient safety incidence rates for every nonfederal hospital in the country using three years of Medicare data (2006 through 2008). In addition to identifying the rates of patient safety events, HealthGrades created a composite score to identify the best-performing hospitals in the U.S. from 2006 through 2008. These hospitals were recognized with the HealthGrades 2010 Patient Safety Excellence Award™.

## Summary of Findings

The Agency for Healthcare Research and Quality (AHRQ) developed the patient safety indicators (PSIs) based on the Institute of Medicine's definition of patient safety—**"freedom from accidental injury due to medical care, or medical errors."**<sup>1</sup> Medical error is defined as "the failure of a planned action to be completed as intended or the use of a wrong plan to achieve an aim... [including] problems in practice, products, procedures, and systems."<sup>6</sup>

In 2002, AHRQ, in collaboration with the University of California–Stanford Evidence-Based Practice Center, identified 20 indicators of potentially preventable patient safety events that could be readily identified in hospital discharge data. This tool set of 20 evidence-based patient safety indicators was created and released to the public in 2003 to be used by various health care stakeholders to assess and improve patient safety in U.S. hospitals.<sup>5</sup>

For the first part of this study, HealthGrades used the Patient Safety Indicator QI Windows Software, version 3.2, developed by AHRQ.<sup>5</sup> In addition to the patient safety indicator software application, HealthGrades used previous research by Zhan and Miller<sup>7</sup> to study the attributable mortality and cost associated with each of 15 patient safety indicators among Medicare beneficiaries from 2006 through 2008. The 15 patient safety indicators studied are listed in *Appendix B*. (Four obstetrics indicators and absence of foreign body indicator were not used in the study of attributable mortality and cost.)

For the second part of this study, using the rates calculated for 12 of the 15 patient safety indicators studied (three indicators use E-codes in their definitions, which are not coded consistently across regions and are therefore excluded from the comparative hospital analysis), HealthGrades calculated an overall patient safety composite score for each hospital to identify the best-performing hospitals in the U.S. for the three-year period 2006 through 2008 (see *Appendix A*). These best-performing hospitals were recognized with the HealthGrades 2010 Patient Safety Excellence Award™.

From 2006 through 2008:

- There were **958,202 total patient safety events** affecting 908,401 Medicare beneficiaries which represents 2.29% of the nearly 39.5 million Medicare hospitalizations (see *Appendix C*).
- These patient safety events were associated with nearly **\$8.9 billion of excess cost** (see *Appendix E*).

Patient safety events cost the federal Medicare program nearly \$8.9 billion and resulted in 96,402 potentially preventable deaths from 2006 through 2008.

Six patient safety indicators showed improvement while eight indicators worsened in 2008 compared to 2006.

- **Six indicators showed improvement** over the course of the study (see *Appendix C*).
  - Complications of anesthesia, failure to rescue, selected infections due to medical care, post-operative hemorrhage or hematoma, post-operative abdominal wound dehiscence, and accidental puncture or laceration showed improvement ranging from 1.91% to 18.97%.
  - These six indicators **accounted for 20.16%** of the total patient safety events during the study period.
- **Eight indicators worsened** over the course of the study (see *Appendix C*).
  - Decubitus ulcer (bed sores), iatrogenic pneumothorax, post-operative hip fracture, post-operative physiologic and metabolic derangements, post-operative respiratory failure, post-operative pulmonary embolism (potentially fatal blood clots forming in the lungs) or deep vein thrombosis (blood clots in the legs), post-operative sepsis, and transfusion reaction all worsened with negative changes ranging from a 6.20% increase in events to 35.91%. Comparative analysis in trending was not available for Death in Low Mortality DRGs due to methodological changes.
  - These eight indicators **accounted for 78.94%** of the total patient safety events during the study period.
  - Within the three-year period, the **post-operative sepsis incidence rate increased by 25.96%** from 14.6 per thousand in 2006 to 18.4 per thousand in 2008 (see *Appendix C*).
- **Medical errors with the highest incidence rates** were associated with four patient safety indicators (below). The event rates per 1,000 patients are also noted (see *Appendix C*).
 

1) Failure to rescue (92.71)	3) Post-operative respiratory failure (17.52)
2) Decubitus ulcer (36.05)	4) Post-operative sepsis (16.53)
- There were **99,180 actual in-hospital deaths** that occurred among patients who experienced one or more of the 15 patient safety events (see *Appendix C*).
  - Medicare patients who experienced one or more of the 15 patient safety events had approximately a **one-in-ten chance of dying** as a result of an event from 2006 through 2008.
  - Applying previous research conducted by Zhan and Miller<sup>7</sup>, 97.19% or **96,402 of these deaths could be directly attributable to a patient safety event** (see *Appendix E*).
- Wide and highly significant gaps in individual patient safety indicators and overall performance exist between hospitals that were recognized with a HealthGrades Patient Safety Excellence Award versus bottom-ranked hospitals.
- Thirty-nine states have one or more hospitals that have been recognized with a HealthGrades Patient Safety Excellence Award.
  - The top ten states in overall average performance were: Iowa, Kansas, Minnesota, Montana, Nebraska, North Dakota, Oregon, South Dakota, Washington and Wisconsin (see *Appendix F*).
- Medicare patients treated at **hospitals recognized with a HealthGrades Patient Safety Excellence Award** had, on average, a **42.58% lower risk of experiencing** one or more of the 15 patient safety events studied compared to patients treated at bottom-ranked hospitals (range: 24.33% to 56.13%, see *Appendix D*).

Medicare patients who experienced one or more patient safety events had a one-in-ten chance of dying from 2006 through 2008.

If all hospitals had performed at the level of Patient Safety Excellence Award™ hospitals, approximately 218,572 patient safety events and 22,590 Medicare deaths could have been avoided, saving nearly \$2.1 billion from 2006 through 2008.

- If all hospitals had performed at the level of **hospitals recognized with a HealthGrades Patient Safety Excellence Award**, approximately **218,572 patient safety events** and **22,590 Medicare deaths** could potentially have been avoided while saving the U.S. health care system nearly **\$2.1 billion** from 2006 through 2008 (see *Appendix D*).

## Methodology Brief

To evaluate hospital patient safety, HealthGrades uses Medicare inpatient data from the Medicare Provider Analysis and Review (MedPAR) database and Patient Safety Indicator software from the Agency for Healthcare Research and Quality (AHRQ).

To examine **trends in patient safety** among the nation's hospitals, HealthGrades calculated national rates for 15 of the 20 AHRQ patient safety indicators, which are types of preventable hospital complications. Four of the obstetrics indicators along with the absence of foreign body left in during procedure indicator were not used (see *Appendix B* for a listing of indicators).

To evaluate **overall hospital performance** and **identify the best-performing hospitals** for patient safety across the U.S., HealthGrades used the same software to evaluate every hospital in the country on 12 patient safety indicators. Three patient safety indicators (complications of anesthesia, accidental puncture or laceration, and transfusion reaction) were not used in this analysis because their definitions use E-codes (a type of ICD-9 code) which are not coded consistently from hospital to hospital (see *Appendix G* for the list of the 12 indicators). The following steps were used to evaluate overall hospital performance and identify the best-performing hospitals:

1. For each patient safety indicator at each hospital, HealthGrades compared the **actual rate** to the **predicted rate** to produce an individual patient safety z-score.
2. The resulting z-scores were then averaged to determine the hospital's **overall patient safety score**. To be eligible to receive an overall patient safety score, a hospital had to have outcomes in nine of the 12 patient safety indicators and they must have an average star rating of at least 2.5 in at least 16 of the 26 HealthGrades cohorts (e.g., procedure and diagnosis categories; for more details, see *HealthGrades Hospital Report Cards™ Mortality and Complication Based Outcome Methodology* at [www.healthgrades.com](http://www.healthgrades.com)).
3. The overall patient safety score was then rank ordered, from most positive (best performing) to most negative (worst performing), within teaching and non-teaching peer groups.
4. Lastly, within each peer group the top 15% of eligible hospitals were identified as Patient Safety Excellence Award recipients. This final group of 238 hospitals represents less than 5% of the nation's nearly 5,000 hospitals initially studied.

Finally, **mortality and cost attributable to patient safety events** were extrapolated using results from previous research by Zhan and Miller.<sup>7</sup>

## Detailed Findings

### Patient Safety Events are Common in U.S. Hospitals

HealthGrades identified a total of **958,202 patient safety events** that occurred in 39,535,293 acute care Medicare hospitalizations from 2006 through 2008. These events occurred among 908,401 unique patients. This means that among hospitalized Medicare patients, 2.29% experienced one or more of the 15 patient safety events. Medicare patients who experienced one or more patient safety events had a one-in-ten chance of dying. In fact, there were **99,180 actual inhospital deaths** that occurred among patients who experienced one or more of the 15 patient safety events (see *Appendix C*).

### Common Patient Safety Events Cost Lives and Dollars

Four patient safety indicators with the **highest incidence rates** (failure to rescue, decubitus ulcer, post-operative respiratory failure, and post-operative sepsis) accounted for 61.96% of all patient safety events from 2006 through 2008 (see *Table 1* below). Failure to rescue rates improved 6.90% during the study period while decubitus ulcer, post-operative respiratory failure, and post-operative sepsis worsened by 35.91%, 6.20%, and 25.96% respectively. For the incidence rates and associated rate change of all 15 patient safety indicators, see *Appendix C*. For the excess mortality and costs attributable to each patient safety indicator, see *Appendix E*.

**Table 1: Most Commonly Occurring Patient Safety Indicators per 1,000 At-Risk Hospitalizations**

Patient Safety Indicator	Incidence Rate per 1,000 At-Risk Hospitalizations	Excess Cost Attributable to PSI (Billion)
Failure to rescue	92.71	NA*
Decubitus ulcer	36.05	\$2.64
Post-operative respiratory failure	17.52	\$1.85
Post-operative sepsis	16.53	\$0.65

\* By definition, all patients with the Failure to Rescue event died and were excluded from Zhan and Miller's analysis on attributable mortality and cost associated with patient safety indicators.

Patient safety events are not only common, but costly. Using cost numbers from the Zhan and Miller<sup>7</sup> research, we estimate that the 15 patient safety indicators studied cost the U.S. health care system nearly \$8.9 billion from 2006 through 2008 (see *Appendix E*). Two of the most common indicators (decubitus ulcer and post-operative respiratory failure) accounted for 50.72% of this \$8.9 billion.

From 2006 through 2008, 99,180 Medicare inpatient patients who experienced one or more patient safety events died.

Two of the most common indicators, decubitus ulcer and post-operative respiratory failure, accounted for 50.72% of the nearly \$8.9 billion excess cost.

The six patient safety indicators that showed improvement accounted for less than a quarter of the total patient safety events.

