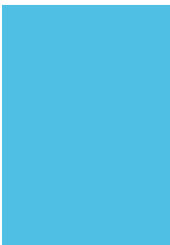# The Fifth Annual HealthGrades Patient Safety in American Hospitals Study

April 2008

HEALTHGRADES®

Fifth Annual
Patient Safety in American Hospitals Study

For this report, HealthGrades identifies the patient safety incident rates for nearly every hospital in the country using the Agency for Healthcare Research and Quality (AHRQ) Patient Safety Indicator methodology[1] to analyze three years of Medicare data (2004-2006). In addition to this analysis, HealthGrades creates a composite score of the results of the patient safety indicators and identifies the best-performing hospitals to establish a best-practice benchmark against which other hospitals can be evaluated. See Appendix A for list of the best-performing hospitals. This study also identifies trends in important patient safety issues among the nation's hospitals. Specific results for each of the nation's non-federal hospitals can be found at www.healthgrades.com.

Introduction

For the fifth consecutive year, HealthGrades has analyzed patient safety among Medicare patients in all U.S. hospitals. It's clear that improvement requires measurement. During the last five years, much attention has been paid to research and development of improvement strategies and patient safety measurements, and important progress has been made. For example, we have witnessed the promulgation of "never events" and "safe practices," and increased transparency and accountability when errors do occur. Also, more hospitals than ever are pledging to report their performance on safe practices and have agreed not to bill for preventable medical errors. New benchmarks in safety are being created and healthcare professionals are witnessing that zero defects are in fact possible[2].

Progress is being seen. We now have convincing case studies that perfection is possible when the will to change and improve is present and the effort is made to implement new practices. While these examples illustrate that we have a much clearer idea of what we need to do, formidable barriers remain. Many in the industry continue to deny that truly safe care is achievable, thus the status quo continues, resulting in variation in patient safety in U.S. hospitals that is large and unpredictable. Numerous studies, including the 2007 AHRQ National Healthcare Quality Report (NHQR) assessing the state of hospital quality and patient safety, conclude and support the findings that the progress remains modest and variation in healthcare quality remains high.[3]

Meanwhile, consumers have become more involved and sophisticated in their healthcare decisions and management. More and more people are using the Web to obtain medical and quality information, particularly as more of the direct cost of healthcare is being shifted to the consumer. As a result, the need for additional transparency and public accountability regarding patient safety is increasing. With death due to preventable medical errors being a leading cause of death[4], it is imperative that the development and dissemination of highly visible consumer guides and public performance reporting be a priority for the industry.

For a fifth year, HealthGrades has researched and publicly reported information on hospital patient safety. HealthGrades used AHRQ's patient safety indicators[1] to identify the patient safety incident rates for every non-federal hospital in the country using three years of Medicare data (2004–2006). In addition to identifying the rates of patient safety incidents, HealthGrades created a composite score to identify the best-performing hospitals in the U.S. during 2004 to 2006. These hospitals were named the 2008 HealthGrades Distinguished Hospitals for Patient Safety™.

Summary of Findings

The Agency for Healthcare Research and Quality (AHRQ) developed the patient safety indicators (PSIs) based on the Institute of Medicine's (IOM) definition of patient safety—"**freedom from accidental injury due to medical care, or medical errors**."[4] 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."[5]

In 2002, AHRQ, in collaboration with the University of California–Stanford Evidence-Based Practice Center, identified 20 indicators of potentially preventable patient safety incidents that could be readily identified in hospital discharge data. This tool set of 20 evidence-based PSIs was created and released to the public in 2003 to be used by various healthcare stakeholders to assess and improve patient safety in U.S. hospitals.[1]

For this study, HealthGrades used the Patient Safety Indicator QI Windows Software, version 3.1c, developed by the AHRQ.[1] In addition to the PSI software application, HealthGrades used previous research by Zhan and Miller[6], to study the attributable mortality and cost associated with the development of each of 16 PSIs (out of a total 20 patient safety indicators, excluding four PSIs related to obstetrics) among Medicare beneficiaries in the U.S. from 2004 through 2006. The 16 PSIs we studied are listed in *Appendix B*. In addition, using the rates calculated for 13 of the 16 PSIs studied (three are for regional use only, and thus, excluded from the comparative hospital analysis), we also calculated an overall patient safety composite score for each hospital to identify the best-performing hospitals in the U.S. during 2004 through 2006 (see *Appendices A* and *C*). These best-performing hospitals were designated as the 2008 HealthGrades Distinguished Hospitals for Patient Safety™.

In our study, we found:

- Approximately 1.12 million total patient safety incidents occurred in almost 41 million hospitalizations in the Medicare population, an almost three-percent incident rate. This rate is relatively unchanged from previous studies. These incidents were associated with almost $8.8 billion of excess cost during 2004 through 2006.

- Improvements were seen across the majority of patient safety indicators and all-cause mortality in patients who developed one or more patient safety incidents.
  - All-cause mortality rate among Medicare beneficiaries that developed one or more patient safety incidents decreased almost five percent from 2004 through 2006 (27.62% to 25.99%)
  - However, four post-operative indicators (post-operative respiratory failure, post-operative pulmonary embolism or deep vein thrombosis, post-operative sepsis, and post-operative abdominal wound dehiscence) showed worsening with increased incidence rates when compared to 2004. This worsening was also associated with higher attributable mortality rates and accounted for approximately 72 percent of all the potentially preventable deaths (excluding deaths attributable to failure to rescue and death in low mortality DRGs).

- The PSIs with the highest incidence rates were decubitus ulcer, failure to rescue, and post-operative respiratory failure and accounted for the majority of incidents (63.41%). Failure to rescue improved 11.11 percent during the study period, while both decubitus ulcer and post-operative respiratory failure worsened during the study period.

- There were 270,491 actual inhospital deaths that occurred among patients who developed one or more of the 16 patient safety incidents (*Appendix D*). Using previous research, we calculated that 238,337 were attributable to patient safety incidents and potentially preventable (*Appendix E*).

  - Medicare patients who experienced a patient safety incident had approximately a one-in-five chance of dying as a result of the incident during 2004 to 2006.

- There were wide, highly significant gaps in individual PSIs and overall performance between the Distinguished Hospitals for Patient Safety™ and the bottom ranked hospitals.

  - Medicare patients in the Distinguished Hospitals for Patient Safety™ had, on average, a 43-percent lower risk of occurrence of developing one or more PSIs compared to patients at the bottom ranked hospitals (range: 18.50% to 56.35%). This better performance was significant and consistent across all 13 PSIs studied.

- If all hospitals performed at the level of Distinguished Hospitals for Patient Safety™, approximately 220,106 patient safety incidents and 37,214 Medicare deaths could have been avoided while saving the U.S. approximately $2.0 billion during 2004 to 2006.