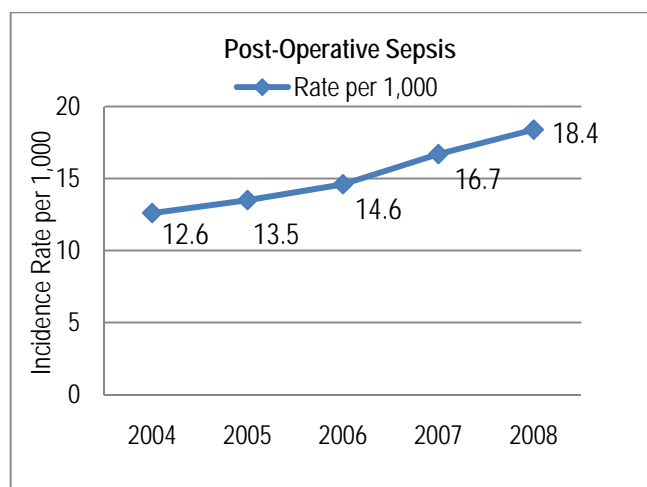
### Improvement Seen Among Less Common Events

Six of 15 patient safety indicators studied showed improvement from 2006 through 2008 (complications of anesthesia, failure to rescue, selected infections due to medical care, post-operative hemorrhage or hematoma, post-operative abdominal wound dehiscence, and accidental puncture or laceration). These six indicators improved, on average, 10.66% (range: 1.91% to 18.97%). Selected infections due to medical care, complications of anesthesia, and post-operative abdominal wound dehiscence were associated with the greatest improvements in 2008 compared to 2006 (see *Appendix C*). While these six indicators showed improvement over the study period, combined they accounted for only 20.16% of the total patient safety events. Finally, the improvement seen in selected infections due to medical care may have been the result of ICD-9 coding changes. (One of the defining codes was split by adding a fifth digit, and one of the resulting five-digit codes is no longer included in the definition.)

Eight indicators (decubitus ulcer, iatrogenic pneumothorax, post-operative hip fracture, post-operative physiologic and metabolic derangements, post-operative respiratory failure, post-operative pulmonary embolism or deep vein thrombosis, post-operative sepsis, and transfusion reaction) worsened from 2006 to 2008 (range: -35.91% to -6.20%). These eight indicators combined account for 78.94% of all the patient safety events during the study period (see *Appendix C*). Comparative analysis in trending was not available for Death in Low Mortality DRGs due to methodological changes.

### Post-Operative Sepsis Showed Large Incidence Rate Increase

Over the last five years, the incidence rate of post-operative sepsis has increased. Within the most recent three-year period, the post-operative sepsis incidence rate increased 25.96% from 14.6 per thousand in 2006 to 18.4 per thousand in 2008 (see *Appendix C*).



Additional analysis shows that this increase is not limited to just a few procedures, and in fact, all of the top ten most common procedures showed increased rates of sepsis between 2006 and 2008 (see *Table 2*). While the sepsis incidence rate increased, the associated mortality has not risen to the same extent; so total deaths associated with post-operative sepsis have remained virtually unchanged over the period. This could be attributable to the increased awareness and participation in the Institute for Healthcare Improvement's Surviving Sepsis campaign.<sup>8</sup>



Table 2: Sepsis Rate Associated with Top Ten Most Common Procedures

ICD-9	Procedure	Sepsis Rate 2006	Cases 2006	Sepsis Rate 2008	Cases 2008	Rate Ratio 2006/2008
81.54	Total Knee Replacement	0.26%	100,133	0.36%	85,875	0.714
81.51	Total Hip Replacement	0.35%	41,675	0.62%	36,570	0.568
81.08	Lumbar and Lumbosacral Fusion, Posterior Technique	0.55%	20,630	0.78%	21,718	0.704
35.21	Replacement of Aortic Valve with Tissue	2.06%	11,567	3.06%	13,716	0.672
36.12	(Aorto) Coronary Bypass of Two Coronary Arteries	1.40%	12,616	1.54%	12,261	0.910
36.13	(Aorto) Coronary Bypass of Three Coronary Arteries	1.50%	11,626	1.68%	10,483	0.891
39.29	Other (Peripheral) Vascular Shunt or Bypass	0.98%	10,057	1.21%	8,774	0.815
00.66	Percutaneous Transluminal Coronary Angioplasty (PTCA) or Coronary Atherectomy	1.31%	8,931	1.95%	8,083	0.670
03.09	Other Exploration and Decompression of Spinal Canal	0.44%	8,842	0.54%	7,747	0.814
45.73	Right Hemicolectomy	2.39%	6,727	2.93%	6,792	0.817

Pressure ulcers also showed a large increase in frequency. As of October 2008, the Centers for Medicare and Medicaid Services (CMS) no longer reimburses hospitals for the care of hospital-acquired conditions including pressure ulcers. Hospitals are now required to indicate if pressure ulcers are present on admission. When present on admission data is more widely available, HealthGrades can conduct further analysis. Due to methodological changes, valid comparisons were not available during this study period for the Death in Low Mortality DRG.

#### Approximately One-in-Ten Medicare Patients with Patient Safety Events Died

There were **99,180 actual inhospital deaths** that occurred among patients who experienced one or more of the 15 patient safety events (*Appendix C*). These deaths represent all-cause mortality among patients that experienced one or more of these patient safety events. To examine the direct relationship between the event and mortality, we utilized previous work by Zhan and Miller<sup>7</sup> to calculate the deaths directly attributed to these patient safety events. Applying Zhan and Miller's research to the patient safety event rate, we estimate that **96,402 deaths could potentially have been avoided** (see *Appendix E*).

#### Large Safety Gaps Identified Between Poorest- and Best-Performing Hospitals

The first part of this study examined the overall impact of 15 patient safety indicators across the nation's hospitals. The second part of this study identified the best-performing hospitals based on 12 patient safety indicators to establish a best-practice benchmark against which other hospitals could be evaluated. (As a reminder, three patient safety indicators—complications of anesthesia, accidental puncture or laceration, and transfusion reaction—were not used in this analysis because their definitions use E-codes which are not coded consistently from hospital to hospital). Best-performing hospitals were identified as the top 15% of ranked hospitals based on overall hospital performance and were recognized with the HealthGrades 2010 Patient Safety Excellence Award.

Of the 99,180 actual inhospital deaths, 97.19% or 96,402 could potentially have been avoided.

To be considered for the overall patient safety performance assessment, hospitals had to be rated in nine of the 12 patient safety indicators used in the study, be full-service hospitals (rated in at least 16 of 26 HealthGrades cohorts), and have a current overall HealthGrades star rating of at least 2.5, with 5.0 being the best possible overall star rating. (For more details, see *HealthGrades Hospital Report Cards™ Mortality and Complication Based Outcome Methodology* at [www.healthgrades.com](http://www.healthgrades.com).)

The top 15%, or 238 hospitals, were recognized with the HealthGrades 2010 Patient Safety Excellence Award.

The final ranking set included 740 teaching hospitals and 848 non-teaching hospitals. The top 15%, or 238 hospitals, were recognized with the HealthGrades 2010 Patient Safety Excellence Award. **These best-performing hospitals represent less than 5% of all U.S. hospitals examined in this study** (see *Appendix A*).

**Table 3: Best-Performing Hospitals by Hospital Type**

Hospital Type	Number of Best-Performing Hospitals (Patient Safety Excellence Award Recipients)
Teaching Hospitals	111
Non-teaching Hospitals	127

Patients treated at best-performing hospitals had, on average, a 42.58% lower chance of experiencing one or more medical errors compared to poorest-performing hospitals.

We found that there were wide, highly significant gaps in individual patient safety indicators and overall performance between the hospitals recognized with the HealthGrades 2010 Patient Safety Excellence Award and the bottom-ranked hospitals. More specifically, we found that **Patient Safety Excellence Award hospitals, as a group, significantly outperformed the bottom 15% hospitals on every patient safety indicator**. We also found that Patient Safety Excellence Award hospitals, as a group, had an overall patient safety performance equating to, on average, a **42.58% lower risk of experiencing one or more patient safety events** compared to the bottom 15% hospitals. This finding of better performance was consistent across all 12 patient safety indicators studied (range: 24.33% to 56.13% relative risk decrease) (see *Appendix D*).

#### **Patient Safety Excellence Award Hospitals Associated with Significantly Fewer Safety Events, Associated Deaths and Cost**

If all hospitals had performed at the level of Patient Safety Excellence Award hospitals, approximately 218,572 patient safety events and 22,590 Medicare deaths could have been avoided while saving the U.S. nearly \$2.1 billion from 2006 through 2008 (see *Appendix D*).

If all hospitals had performed at the level of Patient Safety Excellence Award™ hospitals, approximately 218,572 patient safety events and 22,590 Medicare deaths could have been avoided, saving nearly \$2.1 billion from 2006 through 2008.

#### **Patient Safety Performance Varies by State**

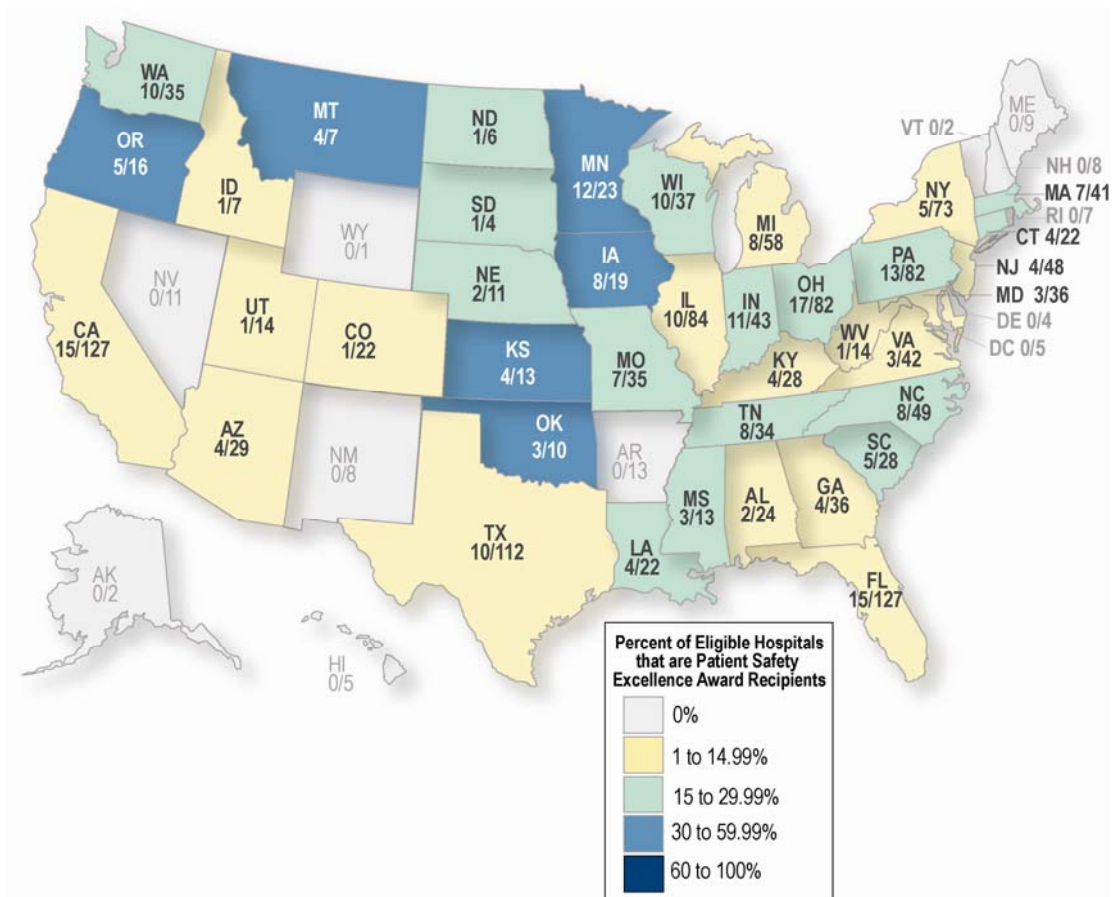
Variation in performance exists by state and within states by patient safety indicator. The top ten states in overall average performance were: Iowa, Kansas, Minnesota, Montana, Nebraska, North Dakota, Oregon, South Dakota, Washington and Wisconsin. Additional variations existed within states by patient safety indicator (see *Appendix F*).

#### **Thirty-nine States have One or More Patient Safety Excellence Hospitals**

Thirty-nine states have one or more hospitals that have been recognized with a HealthGrades Patient Safety Excellence Award. This year Utah joined the list of states that have at least one HealthGrades Patient Safety Excellence Hospital.

Over one-third (34.87%) of the 238 Patient Safety Excellence Award hospitals are in six states: Ohio (7.14%), California (6.30%), Florida (6.30%), Pennsylvania (5.46%), Minnesota (5.04%), and Indiana (4.62%) (see *Table 4*).

Patient Safety Excellence Award Hospitals by Eligible Hospitals by State



Over one-third (34.87%) of the 238 Patient Safety Excellence hospitals are in six states: Ohio, California, Florida, Pennsylvania, Minnesota, and Indiana.

**Table 4. Patient Safety Excellence Hospitals Distribution by State**

Eighty-three or over one-third (34.87%) of the 238 Patient Safety Excellence Award hospitals are in the six states shaded below.

State / Abbreviation	Eligible Hospitals	Patient Safety Excell. Award Hospitals	% of Eligible Hospitals that are Patient Safety Excell. Award Hospitals	% of All Patient Safety Excell. Award Hospitals	
Alabama	AL	24	2	8.33%	0.84%
Alaska	AK	2	0	0.00%	0.00%
Arizona	AZ	29	4	13.79%	1.68%
Arkansas	AR	13	0	0.00%	0.00%
California	CA	127	15	11.81%	6.30%
Colorado	CO	22	1	4.55%	0.42%
Connecticut	CT	22	4	18.18%	1.68%
Delaware	DE	4	0	0.00%	0.00%
Dist. Of Columbia	DC	5	0	0.00%	0.00%
Florida	FL	127	15	11.81%	6.30%
Georgia	GA	36	4	11.11%	1.68%
Hawaii	HI	5	0	0.00%	0.00%
Idaho	ID	7	1	14.29%	0.42%
Illinois	IL	84	10	11.90%	4.20%
Indiana	IN	43	11	25.58%	4.62%
Iowa	IA	19	8	42.11%	3.36%
Kansas	KS	13	4	30.77%	1.68%
Kentucky	KY	28	4	14.29%	1.68%
Louisiana	LA	22	4	18.18%	1.68%
Maine	ME	9	0	0.00%	0.00%
Maryland	MD	36	3	8.33%	1.26%
Massachusetts	MA	41	7	17.07%	2.94%
Michigan	MI	58	8	13.79%	3.36%
Minnesota	MN	23	12	52.17%	5.04%
Mississippi	MS	13	3	23.08%	1.26%
Missouri	MO	35	7	20.00%	2.94%
Montana	MT	7	4	57.14%	1.68%
Nebraska	NE	11	2	18.18%	0.84%
Nevada	NV	11	0	0.00%	0.00%
New Hampshire	NH	8	0	0.00%	0.00%
New Jersey	NJ	48	4	8.33%	1.68%
New Mexico	NM	8	0	0.00%	0.00%
New York	NY	73	5	6.85%	2.10%
North Carolina	NC	49	8	16.33%	3.36%
North Dakota	ND	6	1	16.67%	0.42%
Ohio	OH	82	17	20.73%	7.14%
Oklahoma	OK	10	3	30.00%	1.26%
Oregon	OR	16	5	31.25%	2.10%
Pennsylvania	PA	82	13	15.85%	5.46%
Rhode Island	RI	7	0	0.00%	0.00%
South Carolina	SC	28	5	17.86%	2.10%
South Dakota	SD	4	1	25.00%	0.42%
Tennessee	TN	34	8	23.53%	3.36%
Texas	TX	112	10	8.93%	4.20%
Utah	UT	14	1	7.14%	0.42%
Vermont	VT	2	0	0.00%	0.00%
Virginia	VA	42	3	7.14%	1.26%
Washington	WA	35	10	28.57%	4.20%
West Virginia	WV	14	1	7.14%	0.42%
Wisconsin	WI	37	10	27.03%	4.20%
Wyoming	WY	1	0	0.00%	0.00%

## Interpretation of Results

While many U.S. hospitals have taken extensive action to prevent medical errors, patient safety events are still common in U.S. hospitals. In this study, there were 958,202 patient safety events among Medicare beneficiaries from 2006 through 2008. Only six of the 15 indicators showed improvement and these six indicators represent less than a quarter (20.16%) of the overall patient safety events. Conversely, eight indicators worsened and these indicators represent more than three-quarters (78.94%) of the total patient safety events. Comparative analysis in trending was not available for Death in Low Mortality DRGs due to methodological changes.

**The 99,180 actual deaths and nearly \$8.9 billion likely represent a fraction of the number of avoidable patient safety deaths and associated costs.** Collectively, these results demonstrate that more attention on improving patient safety is necessary. Indeed, patient safety continues to be an important focus for hospitals, national organizations such as the Institute for Healthcare Improvement, and the federal government.

The federal government is directing their efforts towards eliminating “never events” (patient safety events that should never happen) and holding providers accountable for avoidable medical errors. In both the House and Senate versions of the health care reform bills, significant sections of the legislation were dedicated to adjusting provider payments for unnecessary readmissions and for high-cost common conditions acquired while in the hospital. This means that hospitals will no longer be reimbursed for events such as post-operative sepsis and decubitus ulcer. In addition, Congress remains vigilant with regard to the provision of quality medical care, and continues to seek ways to offer incentives to top-performing hospitals and physicians, while identifying and potentially penalizing poor performers.

Additionally, a growing number of states—including California, Minnesota, New York, Ohio, Oregon, Pennsylvania, Washington, and Wisconsin—are making patient safety information on hospitals public through their Web sites, further enhancing transparency and the impact of medical mistakes. In fact, on January 27, 2010, the State of California levied \$650,000 in fines against 13 hospitals for medical efforts that could have resulted in three patient deaths, according to HealthLeaders Media (1/28/2010).<sup>9</sup>

While many suggest that the increased rates of patient safety indicators are attributable to an increase in detection and/or reporting, these causes should not be used as stand-alone explanations. Research by Emory University and the CDC (Centers for Disease Control) has shown an actual increase in the overall incidence rate of sepsis in hospitals nationally.<sup>10</sup> The rates of increase in post-operative sepsis could be attributable to this national trend. The bottom line is that post-operative sepsis is a preventable event and patients do not expect to die from an infection that develops after knee or hip replacement surgery.

Avoiding mistakes by chance is no longer acceptable. When patients enter the health care system, they entrust their health and their lives to their caregivers. The health care system must continue to put systematic safe practices in place to ensure that the system created to save them doesn't unintentionally harm them.

If all U.S. hospitals had performed at the same level as the Patient Safety Excellence Award hospitals, the U.S. health care system could have saved nearly \$2.1 billion and potentially prevented 22,590 deaths in just three years among Medicare cases alone.

If all hospitals performed at the level of Patient Safety Excellence Award hospitals, approximately 218,572 patient safety events and 22,590 Medicare deaths could have been avoided, saving nearly \$2.1 billion from 2006 through 2008.

## Acknowledgements

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## Appendix A: HealthGrades 2010 Patient Safety Excellence Award™ Recipients

The following hospitals are recipients of the HealthGrades Patient Safety Excellence Award\* in 2010. Some of the Patient Safety Excellence Award recipients have multiple locations. In these cases, results for all locations were used in the analysis and each of the facilities is designated as a recipient of the award.

HealthGrades 2010 Patient Safety Excellence Award™ Recipients*	City	Teaching Status
<b>Alabama</b>		
Baptist Medical Center East	Montgomery	Non-teaching
Southeast Alabama Medical Center	Dothan	Non-teaching
<i>including:</i> The Hospital at Southeast Alabama Medical Center	Dothan	Non-teaching
<b>Alaska</b>		
<i>There are no recipients of this award in this state.</i>		
<b>Arizona</b>		
Arrowhead Hospital	Glendale	Non-teaching
Verde Valley Medical Center	Cottonwood	Non-teaching
West Valley Hospital	Goodyear	Non-teaching
Yavapai Regional Medical Center - West	Prescott	Non-teaching
<b>Arkansas</b>		
<i>There are no recipients of this award in this state.</i>		
<b>California</b>		
Bakersfield Memorial Hospital	Bakersfield	Non-teaching
Desert Valley Hospital	Victorville	Non-teaching
Eisenhower Medical Center	Rancho Mirage	Non-teaching
Garfield Medical Center	Monterey Park	Non-teaching
Hoag Memorial Hospital Presbyterian	Newport Beach	Non-teaching
Marian Medical Center	Santa Maria	Non-teaching
Mercy General Hospital	Sacramento	Teaching
Mercy San Juan Medical Center	Carmichael	Non-teaching
Queen of the Valley	Napa	Non-teaching
Saint Elizabeth Community Hospital	Red Bluff	Non-teaching
Saint John's Hospital Health Center	Santa Monica	Non-teaching
Saint Vincent Medical Center	Los Angeles	Teaching
Santa Barbara Cottage Hospital	Santa Barbara	Teaching
Sharp Chula Vista Medical Center	Chula Vista	Non-teaching
Sharp Memorial Hospital	San Diego	Non-teaching
<i>including:</i> THC San Diego	San Diego	Non-teaching
<b>Colorado</b>		
Poudre Valley Hospital	Fort Collins	Teaching

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Continued....