Methodology

We used the Patient Safety Indicator QI Windows Software, version 3.1c, developed by the AHRQ[1] to calculate the national rates for 16 of the 20 patient safety indicators (four of the obstetrics indicators were not used). In order to evaluate *overall* hospital performance and to identify the best-performing hospitals for patient safety across the U.S., we used the same software to evaluate every hospital in the country on 13 PSIs. To minimize the potential impact of variations in hospital coding of specific E codes when assessing overall hospital performance, we excluded three PSIs (complications of anesthesia, accidental puncture or laceration, and transfusion reaction) that included these specific E codes in their numerator definition.

We then developed a ranking methodology to evaluate overall patient safety performance for each hospital. Eligible hospitals' relative performances were determined by calculating the z-score for each patient safety indicator, rescaling the z-scores to mean zero and standard deviation of one, and then averaging the 13 rescaled z-scores. These averaged z-scores by hospital were then rank ordered within their respective peer group (teaching and non-teaching) from most positive (best) to most negative (worst). The top 15 percent of ranked hospitals were identified as Distinguished Hospitals for Patient Safety™. (See *Appendix C* for complete details.)

Mortality and cost attributable to patient safety incidents were extrapolated using attributable charge and mortality associated with the development of a PSI from previous PSI research by Zhan and Miller.[6]

Findings

The Burden of Patient Safety Incidents

Using the Patient Safety Indicator QI Windows Software, version 3.1c, developed by AHRQ,[1] HealthGrades identified a total of 1,123,497 patient safety incidents (PSIs) that occurred in 40,683,396 hospitalizations in the Medicare population from 2004 through 2006 (see *Appendix D*). This results in an incident rate of 2.76 percent across all Medicare inpatient hospitalizations from 2004 through 2006. These patient safety incidents were associated with 270,491 inhospital deaths (all-cause mortality). Using previous research by Zhan and Miller[6], we identified that 88.11 percent (238,337) of the mortalities were potentially attributable to a patient safety incident, and thus potentially preventable (see *Appendices D* and *E*).

The **PSIs with the highest incidence rates** were decubitus ulcer, failure to rescue, and post-operative respiratory failure. Failure to rescue improved 11.11 percent during the study period, while both decubitus ulcer and post-operative respiratory failure modestly worsened by 2.21 and 0.49 percent, respectively (see *Appendix D*) from 2004 through 2006.

Common Patient Safety Incidents are Very Costly

The most commonly occurring PSIs are noted in *Table 1* below. These three PSIs accounted for 63.41 percent of all patient safety incidents from 2004 through 2006. Failure to rescue rates improved 11.11 percent during the study period. However, post-operative respiratory failure and decubitus ulcer worsened by 0.49 and 2.21 percent respectively in 2006 as compared to 2004. For the incidence rates and associated rate change of all 16 PSIs, see *Appendix D*. For the excess mortality and costs attributable to each PSI, see *Appendix E.*

Table 1: Most Commonly Occurring Patient Safety Incidents per 1,000 At-risk Hospitalizations

Patient Safety Indicator	Incident Rate per 1,000 At-risk Hospitalizations	Attributable Cost
Failure to rescue	128	NA*
Decubitus ulcer	31	$2.47B
Post-operative respiratory failure	17	$1.84B

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

Some of the most common patient safety incidents were also the most costly. Decubitus ulcer and post-operative respiratory failure accounted for 49.10 percent of all excess attributable cost from 2004 through 2006. We identified that a total of $8.78 billion of excess cost was attributable to the 16 patient safety incidents studied during 2004 through 2006 (see *Appendix E*).

Most Patient Safety Incidents Improved

More than half (10 of 16) of the rates associated with the patient safety indicators (PSI) studied improved from 2004 through 2006. These ten indicators improved, on average, 10.77 percent (range: 1.42% to 23.25%). Death in low mortality DRGs, post-operative hip fracture, and failure to rescue were associated with the greatest improvements in 2006 compared to 2004, excluding the relative improvement associated with the very rare occurrence of transfusion reaction (see *Appendix D*).

However, four post-operative indicators (post-operative respiratory failure, post-operative pulmonary embolism or deep vein thrombosis, post-operative sepsis, and post-operative abdominal wound dehiscence) showed worsening with increased incidence rates when compared to 2004. (*Appendix D*). This worsening was also associated with higher attributable mortality rates and accounted for approximately 72 percent of all the potentially preventable deaths (excluding deaths attributable to failure to rescue and death in low mortality DRGs) (*Appendix E*).

The Highest Risk Incidents Worsened

The PSIs with the greatest attributable mortality rates[6] (see post-operative sepsis and post-operative respiratory failure in *Appendix E*) showed an average worsening of 8.11 percent (15.74%, 0.49%) from 2004 through 2006.

Approximately One in Five Medicare Patients with Patient Safety Incidents Die

There were 270,491 actual inhospital deaths that occurred among patients who developed one or more of the 16 patient safety incidents (*Appendix D*). All-cause mortality rate among Medicare beneficiaries that developed one or more patient safety incidents decreased almost five percent from 2004 through 2006 (27.62% to 25.99%) (see *Appendix D*). Although mortality attributable to medical errors and injury is relatively rare, and overall patient safety incidents and mortality rates among Medicare beneficiaries have been declining steadily, we determined (using previous work by Zhan and Miller[6]) that the 16 PSIs studied potentially resulted in 238,337 deaths from 2004 through 2006. This translated to a 21.21 percent potentially preventable mortality rate among hospitalized Medicare patients with at least one patient safety incident during 2004 through 2006 (see *Appendix E*).

Large Safety Gaps Identified Between Top and Bottom Performing Hospitals

This study also identified the best-performing hospitals to establish a best-practice benchmark against which other hospitals could be evaluated. Best-performing hospitals were identified as the top 15 percent of ranked hospitals based on overall hospital performance and were identified as Distinguished Hospitals for Patient Safety™. To be ranked on overall patient safety performance assessment, hospitals had to be rated in at least 17 of 27 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. The final ranking set included 767 teaching hospitals and 891 non-teaching hospitals. The top 15 percent, or 249 hospitals, were identified as Distinguished Hospitals for Patient Safety™. These Distinguished Hospitals represent less than five percent of all U.S. hospitals examined in this study (see *Appendices A* and *C*).

We found that there were wide, highly significant gaps in individual PSI and overall performance between the Distinguished Hospitals for Patient Safety™ and the bottom ranked hospitals. More specifically, we found that Distinguished Hospitals, as a group, significantly outperformed the bottom 15 percent hospitals on every PSI. We also found that Distinguished Hospitals, as a group, had an overall patient safety performance equating to, on average, a 42.77 percent lower risk of occurrence of developing one or more patient safety incidents compared to the bottom 15 percent hospitals (see *Appendix F*). This finding of better performance was consistent across all 13 PSIs studied (range: 18.50% to 56.35% relative risk decrease) (see *Appendix F*).

Distinguished Hospitals for Patient Safety™ Associated with Significantly Fewer Safety Incidents, Associated Deaths and Cost

If all hospitals performed at the level of Distinguished Hospitals for Patient Safety™, approximately 220,106 patient safety incidents and 37,214 Medicare deaths could have been avoided while saving the U.S. approximately $2.0 billion from 2004 through 2006 (see *Appendix F*).

Interpretation of Results

This is our fifth study evaluating the potentially avoidable patient safety incidents and associated mortality and cost using AHRQ's PSIs[1] on all Medicare patients admitted to U.S. hospitals from 2004 through 2006. This study identified that the patient safety incident rate is approximately three percent and while the total number of patient safety incidents has decreased since 2004, these incidents are associated with a significant chance of dying.

The Institute for Healthcare Improvement estimates that there are 15 million preventable injuries per year.[7] Based on this estimate, it's clear that our research findings using AHRQ patient safety indicators reflect just the tip of the patient safety iceberg. While our study findings are encouraging and hospitals have more tested and proven safe practices than ever, there is still much work to do. Boards need to set clear expectations and goals for reducing harm to patients and to monitor progress against those goals. CEOs of hospitals and healthcare systems need to be vigorous and consistent in their leadership to inspire meaningful change. They must be visibly and credibly committed to safety and provide the resources to achieve results. Most importantly, meaningful change requires determination and will. Use of checklists, protocols, and other reminders, while a basic requirement of a safe system, cannot replace determination and will. This determination and will cannot be sustained without inspiring and committed leadership.

While there is much work left to be done, our findings also support that substantial progress continues to be made at the top. Distinguished Hospitals for Patient Safety™ continue to lead the nation in avoiding potentially preventable safety incidents, by approximately 43 percent more, and resulting in much lower costs to society. If 249 hospitals can achieve, on average, 43 percent less patient harm, then we believe that all hospitals can achieve similar results. The implication of this is large. Our research found that over 220,000 incidents and over 37,000 deaths among hospitalized Medicare patients during 2004 through 2006 could have potentially been prevented if all hospitals performed at the Distinguished Hospital performance benchmark.

Using characteristics of safe cultures, it is likely then that Distinguished Hospitals believe that safety is a daily priority requiring vigilance, and that safety is the property and ownership of the entire hospital, more so than of any individuals. We also believe that Distinguished Hospitals truly know that safe care is possible, and driven by this will and moral clarity are able to find success where others find many formidable barriers. They are continuously inspired by their pursuit of perfection and know that their answer to the question, "Are we any safer?" is a resounding "Yes."

Appendix A:
List of Best-Performing Hospitals for Overall Patient Safety

The following is a list of hospitals that are recipients of this year's HealthGrades Distinguished Hospital Award for Patient Safety™* in 2008. Some of the recipients of the Distinguished Hospital Award for Patient Safety™ have multiple locations that report under the same Medicare Provider ID. 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.

2008 Distinguished Hospital for Patient Safety™*	City	State	Status
Flowers Hospital	Dothan	AL	Non-teaching
Mobile Infirmary	Mobile	AL	Teaching
Southeast Alabama Medical Center	Dothan	AL	Non-teaching
St. Mary's Rogers Memorial Hospital	Rogers	AR	Non-teaching
St. Vincent Infirmary Medical Center	Little Rock	AR	Teaching
Mayo Clinic Hospital	Phoenix	AZ	Teaching
Yavapai Regional Medical Center	Prescott	AZ	Non-teaching
Yuma Regional Medical Center	Yuma	AZ	Non-teaching
Community Hospital of the Monterey Peninsula	Monterey	CA	Non-teaching
Eisenhower Medical Center	Rancho Mirage	CA	Non-teaching
French Hospital Medical Center	San Luis Obispo	CA	Non-teaching
Glendale Memorial Hospital & Health Center	Glendale	CA	Non-teaching
Hoag Memorial Hospital Presbyterian	Newport Beach	CA	Non-teaching
Mercy General Hospital	Sacramento	CA	Teaching
Oroville Hospital	Oroville	CA	Non-teaching
Queen of the Valley	Napa	CA	Non-teaching
Santa Barbara Cottage Hospital	Santa Barbara	CA	Teaching
Sharp Memorial Hospital	San Diego	CA	Non-teaching
St. Elizabeth Community Hospital	Red Bluff	CA	Non-teaching
Poudre Valley Hospital	Fort Collins	CO	Teaching
Danbury Hospital	Danbury	CT	Teaching
Hospital of St. Raphael	New Haven	CT	Teaching
Middlesex Hospital	Middletown	CT	Teaching
Bay Medical Center	Panama City	FL	Non-teaching
Blake Medical Center	Bradenton	FL	Non-teaching
Boca Raton Community Hospital	Boca Raton	FL	Non-teaching

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2008 Distinguished Hospital for Patient Safety™*	City	State	Status
Flagler Hospital	St. Augustine	FL	Non-teaching
Florida Hospital	Orlando	FL	Teaching
Gulf Breeze Hospital	Gulf Breeze	FL	Non-teaching
Holmes Regional Medical Center	Melbourne	FL	Non-teaching
Holy Cross Hospital	Fort Lauderdale	FL	Non-teaching
J.F.K. Medical Center	Atlantis	FL	Teaching
Lawnwood Regional Medical Center & Heart Inst	Fort Pierce	FL	Non-teaching
Leesburg Regional Medical Center	Leesburg	FL	Non-teaching
Manatee Memorial Hospital	Bradenton	FL	Non-teaching
Mercy Hospital	Miami	FL	Teaching
Morton Plant Hospital	Clearwater	FL	Teaching
Munroe Regional Medical Center	Ocala	FL	Non-teaching
NCH Healthcare System	Naples	FL	Non-teaching
Ocala Regional Medical Center/West Marion Hospital	Ocala	FL	Non-teaching
Palm Beach Gardens Medical Center	Palm Beach Gardens	FL	Non-teaching
Raulerson Hospital	Okeechobee	FL	Non-teaching
Sarasota Memorial Hospital	Sarasota	FL	Non-teaching
St. Luke's Hospital	Jacksonville	FL	Teaching
Venice Regional Medical Center	Venice	FL	Non-teaching
Wuesthoff Medical Center–Rockledge	Rockledge	FL	Non-teaching
Athens Regional Medical Center	Athens	GA	Non-teaching
Fairview Park Hospital	Dublin	GA	Non-teaching
Houston Medical Center	Warner Robin	GA	Non-teaching
Memorial Health University Medical Center	Savannah	GA	Teaching
Northeast Georgia Medical Center	Gainesville	GA	Non-teaching
including NE Georgia Medical Ctr.–Lanier Park Campus	Gainesville	GA	Non-teaching
Piedmont Fayette Hospital	Fayetteville	GA	Non-teaching
Saint Joseph's Hospital of Atlanta	Atlanta	GA	Non-teaching
Great River Medical Center	West Burlington	IA	Non-teaching
Iowa Methodist Medical Center	Des Moines	IA	Teaching
Mary Greeley Medical Center	Ames	IA	Non-teaching
Mercy Medical Center–Clinton	Clinton	IA	Non-teaching