HealthGrades 2010 Patient Safety Excellence Award™ Recipients*	City	Teaching Status
<b>Connecticut</b>		
Danbury Hospital	Danbury	Teaching
Hospital of Saint Raphael	New Haven	Teaching
Lawrence & Memorial Hospital	New London	Teaching
Middlesex Hospital	Middletown	Teaching
<b>Delaware</b>		
<i>There are no recipients of this award in this state.</i>		
<b>District of Columbia</b>		
<i>There are no recipients of this award in this state.</i>		
<b>Florida</b>		
Cleveland Clinic Hospital	Weston	Teaching
Doctors Hospital of Sarasota	Sarasota	Non-teaching
Flagler Hospital	Saint Augustine	Non-teaching
Florida Hospital - Orlando	Orlando	Teaching
Holy Cross Hospital	Fort Lauderdale	Non-teaching
Indian River Medical Center	Vero Beach	Non-teaching
Kendall Regional Medical Center	Miami	Teaching
Manatee Memorial Hospital	Bradenton	Non-teaching
Mease Countryside Hospital	Safety Harbor	Non-teaching
Morton Plant Hospital	Clearwater	Teaching
Munroe Regional Medical Center	Ocala	Non-teaching
NCH Healthcare System	Naples	Non-teaching
Sarasota Memorial Hospital	Sarasota	Non-teaching
Seven Rivers Regional Medical Center	Crystal River	Non-teaching
Venice Regional Medical Center	Venice	Non-teaching
<b>Georgia</b>		
Athens Regional Medical Center	Athens	Non-teaching
Memorial University Medical Center	Savannah	Teaching
Northeast Georgia Medical Center	Gainesville	Non-teaching
<i>including: Northeast Georgia Medical Center - Lanier Park</i>	Gainesville	Non-teaching
Piedmont Hospital	Atlanta	Teaching
<b>Hawaii</b>		
<i>There are no recipients of this award in this state.</i>		
<b>Idaho</b>		
Saint Joseph Regional Medical Center	Lewiston	Non-teaching

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HealthGrades 2010 Patient Safety Excellence Award™ Recipients*	City	Teaching Status
<b>Illinois</b>		
Advocate Good Samaritan Hospital	Downers Grove	Non-teaching
Central DuPage Hospital	Winfield	Non-teaching
Elmhurst Memorial Hospital	Elmhurst	Non-teaching
Methodist Medical Center of Illinois	Peoria	Teaching
Morris Hospital and Healthcare Centers	Morris	Non-teaching
Palos Community Hospital	Palos Heights	Non-teaching
Provena St. Mary's Hospital	Kankakee	Teaching
Riverside Medical Center	Kankakee	Non-teaching
Saint Anthony's Memorial Hospital	Effingham	Non-teaching
Trinity Medical Center - West	Rock Island	Non-teaching
<i>including: Trinity Medical Center - 7th Street</i>	Moline	Non-teaching
<b>Indiana</b>		
Ball Memorial Hospital	Muncie	Teaching
Clark Memorial Hospital	Jeffersonville	Teaching
Columbus Regional Hospital	Columbus	Non-teaching
Community Hospital	Munster	Non-teaching
Hendricks Regional Health	Danville	Non-teaching
Lutheran Hospital of Indiana	Fort Wayne	Teaching
Memorial Hospital and Health Care Center	Jasper	Non-teaching
Memorial Hospital of South Bend	South Bend	Teaching
Saint Francis Hospital and Health Centers - Indianapolis	Indianapolis	Teaching
Saint Joseph Regional Medical Center - South Bend	Mishawaka	Teaching
<i>including: Saint Joseph Community Hospital</i>	Mishawaka	Teaching
St. Vincent Indianapolis Hospital	Indianapolis	Teaching
<b>Iowa</b>		
Genesis Medical Center - Davenport	Davenport	Teaching
Iowa Methodist Medical Center	Des Moines	Teaching
Mercy Medical Center - Des Moines	Des Moines	Teaching
Mercy Medical Center - Dubuque	Dubuque	Non-teaching
Mercy Medical Center - North Iowa	Mason City	Teaching
Mercy Medical Center of Clinton	Clinton	Non-teaching
Saint Luke's Hospital	Cedar Rapids	Teaching
The Finley Hospital	Dubuque	Non-teaching

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HealthGrades 2010 Patient Safety Excellence Award™ Recipients*	City	Teaching Status
<b>Kansas</b>		
Galichia Heart Hospital	Wichita	Non-teaching
Hays Medical Center	Hays	Non-teaching
Saint Luke's South Hospital	Overland Park	Non-teaching
Via Christi Regional Medical Center	Wichita	Teaching
<b>Kentucky</b>		
Frankfort Regional Medical Center	Frankfort	Non-teaching
Murray - Calloway County Hospital	Murray	Non-teaching
Owensboro Medical Health System	Owensboro	Non-teaching
Western Baptist Hospital	Paducah	Non-teaching
<b>Louisiana</b>		
CHRISTUS Saint Patrick Hospital	Lake Charles	Non-teaching
Saint Francis Medical Center	Monroe	Non-teaching
Terrebonne General Hospital	Houma	Non-teaching
Willis Knighton Medical Center	Shreveport	Teaching
<b>Maine</b>		
<i>There are no recipients of this award in this state.</i>		
<b>Maryland</b>		
Saint Joseph Medical Center	Towson	Non-teaching
Suburban Hospital	Bethesda	Teaching
Western Maryland Health System - Braddock	Cumberland	Non-teaching
<b>Massachusetts</b>		
Brigham and Women's Hospital	Boston	Teaching
Cape Cod Hospital	Hyannis	Teaching
Massachusetts General Hospital	Boston	Teaching
North Shore Medical Center - Salem Hospital	Salem	Teaching
<i>including:</i> North Shore Medical Center - Union Hospital	Lynn	Teaching
The Salem Hospital Corporation	Salem	Teaching
South Shore Hospital	South Weymouth	Non-teaching
Southcoast Hospitals Group - Charlton Memorial	Fall River	Non-teaching
<i>including:</i> Southcoast Hospitals Group - Saint Luke's Hospital	New Bedford	Non-teaching
The Cooley Dickinson Hospital	Northampton	Non-teaching

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HealthGrades 2010 Patient Safety Excellence Award™ Recipients*	City	Teaching Status
<b>Michigan</b>		
Allegiance Health	Jackson	Non-teaching
Alpena Regional Medical Center	Alpena	Non-teaching
Harper University Hospital	Detroit	Teaching
<i>including: Hutzel Hospital</i>	Detroit	Teaching
Holland Hospital	Holland	Non-teaching
Marquette General Hospital	Marquette	Teaching
MidMichigan Medical Center - Midland	Midland	Teaching
Munson Medical Center	Traverse City	Teaching
Spectrum Health - Butterworth Hospital	Grand Rapids	Teaching
<i>including: Spectrum Health Blodgett Hospital</i>	Grand Rapids	Teaching
<b>Minnesota</b>		
Abbott - Northwestern Hospital	Minneapolis	Teaching
Fairview Ridges Hospital	Burnsville	Non-teaching
Fairview Southdale Hospital	Edina	Non-teaching
Lakeview Hospital	Stillwater	Non-teaching
Mercy Hospital	Coon Rapids	Teaching
North Memorial	Robbinsdale	Teaching
Park Nicollet Methodist Hospital	Minneapolis	Teaching
Regions Hospital	Saint Paul	Teaching
Saint Cloud Hospital	Saint Cloud	Teaching
Saint Joseph's Hospital	Saint Paul	Teaching
Saint Luke's Hospital	Duluth	Teaching
United Hospitals	Saint Paul	Teaching
<b>Mississippi</b>		
Jeff Anderson Regional Medical Center	Meridian	Non-teaching
North Mississippi Medical Center	Tupelo	Teaching
Singing River Hospital System	Pascagoula	Non-teaching
<b>Missouri</b>		
Heartland Regional Medical Center	St. Joseph	Non-teaching
Liberty Hospital	Liberty	Non-teaching
Missouri Baptist Medical Center	Saint Louis	Teaching
North Kansas City Hospital	North Kansas City	Non-teaching
Saint Luke's Hospital of Kansas City	Kansas City	Teaching
Saint Mary's Health Center	Jefferson City	Non-teaching
Southeast Missouri Hospital	Cape Girardeau	Non-teaching

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HealthGrades 2010 Patient Safety Excellence Award™ Recipients*	City	Teaching Status
<b>Montana</b>		
Billings Clinic	Billings	Teaching
Kalispell Regional Medical Center	Kalispell	Non-teaching
Saint Patrick Hospital and Health Sciences Center	Missoula	Non-teaching
Saint Vincent Healthcare	Billings	Teaching
<b>Nebraska</b>		
Alegent Health-Bergan Mercy Medical Center	Omaha	Teaching
BryanLGH Medical Center - East	Lincoln	Teaching
<i>including: BryanLGH Medical Center - West</i>	Lincoln	Teaching
<b>Nevada</b>		
<i>There are no recipients of this award in this state.</i>		
<b>New Hampshire</b>		
<i>There are no recipients of this award in this state.</i>		
<b>New Jersey</b>		
Jersey Shore University Medical Center	Neptune	Teaching
Morristown Memorial Hospital	Morristown	Teaching
Ocean Medical Center	Brick	Non-teaching
Our Lady of Lourdes Medical Center	Camden	Teaching
<b>New Mexico</b>		
<i>There are no recipients of this award in this state.</i>		
<b>New York</b>		
Arnot Ogden Medical Center	Elmira	Non-teaching
Huntington Hospital	Huntington	Teaching
John T. Mather Memorial Hospital	Port Jefferson	Non-teaching
Saint Francis Hospital - Roslyn	Roslyn	Teaching
Southampton Hospital	Southampton	Non-teaching
<b>North Carolina</b>		
Carolinas Medical Center - Northeast	Concord	Teaching
Firsthealth Moore Regional Hospital	Pinehurst	Non-teaching
Frye Regional Medical Center	Hickory	Non-teaching
Halifax Regional Medical Center	Roanoke Rapids	Non-teaching
Margaret R. Pardee Memorial Hospital	Hendersonville	Teaching
Mission Hospitals	Asheville	Teaching
<i>including: Mission Health and Hospitals - Saint Joseph</i>	Asheville	Teaching
Rex Hospital	Raleigh	Non-teaching
Scotland Memorial Hospital	Laurinburg	Non-teaching

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HealthGrades 2010 Patient Safety Excellence Award™ Recipients*	City	Teaching Status
<b>North Dakota</b>		
Saint Alexius Medical Center	Bismarck	Teaching
<b>Ohio</b>		
Bethesda North Hospital	Cincinnati	Teaching
Blanchard Valley Hospital	Findlay	Non-teaching
Community Health Partners of Ohio - West	Lorain	Teaching
EMH Regional Medical Center	Elyria	Non-teaching
Fairfield Medical Center	Lancaster	Non-teaching
Fairview Hospital	Cleveland	Teaching
Firelands Regional Medical Center	Sandusky	Teaching
Genesis Healthcare System	Zanesville	Non-teaching
Marietta Memorial Hospital	Marietta	Non-teaching
Mercy Franciscan Hospital - Mount Airy	Cincinnati	Teaching
Mercy Medical Center	Canton	Teaching
Parma Community General Hospital	Parma	Non-teaching
Saint Elizabeth Health Center	Youngstown	Teaching
Saint John West Shore Hospital	Westlake	Teaching
St. Luke's Hospital	Maumee	Teaching
Southwest General Health Center	Middleburg Heights	Teaching
The Toledo Hospital	Toledo	Teaching
<b>Oklahoma</b>		
Integris Southwest Medical Center	Oklahoma City	Teaching
Midwest Regional Medical Center	Midwest City	Non-teaching
Saint Anthony Hospital	Oklahoma City	Teaching
<i>including: Saint Michael Hospital</i>	Oklahoma City	Teaching
<b>Oregon</b>		
Mercy Medical Center	Roseburg	Non-teaching
Providence Saint Vincent Medical Center	Portland	Teaching
Rogue Valley Medical Center	Medford	Non-teaching
Sacred Heart Medical Center - University District	Eugene	Non-teaching
Saint Charles Medical Center - Bend	Bend	Teaching