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2008 Distinguished Hospital for Patient Safety™*	City	State	Status
Mercy Medical Center–Dubuque	Dubuque	IA	Non-teaching
Mercy Medical Center–North Iowa	Mason City	IA	Teaching
Trinity Medical Center–Terrace Park Campus	Bettendorf	IA	Teaching
St. Joseph Regional Medical Center	Lewiston	ID	Non-teaching
St. Luke's Regional Medical Center	Boise	ID	Teaching
Blessing Hospital	Quincy	IL	Teaching
including St. Mary Hospital Inc.	Quincy	IL	Teaching
Central DuPage Hospital	Winfield	IL	Non-teaching
Elmhurst Memorial Hospital	Elmhurst	IL	Non-teaching
Morris Hospital & Healthcare Center	Morris	IL	Non-teaching
Palos Community Hospital	Palos Heights	IL	Non-teaching
Provena Covenant Medical Center	Urbana	IL	Teaching
Provena St. Mary's Hospital	Kankakee	IL	Teaching
Riverside Medical Center	Kankakee	IL	Non-teaching
Rockford Memorial Hospital	Rockford	IL	Non-teaching
Saint Anthony's Health Center	Alton	IL	Non-teaching
including St. Joseph's Hospital	Alton	IL	Non-teaching
Saint Joseph Hospital	Chicago	IL	Teaching
St. Anthony's Memorial Hospital	Effingham	IL	Non-teaching
Trinity Medical Center–West Campus	Rock Island	IL	Teaching
including Trinity Medical Center–7th Street Campus	Moline	IL	Teaching
Community Hospital	Munster	IN	Non-teaching
Deaconess Hospital	Evansville	IN	Teaching
Elkhart General Hospital	Elkhart	IN	Non-teaching
King's Daughters' Hospital & Health Services	Madison	IN	Non-teaching
Memorial Hospital of South Bend	South Bend	IN	Teaching
Parkview Hospital	Fort Wayne	IN	Teaching
St. Catherine Hospital	East Chicago	IN	Non-teaching
St. Mary Medical Center	Hobart	IN	Teaching
Hays Medical Center	Hays	KS	Non-teaching
Via Christi Regional Medical Center	Wichita	KS	Teaching
including St. Joseph Medical Center	Wichita	KS	Teaching

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Wesley Medical Center	Wichita	KS	Teaching
ARH Regional Medical Center–Hazard	Hazard	KY	Teaching
Baptist Hospital East	Louisville	KY	Non-teaching
Frankfort Regional Medical Center	Frankfort	KY	Non-teaching
Hardin Memorial Hospital	Elizabethtown	KY	Non-teaching
Western Baptist Hospital	Paducah	KY	Non-teaching
CHRISTUS Schumpert Health System	Shreveport	LA	Teaching
CHRISTUS St. Patrick Hospital	Lake Charles	LA	Non-teaching
Glenwood Regional Medical Center	West Monroe	LA	Non-teaching
Slidell Memorial Hospital	Slidell	LA	Teaching
Terrebonne General Hospital	Houma	LA	Non-teaching
Willis Knighton Bossier Health Center	Bossier City	LA	Non-teaching
Willis Knighton Medical Center	Shreveport	LA	Teaching
Brigham & Women's Hospital	Boston	MA	Teaching
Falmouth Hospital	Falmouth	MA	Non-teaching
North Shore Medical Center–Salem Hospital	Salem	MA	Teaching
including North Shore Medical Ctr.–Union Hospital	Lynn	MA	Teaching
Saint Agnes Hospital	Baltimore	MD	Teaching
Saint Joseph Medical Center	Towson	MD	Teaching
Washington County Hospital	Hagerstown	MD	Non-teaching
Alpena Regional Medical Center	Alpena	MI	Non-teaching
Genesys Regional Medical Center	Grand Blanc	MI	Teaching
Hackley Hospital	Muskegon	MI	Non-teaching
Holland Community Hospital	Holland	MI	Non-teaching
Marquette General Hospital	Marquette	MI	Teaching
McLaren Regional Medical Center	Flint	MI	Teaching
Memorial Medical Center of West Michigan	Ludington	MI	Non-teaching
MidMichigan Medical Center–Midland	Midland	MI	Teaching
Munson Medical Center	Traverse City	MI	Teaching
Oakwood Heritage Hospital	Taylor	MI	Non-teaching
Port Huron Hospital	Port Huron	MI	Non-teaching
Spectrum Health Hospitals	Grand Rapids	MI	Teaching

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William Beaumont Hospital–Troy	Troy	MI	Teaching
Abbott-Northwestern Hospital	Minneapolis	MN	Teaching
Fairview Southdale Hospital	Edina	MN	Non-teaching
Healtheast St. John's Hospital	Maplewood	MN	Teaching
Mercy Hospital	Coon Rapids	MN	Teaching
Ridgeview Medical Center	Waconia	MN	Non-teaching
St. Cloud Hospital	St. Cloud	MN	Teaching
St. Joseph's Hospital	St. Paul	MN	Teaching
St. Luke's Hospital	Duluth	MN	Teaching
United Hospitals	St. Paul	MN	Teaching
Boone Hospital Center	Columbia	MO	Non-teaching
Heartland Regional Medical Center	St. Joseph	MO	Non-teaching
Missouri Baptist Medical Center	St. Louis	MO	Teaching
Northeast Regional Medical Center	Kirksville	MO	Teaching
including Grim-Smith Hospital & Clinic	Kirksville	MO	Teaching
Saint Luke's Hospital of Kansas City	Kansas City	MO	Teaching
SSM St. Joseph Health Center	St. Charles	MO	Non-teaching
including SSM St. Joseph Health Center–Wentzville	Wentzville	MO	Non-teaching
SSM St. Joseph Hospital West	Lake St. Louis	MO	Non-teaching
St. John's Mercy Hospital	Washington	MO	Non-teaching
St. John's Regional Medical Center	Joplin	MO	Non-teaching
North Mississippi Medical Center	Tupelo	MS	Teaching
Benefis Healthcare	Great Falls	MT	Non-teaching
Billings Clinic	Billings	MT	Teaching
Kalispell Regional Hospital	Kalispell	MT	Non-teaching
St. Patrick Hospital & Health Sciences Center	Missoula	MT	Non-teaching
including Missoula General Hospital	Missoula	MT	Non-teaching
St. Vincent Healthcare	Billings	MT	Teaching
Carolinas Medical Center–NorthEast	Concord	NC	Teaching
FirstHealth Moore Regional Hospital	Pinehurst	NC	Non-teaching
Mission Hospitals	Asheville	NC	Teaching
including St. Joseph's Hospital	Asheville	NC	Teaching