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HealthGrades 2010 Patient Safety Excellence Award™ Recipients*	City	Teaching Status
<b>Pennsylvania</b>		
Doylestown Hospital	Doylestown	Non-teaching
Evangelical Community Hospital	Lewisburg	Non-teaching
Grand View Hospital	Sellersville	Non-teaching
Hamot Medical Center	Erie	Teaching
Hazleton General Hospital	Hazleton	Non-teaching
Lancaster General Hospital	Lancaster	Teaching
Latrobe Hospital	Latrobe	Teaching
Main Line Hospitals - Bryn Mawr	Bryn Mawr	Teaching
Mercy Hospital - Scranton	Scranton	Teaching
Pinnacle Health System	Harrisburg	Teaching
Saint Clair Hospital	Pittsburgh	Non-teaching
The Reading Hospital and Medical Center	Reading	Teaching
Washington Hospital	Washington	Teaching
<b>Rhode Island</b>		
<i>There are no recipients of this award in this state.</i>		
<b>South Carolina</b>		
AnMed Health	Anderson	Teaching
Greenville Memorial Hospital	Greenville	Teaching
McLeod Regional Medical Center	Florence	Teaching
Sisters of Charity Providence Hospitals	Columbia	Non-teaching
Waccamaw Community Hospital	Murrells Inlet	Non-teaching
<b>South Dakota</b>		
Sanford USD Medical Center	Sioux Falls	Teaching
<b>Tennessee</b>		
Baptist Hospital West	Knoxville	Non-teaching
Baptist Riverside Hospital**	Knoxville	Non-teaching
Centennial Medical Center	Nashville	Non-teaching
Holston Valley Medical Center	Kingsport	Teaching
Memorial Healthcare System	Chattanooga	Non-teaching
Northcrest Medical Center	Springfield	Non-teaching
Parkridge Medical Center	Chattanooga	Non-teaching
Saint Thomas Hospital	Nashville	Teaching

\*\* Hospital is currently closed but was open during the study period 2006 through 2008.

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Continued...

HealthGrades 2010 Patient Safety Excellence Award™ Recipients*	City	Teaching Status
<b>Texas</b>		
Baptist St. Anthony's Health System	Amarillo	Teaching
CHRISTUS St. Michael Health System	Texarkana	Teaching
CHRISTUS Spohn Hospital Corpus Christi - Memorial	Corpus Christi	Teaching
<i>including:</i> CHRISTUS Spohn Hospital Corpus Christi-South	Corpus Christi	Teaching
CHRISTUS Spohn Hospital Corpus Christi-Shoreline	Corpus Christi	Teaching
Citizens Medical Center	Victoria	Non-teaching
Lubbock Heart Hospital	Lubbock	Non-teaching
Mother Frances Hospital - Tyler	Tyler	Teaching
Providence Healthcare Network	Waco	Teaching
Saint David's Medical Center	Austin	Non-teaching
Texas Health Presbyterian Hospital of Plano	Plano	Non-teaching
Valley Baptist Medical Center	Harlingen	Teaching
<b>Utah</b>		
St. Mark's Hospital	Salt Lake City	Teaching
<b>Vermont</b>		
<i>There are no recipients of this award in this state.</i>		
<b>Virginia</b>		
Augusta Health	Fishersville	Non-teaching
Lynchburg General Hospital	Lynchburg	Teaching
Winchester Medical Center	Winchester	Teaching
<b>Washington</b>		
Central Washington Hospital	Wenatchee	Non-teaching
Good Samaritan Hospital and Rehabilitation Center	Puyallup	Non-teaching
Holy Family Hospital	Spokane	Non-teaching
Northwest Hospital & Medical Center	Seattle	Non-teaching
Overlake Hospital Medical Center	Bellevue	Non-teaching
Providence Regional Medical Center - Everett	Everett	Non-teaching
Sacred Heart Medical Center	Spokane	Teaching
St. Joseph Hospital	Bellingham	Non-teaching
Tacoma General Allenmore Hospital	Tacoma	Teaching
Virginia Mason Medical Center	Seattle	Teaching
<b>West Virginia</b>		
Mon General Hospital	Morgantown	Non-teaching

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HealthGrades 2010 Patient Safety Excellence Award™ Recipients*	City	Teaching Status
<b>Wisconsin</b>		
Aurora BayCare Medical Center	Green Bay	Non-teaching
Aurora Saint Luke's Medical Center	Milwaukee	Teaching
<i>including: Saint Luke's Medical Center</i>	Cudahy	Teaching
Aurora Sheboygan Memorial Medical Center	Sheboygan	Non-teaching
Bay Area Medical Center	Marinette	Non-teaching
Bellin Memorial Hospital	Green Bay	Non-teaching
Holy Family Memorial	Manitowoc	Non-teaching
Luther Hospital Mayo Health System	Eau Claire	Teaching
Meriter Hospital	Madison	Teaching
Saint Joseph's Hospital	Marshfield	Teaching
West Allis Memorial Hospital	West Allis	Teaching
<b>Wyoming</b>		
<i>There are no recipients of this award in this state.</i>		

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## Appendix B: Patient Safety Indicators Used in this HealthGrades Study

The following 15 patient safety indicators were used in this HealthGrades study. Three patient safety indicators—complications of anesthesia, accidental puncture or laceration, and transfusion reaction—were not used in the analysis to identify Patient Safety Excellence Award recipients because their definitions use E-codes which are not coded consistently from hospital to hospital.

Patient Safety Indicator	Translated as...
Complications of anesthesia*	<i>excluded</i>
Death in low mortality Diagnostic Related Groupings (DRGs)	Prevention of death in procedures where mortality is usually very low
Decubitus ulcer	Lack of pressure sores or bed sores acquired in the hospital
Failure to rescue (known as, Death among surgical inpatients with serious treatable complications)	Ability to diagnose and treat in time
Iatrogenic pneumothorax	Avoidance of collapsed lung due to a procedure or surgery in or around the chest
Selected infections due to medical care	Lack of infections acquired at the hospital
Post-operative hip fracture	Absence of hip fracture after surgery
Post-operative hemorrhage or hematoma	Avoidance of excessive bruising or bleeding as a consequence of a procedure or surgery
Post-operative physiologic and metabolic derangements	Adequate organ function and electrolyte and fluid imbalance after surgery
Post-operative respiratory failure	Avoidance of respiratory failure following surgery
Post-operative pulmonary embolism or deep vein thrombosis	Lack of deep blood clots in the lungs or legs after surgery
Post-operative sepsis	Avoidance of severe infection following surgery
Post-operative abdominal wound dehiscence	Lack of surgical wound site breakdown
Accidental puncture or laceration*	<i>excluded</i>
Transfusion reaction*	<i>excluded</i>

\* Complications of anesthesia, accidental puncture or laceration, and transfusion reaction were excluded from the overall performance calculation to identify the Patient Safety Excellence Award recipients.

## Appendix C: Patient Safety Incidence Rates and Associated Mortality Among Medicare Beneficiaries (2006 – 2008)

Patient Safety Indicator	Year	Number of Events	Total Cases Evaluated	Rate per 1,000	Associated Mortality*	% Improvement in Rate (2006 – 2008)
Complications of anesthesia**	2006	651	3,426,934	0.190	4	17.46%
	2007	547	3,317,120	0.165	5	
	2008	509	3,246,092	0.157	0	
	2006-2008	1,707	9,990,146	0.171	9	
Death in low mortality DRGs	2006	2,523	1,573,552	1.603	2,523	-35.84%
	2007	2,484	1,559,626	1.593	2,484	
	2008	3,661	1,680,935	2.178	3,661	
	2006-2008	8,668	4,814,113	1.801	8,668	
Decubitus ulcer	2006	148,112	4,644,308	31.891	14,050	-35.91%
	2007	150,291	4,517,622	33.268	13,385	
	2008	189,315	4,367,954	43.342	17,611	
	2006-2008	487,718	13,529,884	36.047	45,046	
Failure to rescue	2006	4,917	51,523	95.433	4,917	6.90%
	2007	4,834	51,458	93.941	4,834	
	2008	4,667	52,530	88.844	4,667	
	2006-2008	14,418	155,511	92.714	14,418	
Iatrogenic pneumothorax	2006	7,571	12,067,731	0.627	1,191	-18.23%
	2007	7,161	11,810,929	0.606	1,121	
	2008	8,771	11,824,970	0.742	1,266	
	2006-2008	23,503	35,703,630	0.658	3,578	
Selected infections due to medical care	2006	17,409	7,944,799	2.191	1,572	18.97%
	2007	17,781	8,382,463	2.121	1,484	
	2008	14,975	8,433,941	1.776	1,516	
	2006-2008	50,165	24,761,203	2.026	4,572	
Post-operative hip fracture	2006	995	2,109,426	0.472	102	-6.74%
	2007	987	2,005,928	0.492	100	
	2008	967	1,920,588	0.503	87	
	2006-2008	2,949	6,035,942	0.489	289	
Post-operative hemorrhage or hematoma	2006	9,004	3,407,112	2.643	661	1.91%
	2007	8,552	3,297,030	2.594	501	
	2008	8,361	3,225,357	2.592	568	
	2006-2008	25,917	9,929,499	2.610	1,730	
Post-operative physiologic and metabolic derangements	2006	2,212	1,805,814	1.225	460	-13.61%
	2007	2,269	1,751,822	1.295	424	
	2008	2,370	1,702,960	1.392	431	
	2006-2008	6,851	5,260,596	1.302	1,315	

Continued...

Patient Safety Indicator	Year	Number of Events	Total Cases Evaluated	Rate per 1,000	Associated Mortality*	% Improvement in Rate (2006 – 2008)
Post-operative respiratory failure	2006	22,670	1,328,177	17.069	5,249	-6.20%
	2007	22,726	1,307,265	17.384	4,919	
	2008	23,682	1,306,407	18.128	4,895	
	2006-2008	69,078	3,941,849	17.524	15,063	
Post-operative pulmonary embolism or deep vein thrombosis	2006	46,830	3,372,941	13.884	3,967	-11.78%
	2007	47,388	3,260,820	14.533	3,709	
	2008	49,481	3,188,216	15.520	4,013	
	2006-2008	143,699	9,821,977	14.630	11,689	
Post-operative sepsis	2006	6,784	464,391	14.608	1,778	-25.96%
	2007	7,643	457,509	16.706	1,864	
	2008	8,032	436,509	18.401	1,813	
	2006-2008	22,459	1,358,409	16.533	5,455	
Post-operative wound dehiscence in abdominopelvic surgical patients	2006	1,711	435,790	3.926	256	14.03%
	2007	1,721	434,552	3.960	220	
	2008	1,415	419,192	3.376	180	
	2006-2008	4,847	1,289,534	3.759	656	
Accidental puncture or laceration**	2006	33,077	12,584,945	2.628	2,249	4.67%
	2007	32,006	12,321,425	2.598	2,063	
	2008	30,999	12,372,153	2.506	2,187	
	2006-2008	96,082	37,278,523	2.577	6,499	
Transfusion reaction**	2006	45	12,809,345	0.004	1	-35.43%
	2007	36	12,554,302	0.003	1	
	2008	60	12,611,316	0.005	3	
	2006-2008	141	37,974,963	0.004	5	
<b>Totals</b>	-	<b>958,202</b>	-	-	-	
<b>Less Double Counts</b>	-	<b>908,401<sup>^</sup></b>	-	-	<b>99,180</b>	

\* The mortality reported is all-cause in-hospital mortality among all U.S. patients that experienced one or more patient safety events during hospitalization from 2006 through 2008.

\*\* Complications of anesthesia, accidental puncture or laceration, and transfusion reaction were excluded from the overall performance calculation to identify the Patient Safety Excellence Award recipients.

<sup>^</sup> This is the number of patients with one or more patient safety events.

Appendix D: Comparing Different Performance Categories (2006 – 2008)

Patient Safety Indicator	Observed-to-Expected Ratios (O/E) by PSI and Associated Outcomes				As Compared to the Top 15% Performance			
	Top 15% Hospitals (Hospitals Recognized with Patient Safety Excellence Award) O/E Ratios (95% CI)	Middle 70% Hospitals O/E Ratios	Bottom 15% Hospitals O/E Ratios (95% CI)	Relative Risk Decrease Associated with Patient Safety Excellence Hospitals Compared to Bottom Hospitals	# of Excess Patient Safety Events** Among All Non-Patient Safety Award Hospitals	# Potentially Avoidable Deaths** Associated with Excess Patient Safety Events Among All Non-Patient Safety Award Hospitals	Excess Charge^ (Millions) Associated with Excess Patient Safety Events Among All Non-Patient Safety Award Hospitals	Excess Cost^^ (Millions) Associated with Excess Patient Safety Events Among All Non-Patient Safety Award Hospitals
Death in low mortality DRGs*	.752 (.711-.794)	1.013	1.224 (1.164-1.284)	38.52%	2,146	2,146	NA*	NA*
Decubitus ulcer	.725 (.720-.731)	1.006	1.254 (1.247-1.262)	42.17%	133,908	9,682	\$1,452	\$726
Failure to rescue*	.824 (.793-.855)	.992	1.187 (1.152-1.222)	30.56%	2,536	2,536	NA*	NA*
Iatrogenic pneumothorax	.856 (.831-.881)	1.009	1.132 (1.100-1.163)	24.33%	3,378	236	\$58	\$29
Selected infections due to medical care	.708 (.692-.723)	.995	1.382 (1.358-1.406)	48.79%	14,663	632	\$567	\$283
Post-operative hip fracture	.618 (.560-.676)	1.022	1.409 (1.305-1.514)	56.13%	1,125	51	\$15	\$8
Post-operative hemorrhage or hematoma	.802 (.779-.824)	1.004	1.228 (1.196-1.259)	34.70%	5,141	155	\$110	\$55
Post-operative physiologic and metabolic derangements	.692 (.654-.731)	.973	1.538 (1.472-1.604)	54.98%	2,108	418	\$116	\$58
Post-operative respiratory failure	.794 (.780-.808)	.991	1.291 (1.272-1.310)	38.52%	14,248	3,112	\$762	\$381
Post-operative pulmonary embolism or deep vein thrombosis	.782 (.773-.791)	.997	1.303 (1.289-1.316)	39.96%	31,315	2,054	\$680	\$340
Post-operative sepsis	.711 (.689-.733)	.985	1.443 (1.407-1.478)	50.73%	6,494	1,423	\$375	\$187
Post-op wound dehiscence in abdominopelvic surgical patients	.688 (.637-.740)	.995	1.422 (1.339-1.505)	51.59%	1,510	145	\$61	\$30
Average relative risk increase in and number of potentially avoidable patient safety events, death, charge and cost associated with All Other hospitals compared to Award hospitals.				<b>42.58%</b>	<b>218,572</b>	<b>22,590</b>	<b>\$4,196</b>	<b>\$2,098</b>

\* By definition, all patients with the event died and were excluded from Zhan and Miller's analysis on attributable mortality and cost associated with patient safety events.

\*\* Excess events are determined by applying the Patient Safety Excellence Hospital event rates to all other hospitals and subtracting from their actual event rate.

^ Based on previous research done by Zhan and Miller. *Excess Length of Stay, Charges, and Mortality Attributable to Medical Injuries During Hospitalization*. JAMA. 2003; 290(14):1868-1874.

^^ Assuming an average cost to charge ratio of 0.5 (Friedman, La Mare, Andrews, and McKenzie. *Practical Options for Estimating Cost of Hospital Inpatient Stays*. J Health Care Finance. 2002; 29(1): 1-13).

## Appendix E: Patient Safety Events and Their Attributable Mortality and Excess Charge Among Medicare Beneficiaries by Patient Safety Indicator (2006 – 2008)

Patient Safety Indicator	Actual Number of National Events	Percentage of Total Number of Events	Attributable Mortality Rates**	Number of Deaths Attributable to PSI (Attributable Mortality**)	Attributable Charge**	Excess Charge Attributable to PSI** (Millions)	Excess Cost Attributable to PSI ^^ (Millions)
Decubitus ulcer	487,718	50.90%	7.23%	35,262	\$10,845	\$5,289.30	\$2,644.65
Post-operative pulmonary embolism or deep vein thrombosis	143,699	15.00%	6.56%	9,427	\$21,709	\$3,119.56	\$1,559.78
Accidental puncture or laceration	96,082	10.03%	2.16%	2,075	\$8,271	\$794.69	\$397.35
Post-operative respiratory failure	69,078	7.21%	21.84%	15,087	\$53,502	\$3,695.81	\$1,847.91
Selected infections due to medical care	50,165	5.24%	4.31%	2,162	\$38,656	\$1,939.18	\$969.59
Post-operative hemorrhage or hematoma	25,917	2.70%	3.01%	780	\$21,431	\$555.43	\$277.71
Iatrogenic pneumothorax	23,503	2.45%	6.99%	1,643	\$17,312	\$406.88	\$203.44
Post-operative sepsis	22,459	2.34%	21.92%	4,923	\$57,727	\$1,296.49	\$648.25
Failure to rescue*	14,418	1.50%	NA*	14,418	NA*	NA*	NA*
Death in low mortality DRGs*	8,668	0.90%	NA*	8,668	NA*	NA*	NA*
Post-operative physiologic and metabolic derangements	6,851	0.71%	19.81%	1,357	\$54,818	\$375.56	\$187.78
Post-operative abdominal wound dehiscence	4,847	0.51%	9.63%	467	\$40,323	\$195.45	\$97.72
Post-operative hip fracture	2,949	0.31%	4.52%	133	\$13,441	\$39.64	\$19.82
Complications of anesthesia	1,707	0.18%	0.00%	0	\$1,598	\$2.73	\$1.36
Transfusion reaction	141	0.01%	0.00%	0	\$18,929	\$2.67	\$1.33
<b>Totals</b>	<b>958,202</b>	<b>-</b>	<b>-</b>	<b>96,402</b>	<b>-</b>	<b>\$17,713.39</b>	<b>\$8,856.69</b>

\* By definition, all patients with the event died and were excluded from Zhan and Miller's analysis on attributable mortality and cost associated with patient safety events.

\*\* Based on previous research done by Zhan and Miller. *Excess Length of Stay, Charges, and Mortality Attributable to Medical Injuries During Hospitalization*. JAMA. 2003; 290(14):1868-1874. Insufficient data to estimate attributable mortality rates for Complications of Anesthesia and Transfusion Reaction.

^^ Assuming an average cost to charge ratio of 0.5 (Friedman, La Mare, Andrews, McKenzie, *Practical Options for Estimating Cost of Hospital Inpatient Stays*. J Health Care Finance. 2002; 29(1): 1-13.

## Appendix F: Patient Safety Observed-to-Expected Incidence Rate by State

The following table presents patient safety observed-to-expected ratios by patient safety indicator across states; and highlights the top-performing states.

● Best - Top 10 States    ◎ Average - Middle 31 States    ○ Worst - Bottom 10 States

Patient Safety Indicator	AK	AL	AR	AZ	CA	CO	CT	DC	DE	FL
Overall Average	0.94 ◎	1.02 ◎	1.09 ○	0.98 ◎	1.03 ◎	1.09 ○	0.93 ◎	1.43 ○	0.99 ◎	1.03 ◎
Death in low mortality DRGs	0.84 ◎	1.14 ◎	1.27 ○	0.66 ●	1.03 ◎	0.83 ●	0.74 ●	1.03 ◎	0.75 ●	0.82 ●
Decubitus ulcer	1.07 ○	0.94 ◎	1.00 ◎	0.78 ◎	1.20 ○	0.80 ◎	0.99 ◎	1.53 ○	0.86 ◎	0.97 ◎
Failure to rescue	1.07 ◎	1.24 ○	1.13 ◎	0.81 ●	1.06 ◎	0.92 ◎	0.86 ●	1.18 ○	0.96 ◎	1.01 ◎
Iatrogenic pneumothorax	0.83 ●	1.01 ◎	1.37 ○	1.02 ◎	0.98 ◎	1.50 ○	0.99 ◎	1.19 ◎	1.02 ◎	1.04 ◎
Selected infections due to medical care	1.06 ◎	0.87 ◎	0.83 ◎	1.16 ◎	1.11 ◎	1.30 ○	1.14 ◎	1.34 ○	0.97 ◎	1.30 ○
Post-operative hip fracture	1.12 ◎	1.04 ◎	1.08 ◎	1.18 ○	0.90 ◎	1.07 ◎	0.97 ◎	1.23 ○	1.12 ◎	1.05 ◎
Post-operative hemorrhage or hematoma	1.13 ◎	1.14 ○	1.15 ○	0.91 ●	1.04 ◎	1.18 ○	0.98 ◎	1.15 ○	0.93 ◎	0.94 ◎
Post-operative physiologic and metabolic derangements	0.44 ●	1.15 ◎	1.17 ◎	0.99 ◎	1.15 ◎	0.92 ◎	0.59 ●	0.94 ◎	1.01 ◎	1.07 ◎
Post-operative respiratory failure	0.77 ●	0.98 ◎	1.13 ○	1.09 ○	0.93 ◎	0.99 ◎	0.95 ◎	1.67 ○	0.99 ◎	1.07 ◎
Post-op pulmonary embolism or deep vein thrombosis	0.84 ◎	0.93 ◎	0.81 ◎	0.95 ◎	1.00 ◎	1.09 ◎	0.97 ◎	1.34 ○	1.22 ○	1.03 ◎
Post-operative sepsis	0.32 ●	0.90 ◎	0.82 ◎	1.12 ◎	1.21 ○	1.02 ◎	0.94 ◎	2.66 ○	0.91 ◎	1.13 ○
Post-operative abdominal wound dehiscence	1.81 ○	0.95 ◎	1.37 ○	1.06 ◎	0.80 ●	1.39 ○	1.07 ◎	1.92 ○	1.18 ◎	0.90 ●

Continued....