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Rex Hospital	Raleigh	NC	Non-teaching
Stanly Memorial Hospital	Albemarle	NC	Non-teaching
Trinity Hospitals	Minot	ND	Teaching
including Trinity Medical Center	Minot	ND	Teaching
Alegent Health-Bergan Mercy Medical Center	Omaha	NE	Teaching
Jersey Shore University Medical Center	Neptune	NJ	Teaching
Morristown Memorial Hospital	Morristown	NJ	Teaching
Ocean Medical Center	Brick	NJ	Non-teaching
Our Lady of Lourdes Medical Center	Camden	NJ	Teaching
Ellis Hospital	Schenectady	NY	Teaching
Our Lady of Lourdes Memorial Hospital	Binghamton	NY	Teaching
Phelps Memorial Hospital Association	Sleepy Hollow	NY	Non-teaching
Southampton Hospital	Southampton	NY	Non-teaching
St. Francis Hospital–Roslyn	Roslyn	NY	Teaching
St. Luke's Cornwall Hospital	Newburgh	NY	Non-teaching
Woman's Christian Association	Jamestown	NY	Non-teaching
Adena Regional Medical Center	Chillicothe	OH	Non-teaching
Bethesda North Hospital	Cincinnati	OH	Teaching
Cleveland Clinic	Cleveland	OH	Teaching
Community Hospital of Springfield & Clark County	Springfield	OH	Non-teaching
EMH Regional Medical Center	Elyria	OH	Non-teaching
Jewish Hospital	Cincinnati	OH	Teaching
Kettering Medical Center	Kettering	OH	Teaching
Mercy Hospital–Mt. Airy	Cincinnati	OH	Non-teaching
Mercy Hospital–Anderson	Anderson Township	OH	Non-teaching
Mercy Hospital–Clermont	Batavia	OH	Non-teaching
Mercy Hospital–Western Hills	Cincinnati	OH	Non-teaching
Mercy Medical Center of Springfield	Springfield	OH	Non-teaching
Middletown Regional Hospital	Middletown	OH	Non-teaching
Parma Community General Hospital	Parma	OH	Non-teaching
Riverside Methodist Hospital	Columbus	OH	Teaching
Southwest General Health Center	Middleburg Heights	OH	Teaching

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St. Elizabeth Health Center	Youngstown	OH	Teaching
St. John West Shore Hospital	Westlake	OH	Teaching
St. Luke's Hospital	Maumee	OH	Non-teaching
St. Vincent Mercy Medical Center	Toledo	OH	Teaching
including Mercy Healthcare Center	Toledo	OH	Teaching
Comanche County Memorial Hospital	Lawton	OK	Teaching
Duncan Regional Hospital	Duncan	OK	Non-teaching
St. Mary's Regional Medical Center	Enid	OK	Non-teaching
Mercy Medical Center	Roseburg	OR	Non-teaching
Providence Medford Medical Center	Medford	OR	Non-teaching
Rogue Valley Medical Center	Medford	OR	Non-teaching
St. Charles Medical Center–Bend	Bend	OR	Teaching
Alle Kiski Medical Center	Natrona Heights	PA	Non-teaching
DuBois Regional Medical Center	Dubois	PA	Non-teaching
Evangelical Community Hospital	Lewisburg	PA	Non-teaching
Geisinger South Wilkes-Barre	Wilkes-Barre	PA	Teaching
Good Samaritan Hospital	Lebanon	PA	Teaching
Grand View Hospital	Sellersville	PA	Non-teaching
Hazleton General Hospital	Hazleton	PA	Teaching
Lancaster General Hospital	Lancaster	PA	Teaching
Mercy Hospital Scranton	Scranton	PA	Teaching
Shamokin Area Community Hospital	Coal Township	PA	Non-teaching
The Medical Center–Beaver	Beaver	PA	Teaching
The Reading Hospital & Medical Center	West Reading	PA	Teaching
Uniontown Hospital	Uniontown	PA	Non-teaching
University of Pittsburgh Medical Center–Passavant	Pittsburgh	PA	Non-teaching
including UPMC Cranberry	Cranberry Township	PA	Non-teaching
Washington Hospital	Washington	PA	Teaching
Williamsport Hospital & Medical Center	Williamsport	PA	Teaching
WVHCS Hospital	Wilkes-Barre	PA	Teaching
including Wilkes-Barre General Hospital	Wilkes-Barre	PA	Teaching
Newport Hospital	Newport	RI	Non-teaching

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The Fifth Annual HealthGrades Patient Safety in American Hospitals Study

2008 Distinguished Hospital for Patient Safety™*	City	State	Status
AnMed Health	Anderson	SC	Teaching
Greenville Memorial Hospital	Greenville	SC	Teaching
McLeod Regional Medical Center	Florence	SC	Teaching
Medical University Hospital	Charleston	SC	Teaching
Tuomey Healthcare System	Sumter	SC	Non-teaching
Avera McKennan Hospital & Univ. Health Center	Sioux Falls	SD	Teaching
Sanford USD Medical Center	Sioux Falls	SD	Teaching
Centennial Medical Center	Nashville	TN	Non-teaching
Memorial Healthcare System	Chattanooga	TN	Non-teaching
Saint Thomas Hospital	Nashville	TN	Teaching
Baptist St. Anthony's Health System	Amarillo	TX	Teaching
Baylor Regional Medical Center at Plano	Plano	TX	Non-teaching
CHRISTUS Spohn Hospital–Corpus Christi Memorial	Corpus Christi	TX	Teaching
including CHRISTUS Spohn Hospital Corpus Christi–South	Corpus Christi	TX	Teaching
Southside Health Center	Corpus Christi	TX	Teaching
Citizens Medical Center	Victoria	TX	Non-teaching
Corpus Christi Medical Center	Corpus Christi	TX	Teaching
Detar Hospital Navarro	Victoria	TX	Non-teaching
including Detar Hospital North	Victoria	TX	Non-teaching
Doctors Hospital at Renaissance	Edinburg	TX	Non-teaching
Mother Frances Hospital–Tyler	Tyler	TX	Teaching
Providence Healthcare Network	Waco	TX	Teaching
San Angelo Community Medical Center	San Angelo	TX	Non-teaching
Scott & White Memorial Hospital	Temple	TX	Teaching
Shannon West Texas Medical Center	San Angelo	TX	Non-teaching
including SCCI Hospital San Angelo	San Angelo	TX	Non-teaching
St. David's Hospital	Austin	TX	Teaching
Texoma Medical Center	Denison	TX	Non-teaching
United Regional Health Care System	Wichita Falls	TX	Teaching
Walls Regional Hospital	Cleburne	TX	Non-teaching
Woodland Heights Medical Center	Lufkin	TX	Non-teaching
Bon Secours–Maryview Medical Center	Portsmouth	VA	Teaching