● Best - Top 10 States    ◎ Average - Middle 31 States    ○ Worst - Bottom 10 States

Patient Safety Indicator	GA	HI	IA	ID	IL	IN	KS	KY	LA	MA
Overall Average	0.98 ◎	1.06 ○	0.79 ●	0.95 ◎	1.01 ◎	0.95 ◎	0.92 ●	1.05 ◎	0.98 ◎	0.92 ◎
Death in low mortality DRGs	1.16 ◎	0.86 ◎	0.97 ◎	1.69 ○	0.84 ◎	1.12 ◎	1.15 ◎	1.00 ◎	1.31 ○	0.81 ●
Decubitus ulcer	0.93 ◎	0.70 ●	0.45 ●	0.64 ●	1.12 ○	0.75 ◎	0.76 ◎	0.94 ◎	1.07 ○	0.79 ◎
Failure to rescue	1.06 ◎	1.50 ○	0.94 ◎	1.03 ◎	0.87 ●	0.92 ◎	1.01 ◎	1.02 ◎	1.03 ◎	0.78 ●
Iatrogenic pneumothorax	0.89 ●	1.21 ○	0.97 ◎	0.96 ◎	0.94 ◎	0.84 ●	1.11 ◎	0.94 ◎	0.80 ●	1.24 ○
Selected infections due to medical care	0.81 ◎	1.16 ○	0.63 ●	0.74 ●	1.08 ◎	0.79 ●	0.80 ◎	0.87 ◎	0.71 ●	1.22 ○
Post-operative hip fracture	1.15 ◎	1.33 ○	0.77 ◎	0.64 ●	0.99 ◎	0.95 ◎	0.87 ◎	1.21 ○	0.65 ●	0.90 ◎
Post-operative hemorrhage or hematoma	0.95 ◎	1.03 ◎	0.97 ◎	0.96 ◎	1.06 ◎	0.92 ●	0.95 ◎	0.96 ◎	1.08 ◎	1.02 ◎
Post-operative physiologic and metabolic derangements	0.86 ◎	0.81 ◎	0.66 ●	1.28 ○	1.00 ◎	1.29 ○	1.04 ◎	1.31 ○	1.30 ○	0.71 ◎
Post-operative respiratory failure	1.05 ◎	1.12 ○	0.96 ◎	0.68 ●	0.99 ◎	1.04 ◎	0.90 ◎	1.21 ○	1.03 ◎	0.86 ◎
Post-op pulmonary embolism or deep vein thrombosis	1.05 ◎	0.79 ●	0.59 ●	0.70 ●	1.25 ○	0.81 ◎	0.71 ●	0.87 ◎	0.96 ◎	0.91 ◎
Post-operative sepsis	1.00 ◎	1.26 ○	0.72 ●	1.00 ◎	1.03 ◎	1.02 ◎	0.69 ●	1.19 ○	0.87 ◎	0.76 ◎
Post-operative abdominal wound dehiscence	0.86 ●	0.89 ●	0.89 ●	1.07 ◎	0.97 ◎	0.92 ◎	1.01 ◎	1.14 ◎	0.95 ◎	1.01 ◎

Continued...

● Best - Top 10 States    ◎ Average - Middle 31 States    ○ Worst - Bottom 10 States

Patient Safety Indicator	MD	ME	MI	MN	MO	MS	MT	NC	ND	NE
Overall Average	1.03 ◎	0.98 ◎	0.99 ◎	0.83 ●	1.03 ◎	1.05 ◎	0.79 ●	0.99 ◎	0.89 ●	0.88 ●
Death in low mortality DRGs	0.95 ◎	0.80 ●	0.87 ◎	0.71 ●	1.07 ◎	1.66 ○	0.92 ◎	1.11 ◎	0.85 ◎	0.94 ◎
Decubitus ulcer	1.32 ○	0.79 ◎	0.98 ◎	0.58 ●	0.92 ◎	1.05 ◎	0.63 ●	0.96 ◎	0.49 ●	0.59 ●
Failure to rescue	0.88 ◎	1.04 ◎	0.86 ●	0.84 ●	1.08 ◎	1.33 ○	0.97 ◎	1.01 ◎	1.31 ○	0.97 ◎
Iatrogenic pneumothorax	0.95 ◎	1.45 ○	0.93 ◎	0.91 ●	1.04 ◎	0.85 ●	1.16 ◎	0.95 ◎	1.03 ◎	1.31 ○
Selected infections due to medical care	1.06 ◎	1.16 ○	0.99 ◎	0.89 ◎	0.98 ◎	0.74 ●	0.85 ◎	0.91 ◎	0.83 ◎	0.75 ●
Post-operative hip fracture	0.97 ◎	1.17 ○	1.04 ◎	0.69 ●	1.19 ○	0.72 ●	0.57 ●	1.09 ◎	0.32 ●	0.71 ●
Post-operative hemorrhage or hematoma	1.09 ◎	1.07 ◎	1.06 ◎	1.15 ○	1.02 ◎	0.82 ●	0.97 ◎	1.02 ◎	0.99 ◎	1.14 ○
Post-operative physiologic and metabolic derangements	0.73 ◎	0.64 ●	0.95 ◎	0.80 ◎	1.03 ◎	1.13 ◎	0.55 ●	0.92 ◎	1.20 ○	0.71 ●
Post-operative respiratory failure	0.94 ◎	0.79 ●	0.99 ◎	0.85 ◎	1.17 ○	1.06 ◎	0.73 ●	0.99 ◎	0.81 ◎	0.87 ◎
Post-op pulmonary embolism or deep vein thrombosis	1.11 ◎	0.85 ◎	1.11 ◎	0.84 ◎	0.98 ◎	0.98 ◎	0.66 ●	1.02 ◎	0.52 ●	0.83 ◎
Post-operative sepsis	1.54 ○	0.80 ◎	1.10 ◎	0.78 ◎	1.09 ◎	0.93 ◎	0.53 ●	0.95 ◎	0.76 ●	0.67 ●
Post-operative abdominal wound dehiscence	0.88 ●	1.17 ◎	1.02 ◎	0.95 ◎	0.86 ●	1.32 ○	0.91 ●	0.90 ●	1.56 ○	1.02 ◎

Continued...



● Best - Top 10 States    ◎ Average - Middle 31 States    ○ Worst - Bottom 10 States

Patient Safety Indicator	NH	NJ	NM	NV	NY	OH	OK	OR	PA	RI
Overall Average	1.02 ◎	1.10 ○	1.24 ○	1.29 ○	1.09 ○	0.94 ◎	0.97 ◎	0.91 ●	0.92 ◎	1.02 ◎
Death in low mortality DRGs	1.23 ○	1.12 ◎	0.94 ◎	1.18 ◎	1.10 ◎	0.91 ◎	1.27 ○	1.10 ◎	0.78 ●	0.83 ●
Decubitus ulcer	0.71 ●	1.22 ○	1.08 ○	1.19 ○	1.57 ○	0.78 ◎	0.84 ◎	0.75 ◎	0.89 ◎	0.97 ◎
Failure to rescue	0.96 ◎	1.11 ◎	1.19 ○	1.10 ◎	1.02 ◎	0.81 ●	1.15 ○	1.18 ○	0.88 ●	1.07 ◎
Iatrogenic pneumothorax	1.39 ○	0.87 ●	1.14 ◎	0.93 ●	1.02 ◎	0.94 ◎	1.07 ◎	1.23 ○	1.01 ◎	1.18 ◎
Selected infections due to medical care	1.26 ○	1.53 ○	0.98 ◎	1.37 ○	1.14 ◎	0.93 ◎	0.65 ●	0.72 ●	0.96 ◎	1.51 ○
Post-operative hip fracture	1.11 ◎	0.97 ◎	1.27 ○	1.77 ○	1.11 ◎	1.00 ◎	0.99 ◎	0.77 ◎	0.86 ◎	0.81 ◎
Post-operative hemorrhage or hematoma	1.09 ◎	0.90 ●	1.27 ○	1.17 ○	0.95 ◎	1.01 ◎	1.00 ◎	1.04 ◎	0.94 ◎	0.88 ●
Post-operative physiologic and metabolic derangements	0.99 ◎	0.93 ◎	1.25 ○	1.85 ○	0.97 ◎	0.88 ◎	1.13 ◎	0.63 ●	0.77 ◎	1.02 ◎
Post-operative respiratory failure	0.89 ◎	1.01 ◎	1.35 ○	1.28 ○	0.99 ◎	1.02 ◎	0.92 ◎	0.76 ●	0.98 ◎	0.88 ◎
Post-op pulmonary embolism or deep vein thrombosis	0.88 ◎	1.40 ○	1.61 ○	1.29 ○	1.11 ○	1.16 ○	0.71 ●	0.86 ◎	1.12 ○	1.04 ◎
Post-operative sepsis	0.76 ◎	1.11 ◎	1.27 ○	1.13 ○	1.16 ○	0.79 ◎	0.92 ◎	0.91 ◎	0.80 ◎	0.75 ●
Post-operative abdominal wound dehiscence	0.98 ◎	1.06 ◎	1.56 ○	1.23 ◎	0.98 ◎	1.09 ◎	0.99 ◎	0.98 ◎	1.09 ◎	1.34 ○

Continued...