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The Fifth Annual HealthGrades Patient Safety in American Hospitals Study

2008 Distinguished Hospital for Patient Safety™*	City	State	Status
Winchester Medical Center	Winchester	VA	Teaching
Capital Medical Center	Olympia	WA	Non-teaching
Good Samaritan Hospital & Rehabilitation Center	Puyallup	WA	Non-teaching
Holy Family Hospital	Spokane	WA	Non-teaching
Northwest Hospital & Medical Center	Seattle	WA	Non-teaching
Overlake Hospital Medical Center	Bellevue	WA	Teaching
Providence Everett Medical Center–Colby Campus	Everett	WA	Non-teaching
Providence St. Peter Hospital	Olympia	WA	Teaching
Sacred Heart Medical Center	Spokane	WA	Teaching
Tacoma General Allenmore Hospital	Tacoma	WA	Teaching
including The Doctors Hospital of Tacoma	Tacoma	WA	Teaching
Aspirus Wausau Hospital	Wausau	WI	Teaching
Bellin Memorial Hospital	Green Bay	WI	Non-teaching
Memorial Hospital Burlington	Burlington	WI	Non-teaching
Mercy Medical Center	Oshkosh	WI	Non-teaching
St. Mary's Hospital Medical Center	Madison	WI	Teaching
West Allis Memorial Hospital	West Allis	WI	Teaching
Monongalia County General Hospital	Morgantown	WV	Teaching

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Some of the recipients of the Distinguished Hospital for Patient Safety™ award have multiple locations that report under the same Medicare Provider ID. 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.

Appendix B:
List of Patient Safety Indicators Used in this HealthGrades Study

- Accidental puncture or laceration
- Complications of anesthesia
- Death in low mortality DRGs
- Decubitus ulcer
- Failure to rescue
- Foreign body left in during procedure
- Iatrogenic pneumothorax
- Selected infections due to medical care
- Post-operative hemorrhage or hematoma
- Post-operative hip fracture
- Post-operative physiologic and metabolic derangement
- Post-operative pulmonary embolism or deep vein thrombosis
- Post-operative respiratory failure
- Post-operative sepsis
- Post-operative abdominal wound dehiscence
- Transfusion reaction

Appendix C: Overall Patient Safety Indicator Hospital Performance Assessment Methodology (2004 – 2006 MedPAR Data)

Patient Safety Measurement

This methodology includes the following patient safety indicators:

- Death in low mortality Diagnostic Related Groupings (DRGs)
- Decubitus ulcer
- Failure to rescue
- Foreign body left in during procedure
- Iatrogenic pneumothorax
- Selected infections due to medical care
- Post-operative hip fracture
- Post-operative hemorrhage or hematoma
- Post-operative physiologic and metabolic derangements
- Post-operative respiratory failure
- Post-operative pulmonary embolism or deep vein thrombosis
- Post-operative sepsis
- Post-operative abdominal wound dehiscence

Data Acquisition

HealthGrades uses the MedPAR data file from the Centers for Medicare and Medicaid Services (CMS) for several reasons:

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

HealthGrades used the QI Windows Software, version 3.1c, developed by the Agency for Healthcare Research and Quality (AHRQ) and downloaded from www.qualityindicators.ahrq.gov/software.htm. Following all AHRQ guidelines for using PSI software, HealthGrades applied it to all short-term acute care hospitals in the MedPAR file for three years (2004 through 2006).

Given that this data set applies mostly to patients over the age of 65, HealthGrades excluded the following PSIs 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

Data Exclusions

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.

HealthGrades also removed hospitals in the U.S. territories and Puerto Rico from the data set.

Overall Patient Safety Score

To determine the overall patient safety score by hospital, HealthGrades performed the following steps.

1. AHRQ software calculated observed, expected, risk-adjusted and smoothed rates for each hospital and PSI, provided that the PSI had at least three cases. (HealthGrades used a stratification process to calculate expected rates for those PSIs where AHRQ software only provided observed rates.)

2. HealthGrades identified significant bias in the expected rates for larger hospitals (which had consistently higher observed rates than expected). Therefore, 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.

   To perform the case mix index adjustment and remove the bias, HealthGrades:

   a) Stratified hospitals by their CMI category. This was done separately for each of the three years (2004–2006) using the corresponding year's CMI. Therefore, it is possible that a hospital could be in different CMI strata from year to year. (See *CMI Index*, below, for definitions.) CMI < 1.25 was the first level, and so on.

   b) Adjusted the expected (predicted) counts so that the total observed count was equal to the total expected for each PSI, and for each year-CMI level combination. For example, if CMI level 1 had 2,000 predicted events and 1,800 observed for a given year and PSI, each of the hospitals in this group would have its predicted value reduced by 10 percent. If the CMI level 6 had 3,000 predicted and 4,000 observed, those hospitals would have the predicted values increased by 33 percent.

3. HealthGrades statistically compared the observed rate to the expected rate to produce a z-score for each PSI that had sufficient volume at any hospital. To normalize the effect of the 13 indicators, these z-scores were rescaled to a mean of zero and standard deviation of one. The average of the 13 resulting scores determined a hospital's ranking.

4. HealthGrades divided the hospitals into two peer groups: teaching and non-teaching. To identify the teaching peer group, HealthGrades used the data from Medicare Cost Reports (Form CMS-2552-96). A facility was considered a teaching hospital if they answered "yes" to the question: "Is this a teaching hospital or affiliated with a teaching hospital?" Hospitals that received substantial Indirect Medical Education payments in 2006 were also classified as teaching hospitals. Independent verification by phone was used for a few hospitals.

5. To be considered for the Distinguished Hospital Award for Patient Safety™, hospitals had to be rated in at least 17 of 27 HealthGrades cohorts and have a current overall HealthGrades star rating of at least 2.5. The final data set included 767 teaching hospitals and 891 non-teaching hospitals.

6. From this final data set, HealthGrades identified both teaching and non-teaching hospitals in the top 15 percent as "best performing" and these hospitals are recognized as Distinguished Hospital Award for Patient Safety™ recipients. These 249 hospitals represent less than five percent of the total hospitals evaluated.

Hospital Type	Number of Best Performing Providers
Teaching Hospitals	115
Non-teaching Hospitals	134

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; and 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 report, therefore, "hospital" refers to one hospital or a group of hospitals reporting under a single provider ID.

Hospitals were assigned one of eight CMI levels. Hospitals were categorized according to their 2006 index as follows.

CMI Index

CMI Index	CMI Group	Number of Award Recipients
0.00 < CMI < 1.25	1	23
1.25 < CMI < 1.35	2	41
1.35 < CMI < 1.45	3	31
1.45 < CMI < 1.55	4	47
1.55 < CMI < 1.65	5	39
1.65 < CMI < 1.75	6	31
1.75 < CMI < 1.90	7	23
CMI > 1.90	8	14

Appendix D:
Patient Safety Incident Rates and Associated Mortality
Among Medicare Beneficiaries – 2004 through 2006

Patient Safety Incident	Year	Number of Incidents	Total Cases Evaluated	Rate per 1,000	Associated Mortality**	% Change in Rate (2004 - 2006)
Complications of anesthesia*	2004	728	3,461,955	0.210	7	9.70%
	2005	681	3,523,083	0.193	6	
	2006	653	3,438,966	0.190	4	
	2004-2006	2,062	10,424,004	0.198	17	
Death in low mortality DRGs	2004	4,119	1,953,163	2.109	4,119	22.84%
	2005	3,677	1,941,024	1.894	3,677	
	2006	2,572	1,580,706	1.627	2,572	
	2004-2006	10,368	5,474,893	1.894	10,368	
Decubitus ulcer	2004	154,792	4,983,453	31.061	17,432	-2.21%
	2005	151,552	4,923,716	30.780	15,491	
	2006	148,961	4,691,934	31.748	14,224	
	2004-2006	455,305	14,599,103	31.187	47,147	
Failure to rescue	2004	63,207	467,201	135.289	63,207	11.11%
	2005	63,482	495,412	128.140	63,482	
	2006	61,640	512,590	120.252	61,640	
	2004-2006	188,329	1,475,203	127.663	188,329	
Foreign body left in during procedure	2004	939	13,171,876	0.071	41	2.79%
	2005	896	13,340,422	0.067	42	
	2006	892	12,871,682	0.069	33	
	2004-2006	2,727	39,383,980	0.069	116	
Iatrogenic pneumothorax	2004	8,166	12,412,790	0.658	1,482	5.29%
	2005	8,230	12,574,099	0.655	1,374	
	2006	7,556	12,127,257	0.623	1,188	
	2004-2006	23,952	37,114,146	0.645	4,044	
Selected infections due to medical care	2004	19,589	8,516,895	2.300	2,030	5.26%
	2005	19,969	8,575,011	2.329	1,876	
	2006	17,393	7,982,280	2.179	1,578	
	2004-2006	56,951	25,074,186	2.271	5,484	
Post-operative hip fracture	2004	1,232	2,179,424	0.565	140	16.42%
	2005	1,132	2,190,316	0.517	112	
	2006	1,001	2,118,682	0.472	103	
	2004-2006	3,365	6,488,422	0.519	355	

Continues...

Legend	Improvement	
	Worsening	

Appendix D: Patient Safety Incident Rates and Associated Mortality Among Medicare Beneficiaries – 2004 through 2006 (continued)

Patient Safety Incident	Year	Number of Incidents	Total Cases Evaluated	Rate per 1,000	Associated Mortality**	% Change in Rate (2004 - 2006)
Post-operative hemorrhage or hematoma	2004	9,211	3,443,315	2.675	596	1.42%
	2005	9,329	3,503,303	2.663	638	
	2006	9,017	3,419,210	2.637	664	
	2004-2006	27,557	10,365,828	2.658	1,898	
Post-operative physiologic and metabolic derangements	2004	2,444	1,800,945	1.357	526	9.58%
	2005	2,378	1,851,330	1.284	483	
	2006	2,224	1,812,409	1.227	466	
	2004-2006	7,046	5,464,684	1.289	1,475	
Post-operative respiratory failure	2004	22,692	1,333,003	17.023	5,603	-0.49%
	2005	23,305	1,367,239	17.045	5,500	
	2006	22,822	1,334,087	17.107	5,279	
	2004-2006	68,819	4,034,329	17.058	16,382	
Post-operative pulmonary embolism or deep vein thrombosis	2004	42,747	3,416,094	12.513	4,326	-10.94%
	2005	44,105	3,471,560	12.705	4,243	
	2006	46,990	3,384,953	13.882	3,974	
	2004-2006	133,842	10,272,607	13.029	12,543	
Post-operative sepsis	2004	6,484	513,715	12.622	1,793	-15.74%
	2005	6,890	508,891	13.539	1,882	
	2006	6,782	464,267	14.608	1,782	
	2004-2006	20,156	1,486,873	13.556	5,457	
Post-operative wound dehiscence in abdominopelvic surgical patients	2004	1,758	490,748	3.582	220	-8.95%
	2005	1,822	476,732	3.822	231	
	2006	1,721	440,968	3.903	257	
	2004-2006	5,301	1,408,448	3.764	708	
Accidental puncture or laceration*	2004	38,681	13,153,429	2.941	2,572	-4.06%
	2005	39,531	13,319,530	2.968	2,433	
	2006	39,324	12,850,481	3.060	2,286	
	2004-2006	117,536	39,323,440	2.989	7,291	
Transfusion reaction*	2004	60	13,172,044	0.005	1	23.25%
	2005	76	13,340,577	0.006	3	
	2006	45	12,871,879	0.003	1	
	2004-2006	181	39,384,500	0.005	5	
Totals	-	1,123,497	-	-	301,619	
				Less Double Counts	270,491	

Legend	Improvement	
	Worsening	

* Complications of anesthesia, accidental puncture or laceration, and transfusion reaction were excluded from the overall performance calculation to identify the Distinguished Hospitals for Patient Safety™.
** The mortality reported is all-cause inhospital mortality among all U.S. patients that developed one or more patient safety incidents during hospitalization from 2004 through 2006.