● Best - Top 10 States

◎ Average - Middle 31 States

○ Worst - Bottom 10 States

Patient Safety Indicator	SC	SD	TN	TX	UT	VA	VT	WA	WI	WV	WY
Overall Average	0.98 ◎	0.82 ●	0.99 ◎	1.02 ◎	0.96 ◎	1.06 ○	1.00 ◎	0.89 ●	0.87 ●	1.07 ○	0.92 ◎
Death in low mortality DRGs	1.17 ◎	1.31 ○	1.06 ◎	1.03 ◎	1.35 ○	1.20 ◎	1.41 ○	0.98 ◎	0.90 ◎	1.10 ◎	1.25 ○
Decubitus ulcer	0.93 ◎	0.49 ●	0.96 ◎	0.98 ◎	0.74 ◎	1.00 ◎	0.64 ●	0.82 ◎	0.78 ◎	0.90 ◎	0.85 ◎
Failure to rescue	1.14 ○	0.88 ◎	1.09 ◎	1.05 ◎	0.75 ●	1.03 ◎	1.02 ◎	1.04 ◎	0.88 ●	1.09 ◎	1.26 ○
Iatrogenic pneumothorax	1.00 ◎	0.69 ●	0.95 ◎	1.03 ◎	0.97 ◎	0.92 ●	1.23 ○	1.02 ◎	1.04 ◎	1.10 ◎	1.38 ○
Selected infections due to medical care	0.92 ◎	0.53 ●	0.88 ◎	0.93 ◎	0.75 ●	0.96 ◎	1.04 ◎	0.85 ◎	0.93 ◎	0.98 ◎	0.90 ◎
Post-operative hip fracture	1.05 ◎	1.07 ◎	1.17 ○	1.09 ◎	1.06 ◎	1.05 ◎	1.14 ◎	0.69 ●	0.74 ●	1.37 ○	0.32 ●
Post-operative hemorrhage or hematoma	0.85 ●	0.72 ●	0.83 ●	0.96 ◎	1.29 ○	1.00 ◎	0.91 ●	1.11 ◎	1.17 ○	0.97 ◎	0.82 ●
Post-operative physiologic and metabolic derangements	0.85 ◎	0.86 ◎	0.90 ◎	1.19 ○	0.70 ●	1.35 ○	1.38 ○	0.70 ●	0.95 ◎	0.98 ◎	0.60 ●
Post-operative respiratory failure	1.01 ◎	0.68 ●	1.14 ○	1.08 ◎	0.71 ●	1.04 ◎	0.82 ◎	0.79 ●	0.67 ●	1.29 ○	0.67 ●
Post-op pulmonary embolism or deep vein thrombosis	0.90 ◎	0.76 ●	0.87 ◎	0.92 ◎	1.05 ◎	1.16 ○	0.82 ◎	0.80 ◎	0.73 ●	0.87 ◎	0.65 ●
Post-operative sepsis	0.94 ◎	0.58 ●	1.04 ◎	1.03 ◎	1.13 ○	1.03 ◎	0.87 ◎	0.90 ◎	0.72 ●	1.07 ◎	0.57 ●
Post-operative abdominal wound dehiscence	0.99 ◎	1.25 ○	1.04 ◎	0.98 ◎	1.07 ◎	0.95 ◎	0.76 ●	1.03 ◎	0.99 ◎	1.13 ◎	1.82 ○

## Appendix G: HealthGrades Patient Safety Methodology 2010

To help consumers evaluate and compare hospital patient safety performance, HealthGrades analyzed patient data for virtually every hospital in the country to determine patient safety outcomes.

HealthGrades used Medicare inpatient data from the Medicare Provider Analysis Review (MedPAR) data file (purchased from the Centers for Medicare and Medicaid Services; 2006 through 2008 data) and Patient Safety Indicator software (QI Windows Software, version 3.2) from the Agency for Healthcare Research and Quality (AHRQ) to analyze the following 12 patient safety indicators.

Patient Safety Indicator	Translated as...
Death in low mortality Diagnostic Related Groupings (DRGs)	Prevention of death in procedures where mortality is usually very low
Decubitus ulcer	Lack of pressure sores or bed sores acquired in the hospital
Failure to rescue (known as, "Death among surgical inpatients with serious treatable complications")	Ability to diagnose and treat in time
Iatrogenic pneumothorax	Avoidance of collapsed lung due to a procedure or surgery in or around the chest
Selected infections due to medical care	Lack of infections acquired at the hospital
Post-operative hip fracture	Absence of hip fracture after surgery
Post-operative hemorrhage or hematoma	Avoidance of excessive bruising or bleeding as a consequence of a procedure or surgery
Post-operative physiologic and metabolic derangements	Adequate organ function and electrolyte and fluid imbalance after surgery
Post-operative respiratory failure	Avoidance of respiratory failure following surgery
Post-operative pulmonary embolism or deep vein thrombosis	Lack of deep blood clots in the lungs or legs after surgery
Post-operative sepsis	Avoidance of severe infection following surgery
Post-operative abdominal wound dehiscence	Lack of surgical wound site breakdown

For most indicators, the AHRQ software uses advanced statistical algorithms that can predict the number of patient safety incidences that are likely to occur at a hospital based on the types of patients treated at that hospital. For indicators that the AHRQ software does not provide predicted results, predicted results were generated by grouping the patient populations according to risk, and assigning average group values to patients in each group. This information is used, in part, to determine a HealthGrades individual patient safety rating for each patient safety indicator and an overall patient safety score for a hospital.

## Data Acquisition

HealthGrades uses Medicare inpatient data from the Medicare Provider Analysis and Review (MedPAR) database purchased from the Centers for Medicare and Medicaid Services (CMS) for several reasons.

- The MedPAR data file includes virtually every hospital in the country, with the exception of military and Veterans Administration hospitals.
- Hospitals are required by law to submit complete and accurate information with substantial penalties for those that report inaccurate or incomplete data.
- The Medicare population represents a majority of adult inpatient admissions.

HealthGrades evaluated all short-term acute care hospitals in the MedPAR file for three years (2006 through 2008) following all AHRQ guidelines for using their patient safety indicator software. Specifically, HealthGrades used the QI Windows Software, version 3.2, developed by the AHRQ and downloaded from <http://www.qualityindicators.ahrq.gov/software.htm>.

## Data Exclusions

“Foreign body left in during a procedure” was not utilized as one of the indicators. This patient safety indicator requires a “present on admission indicator,” which was left blank or not coded accurately for a majority of patients in the fiscal year 2008 data when the indicator first became available.

Given that the MedPAR data set applies mostly to patients over the age of 65, HealthGrades excluded the following patient safety indicators from the analysis:

- Birth trauma – injury to neonate
- Obstetric trauma – cesarean delivery
- Obstetric trauma – vaginal delivery with instrument
- Obstetric trauma – vaginal delivery without instrument

Due to coding variation in the use of E codes, HealthGrades excluded three additional indicators:

- Complications of anesthesia
- Accidental puncture or laceration
- Transfusion reaction

Additionally, HealthGrades modified the “Failure to rescue” patient group by excluding cancer patients—patients having any ICD-9 code between 140.0 and 208.9 or between 230.0 and 239.9. (AHRQ now refers to “Failure to rescue,” as “Death among surgical inpatients with serious treatable complications.”) HealthGrades also removed hospitals in the U.S. territories and Puerto Rico from the data set.

### Determining Individual Patient Safety Indicator Scores and Rating

To determine a patient safety indicator score for each of the 12 patient safety indicators for each hospital, HealthGrades statistically compared the **actual** rate of individual patient safety events to the **predicted** rate. HealthGrades then indicates whether the patient safety rating is Best, Average, or Poor. Ratings are available at [www.healthgrades.com](http://www.healthgrades.com).

- Best – Fewer patients were affected than expected.
- Average – About the same number of patients were affected as expected.
- Poor – More patients were affected than expected.

When a hospital is not rated, it means the hospital had **too few cases** to be eligible to receive a patient safety rating.

### Determining the Overall Patient Safety Score

To be eligible for an overall patient safety score, a hospital must have had outcomes in nine of the 12 patient safety indicators. Hospitals with eight or fewer patient safety ratings were not eligible to receive an overall patient safety score, but may have individual patient safety indicator ratings.

To determine the overall patient safety score by hospital, HealthGrades statistically compares the **actual** rate to the **predicted** rate for each individual patient safety indicator to produce a score for each patient safety indicator. The overall patient safety score was then calculated as the average of the 12 individual patient safety scores, and the overall patient safety score is used to determine the hospital's ranking.

1. HealthGrades uses the AHRQ software to calculate observed and expected rates for each hospital and each patient safety indicator, provided that the patient safety indicator had at least one case. (HealthGrades used a stratification process to calculate expected rates for those patient safety indicators where AHRQ software only provided observed rates.)
2. Since HealthGrades identified significant bias in the expected rates for larger hospitals (which had consistently higher observed rates than expected), HealthGrades performed further risk adjustment using the Medicare Case Mix Index (CMI). The case mix index adjustment compensates for the fact that within a given DRG the most severely ill will probably be clustered at larger hospitals. CMI is a hospital-level indicator of the seriousness of the cases seen at a hospital—higher CMI values indicate more seriously ill patients are seen at the hospital.

To perform the case mix index adjustment and remove the bias, HealthGrades stratified hospitals into one of eight categories according to their case mix index and then adjusted the expected values so that the sum of the expected equaled the sum of the observed for each patient safety indicator for each combination of CMI group and year.

CMI Index	CMI Group
0.00 < CMI < 1.25	1
1.25 < CMI < 1.35	2
1.35 < CMI < 1.45	3
1.45 < CMI < 1.55	4
1.55 < CMI < 1.65	5
1.65 < CMI < 1.75	6
1.75 < CMI < 1.90	7
CMI > 1.90	8

- HealthGrades statistically compared the observed rate to the expected rate to produce a z-score for each patient safety indicator. To normalize the effect of the 12 indicators, these z-scores were rescaled to a mean of zero and standard deviation of one. The Overall Patient Safety Score was then calculated as the average of the 12 resulting scores, and this score is used to determine a hospital's ranking.



### Designating 2010 Patient Safety Excellence Award Recipients

To be considered for a Patient Safety Excellence Award™, hospitals had to be rated in at least 16 of 26 HealthGrades cohorts and have a current overall HealthGrades star rating of at least 2.5. The final data set of hospitals that met these qualifications included 740 teaching hospitals and 848 non-teaching hospitals. Hospitals in each group were then ranked based on their **overall patient safety score** (as explained above).

To identify the teaching peer group, HealthGrades used data from the Medicare Cost Reports (Form CMS-2552-96). A facility was considered a teaching hospital if they answered "yes" to the question: "Does the hospital have a teaching program approved in accordance with CMS publication 15-1, Chapter 4?" As a further confirmation, the hospital was required to report either Indirect Medical Education (IME) payments or FTEs for residents on the Cost Report. When the Cost Report data were unavailable or contradictory, IME from the MedPAR file and the COTH (Council of Teaching Hospitals) list were used to determine status.

HealthGrades then identified both teaching and non-teaching hospitals in the top 15% as "best performing" and these hospitals were selected to be HealthGrades Patient Safety Excellence Award recipients. These 238 hospitals represent less than 5% of the total hospitals evaluated.

Hospital Type	Number of Best Performing Providers
Teaching Hospitals	111
Non-teaching Hospitals	127

The Patient Safety Excellence Award recipients were categorized according to their 2008 case mix index as follows.

Case Mix Index	Case Mix Index Group	# of Award Recipients
0.00 < CMI < 1.25	1	5
1.25 < CMI < 1.35	2	18
1.35 < CMI < 1.45	3	35
1.45 < CMI < 1.55	4	29
1.55 < CMI < 1.65	5	46
1.65 < CMI < 1.75	6	43
1.75 < CMI < 1.90	7	43
CMI > 1.90	8	19

#### 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. Therefore, 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 HealthGrades has taken steps to carefully compile these data, no techniques are infallible; therefore, some information may be missing, outdated or incorrect.

Please note that if more than one hospital reported to CMS under a single provider ID, HealthGrades analyzed patient safety 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.