Patient Safety Indicator	Actual Number of National Incidents	Percentage of Total Number of Incidents	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	455,305	40.53%	7.23%	32,919	$10,845	$4,937.78	$2,468.89
Failure to rescue*	188,329	16.77%	NA*	188,329	NA*	NA*	NA*
Post-op pulmonary embolism or deep vein thrombosis	133,842	11.91%	6.56%	8,780	$21,709	$2,905.58	$1,452.79
Accidental puncture or laceration	117,536	10.46%	2.16%	2,539	$8,271	$972.14	$486.07
Selected infections due to medical care	56,951	5.07%	4.31%	2,455	$38,656	$2,201.50	$1,100.75
Iatrogenic pneumothorax	23,952	2.13%	6.99%	1,674	$17,312	$414.66	$207.33
Post-op respiratory failure	68,819	6.13%	21.84%	15,030	$53,502	$3,681.95	$1,840.98
Post-op hemorrhage or hematoma	27,557	2.45%	3.01%	829	$21,431	$590.57	$295.29
Post-op hip fracture	3,365	0.30%	4.52%	152	$13,441	$45.23	$22.61
Post-op sepsis	20,156	1.79%	21.92%	4,418	$57,727	$1,163.55	$581.77
Death in low mortality DRGs*	10,368	0.92%	NA*	10,368	NA*	NA*	NA*
Post-op physiologic and metabolic derangements	7,046	0.63%	19.81%	1,396	$54,818	$386.25	$193.12
Post-op abdominal wound dehiscence	5,301	0.47%	9.63%	510	$40,323	$213.75	$106.88
Foreign body left in during procedure	2,727	0.24%	2.14%	58	$13,315	$36.31	$18.16
Complications of anesthesia	2,062	0.18%	0.00%	0	$1,598	$3.30	$1.65
Transfusion reaction	181	0.02%	4.31%	8	$18,929	$3.43	$1.71
Totals	1,123,497	-	-	269,465	-	$17,555.99	$8,777.99
Less Double Counts	-	-	-	238,337	-	-	-

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

** Based on previous research done by Zhan C., and Miller M. R. "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 B., La Mare J., Andrews R., and McKenzie D. "Practical Options for Estimating Cost of Hospital Inpatient Stays." *J Health Care Finance*. 2002; 29(1): 1-13.

Appendix F:
Comparisons Between Different Performance Categories – 2004 through 2006

	Observed-to-Expected Ratios (O/E) by PSI and Associated Outcomes					As Compared to the Top 15% Performance			
Patient Safety Indicator	ALL	Distinguished Hospitals for Patient Safety™ O/E Ratios (95% CI)	Middle 70% O/E Ratios	Bottom 15% Hospitals O/E Ratios (95% CI)	Relative Risk Decrease Associated with Distinguished Hospitals Compared to Bottom Hospitals	# of Excess Patient Safety Incidents Among All Non-Distinguished Hospitals	# Potentially Avoidable Deaths** Associated with Excess Patient Safety Incidents Among All Non-Distinguished Hospitals	Excess Charge** (Millions) Associated with Excess Patient Safety Incidents Among All Non-Distinguished Hospitals	Excess Cost^^ (Millions) Associated with Excess Patient Safety Incidents Among All Non-Distinguished Hospitals
Death in low mortality DRGs	0.972	0.698 (0.663-0.733)	0.985	1.248 (1.194-1.303)	44.08%	2,843	2,843	NA*	NA*
Decubitus ulcer	0.996	0.724 (0.718-0.730)	0.998	1.274 (1.266-1.282)	43.17%	123,053	8,897	$1,335	$667
Failure to rescue	0.989	0.864 (0.854-0.875)	0.997	1.061 (1.050-1.072)	18.50%	17,671	17,671	NA*	NA*
Foreign body left in during procedure	1.013	0.649 (0.586-0.712)	1.014	1.470 (1.363-1.578)	55.86%	977	21	$13	$7
Iatrogenic pneumothorax	1.024	0.830 (0.806-0.855)	1.027	1.251 (1.218-1.285)	33.63%	4,513	315	$78	$39
Selected infections due to medical care	0.917	0.636 (0.623-0.649)	0.908	1.327 (1.306-1.348)	52.07%	17,376	749	$672	$336
Post-op hip fracture	1.011	0.767 (0.706-0.828)	1.016	1.324 (1.230-1.419)	42.07%	807	36	$11	$5
Post-op hemorrhage or hematoma	1.005	0.837 (0.815-0.859)	0.998	1.259 (1.229-1.290)	33.56%	4,584	138	$98	$49
Post-op physiologic and metabolic derangements	0.94	0.616 (0.581-0.650)	0.928	1.410 (1.351-1.470)	56.35%	2,418	479	$133	$66

Continues…

Patient Safety Indicator	ALL	Observed-to-Expected Ratios (O/E) by PSI and Associated Outcomes				As Compared to the Top 15% Performance			
		Distinguished Hospitals for Patient Safety™ O/E Ratios (95% CI)	Middle 70% O/E Ratios	Bottom 15% Hospitals O/E Ratios (95% CI)	Relative Risk Decrease Associated with Distinguished Hospitals Compared to Bottom Hospitals	# of Excess Patient Safety Incidents Among All Non-Distinguished Hospitals	# Potentially Avoidable Deaths** Associated with Excess Patient Safety Incidents Among All Non-Distinguished Hospitals	Excess Charge** (Millions) Associated with Excess Patient Safety Incidents Among All Non-Distinguished Hospitals	Excess Cost^^ (Millions) Associated with Excess Patient Safety Incidents Among All Non-Distinguished Hospitals
Post-op respiratory failure	1.005	0.789 (0.775-0.803)	1.000	1.287 (1.268-1.307)	38.70%	14,736	3,218	$788	$394
Post-op pulmonary embolism or deep vein thrombosis	0.994	0.812 (0.802-0.821)	0.979	1.311 (1.297-1.325)	38.11%	24,472	1,605	$531	$266
Post-op sepsis	0.975	0.738 (0.714-0.761)	0.954	1.391 (1.354-1.428)	46.95%	4,878	1,069	$282	$141
Post-op wound dehiscence in abdominopelvic surgical patients	1.003	0.666 (0.618-0.713)	1.008	1.416 (1.337-1.495)	52.98%	1,777	171	$72	$36
Average relative risk increase in and number of potentially avoidable patient safety incidents, death, charge and cost associated with All Non-Distinguished Hospitals compared to Distinguished Hospitals.					42.77%	220,106	37,214	$4,012	$2,006

* By definition, all patients with the event died and were excluded from Zhan and Miller's analysis on attributable mortality and cost associated with PSI incidents.
** Based on previous research done by Zhan C., and Miller M. R. "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 B., La Mare J., Andrews R., and McKenzie D. "Practical Options for Estimating Cost of Hospital Inpatient Stays." *J Health Care Finance.* 2002; 29(1): 1-13).

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