HealthGrades Quality Study

Third Annual Patient Safety in American Hospitals Study

April 2006

HEALTHGRADES®
GUIDING AMERICA TO BETTER HEALTHCARE™

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In this report, HealthGrades identifies the patient safety incident rates for nearly every hospital in the country by applying the Agency for Healthcare Research and Quality (AHRQ) Patient Safety Indicator methodology[1] to three years of Medicare data (2002-2004). From this analysis, HealthGrades identifies the best-performing hospitals to establish a best-practice benchmark against which other hospitals can be evaluated. See Appendix A for list of best-performing hospitals. This study also identifies trends in important patient safety issues among the nation's hospitals.

Introduction

More than half a decade has passed since the Institute of Medicine (IOM) released its first reports on healthcare quality and medical errors. IOM reported that "serious and widespread problems occur in small and large communities alike, in all parts of the country…"[2] Much research has been done since and it is now widely accepted that "safety is a characteristic of systems and not of their components" and that "safety is an emergent property of systems."[3] However, despite what we have learned from this research, recent studies assessing the state of hospital patient safety conclude that current progress is slow, results in general are at best modest, and the gap between the best possible care and actual care remains large.[4,5]

Cohesive National Agenda Still Missing—Minnesota Takes the Lead

Despite the fact that medical errors are a leading cause of injury and death in the United States, only some states have mandatory reporting of medical errors—some required by law and others by administrative action. As of September 2005, 25 states have reporting laws. However, the standards of measurement are not consistent, and in some states, the reporting standards change over time. Minnesota, however, was the first state to adopt legislation requiring reporting on all of the National Quality Forum's (NQF) 27 adverse events. NQF hopes Minnesota's new law will lead to the establishment of a national standard with consistent language and standards of measurement. A national standard would enable the federal government and states to accurately compare data and benefit from shared information.

"Minnesota's decision-makers have demonstrated national leadership in improving patient safety," said former NQF President and CEO Kenneth W. Kizer, MD, MPH. "Focusing on the National Quality Forum's list of 27 serious reportable events—identified through national consensus of a broad range of stakeholders—will lead to improvements in healthcare delivery and safer care for Minnesotans. We commend Minnesota for being the first state to adopt this systematic and standardized approach, and we hope other states will follow Minnesota's lead," Kizer said.[6]

Measuring Patient Safety

There are several estimates on the number of medical errors and associated deaths. Most of these estimates would rank medical errors as a leading cause of death in the U.S. However, these well-accepted figures likely represent only the tip of the medical-errors iceberg. A major reason for this is the lack of effective measurement tools to help providers measure and reduce medical errors to improve patient safety. In response to the increased need for patient safety measurements, the Agency for Healthcare Research and Quality (AHRQ) recently developed and released a set of Patient Safety Indicators (PSIs), which are specifically designed for screening administrative data for incidences of concern related to patient safety.[1] AHRQ is the lead agency for the U.S. government on quality in healthcare, sponsoring research that examines the frequency and cause of medical errors and testing techniques designed to reduce these mistakes. (For a complete list of the AHRQ Patient Safety Indicators (PSIs) used in this study, see Appendix B.)

Using this measurement tool, AHRQ researchers were the first to identify the rates of, and excess length of stay and mortality associated with, these specific patient safety indicators. Extrapolating from AHRQ's sample data, representing approximately 20 percent of all U.S. hospitals (2000 Healthcare Cost and Utilization Project Nationwide Inpatient Sample), researchers estimated that the 18 patient safety indicators evaluated contributed to $9.3 billion excess charges and 32,591 deaths in the U.S. annually.[7]

Using this same measurement tool, HealthGrades was the first to identify and make publicly available the rates of patient safety incidents and overall performance for every non-federal hospital in the U.S.

Continued Healthcare Epidemic

A recent study found that only 74 percent of hospitals surveyed reported full-implementation of a written patient safety plan and nearly nine percent reported no plan.[4] This finding supports many other conclusions that progress is too slow and should be cause for great alarm. Because of the associated variability of hospital patient safety across the nation and the lack of a cohesive and consistent structure to identify, analyze, report and share critical information, it is imperative that the development and dissemination of highly visible consumer guides and performance reporting systems be a priority for consumers.

For a third year HealthGrades has researched and provided information on hospital patient safety. To identify the patient safety incident rates for every non-federal hospital in the country, HealthGrades applied AHRQ's Patient Safety Indicator methodology[1] to three years of Medicare data (2002-2004). In order to better understand variations across the U.S., HealthGrades evaluated and rank ordered all 50 states and the District of Columbia. To our knowledge, this is the first study to evaluate and publish patient safety performance for each state using AHRQ's Patient Safety Indicators (PSI).[1]

Summary of Findings

AHRQ's development of the Patient Safety Indicators (PSIs) was based on the IOM's definition of patient safety: "freedom from accidental injury due to medical care, or medical errors."[8] 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."[9]

In 2002, AHRQ, in collaboration with the University of California-Stanford Evidence-Based Practice Center, identified 20 indicators for 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]

HealthGrades used AHRQ's *PSI Version 2.1, Revision 3a February 2005* software application[1] and research by Zhan and Miller,[7] to study the safety of inpatient hospital care based on 16 of the total 20 patient safety indicators (excluding four PSIs related to obstetrics) among Medicare beneficiaries in the U.S. from 2002 to 2004. The 16 PSIs we studied are listed in Appendix B. In addition, using the rates calculated for 13 of the 16 PSIs studied, we also calculated an overall patient safety score for each state and hospital to identify the best. (See Appendix A and C.)

In our study, we found:

- Approximately 1.24 million total patient safety incidents occurred in almost 40 million hospitalizations in the Medicare population. These incidents were associated with $9.3 billion of excess cost during 2002 through 2004. For the second year in a row, patient safety incidents have increased—up from 1.14 and 1.18 million reported in HealthGrades' First and Second Annual Patient Safety in American Hospitals studies, respectively.
- Of the 304,702 deaths that occurred among patients who developed one or more patient safety incidents, 250,246 were potentially preventable.
    - Medicare beneficiaries that developed one or more patient safety incidents had a one-in-four chance of dying during the hospitalization during 2002-2004. This rate remains unchanged since our first study released July 2003.
- Wide, highly significant gaps in individual PSI and overall performance exist between the top and the bottom performing states during 2002-2004.
    - Minnesota, Wisconsin, Iowa, Michigan and Kansas ranked as the top states for hospital patient safety during the period studied.
    - New Jersey, New York, Nevada, Tennessee and District of Columbia, ranked last for hospital patient safety during the period studied.
    - Compared to the worst state (N.J.), the best state (Minn.) had an overall almost 30-percent lower relative risk of developing one or more of the 13 patient safety incidents in its hospitals. However, performance variation between best and worst state was even more significant with individual patient safety incidents. For example, patients had an almost 92-percent lower relative risk of developing post-operative physiologic and metabolic derangements (post-operative delirium) in the top state compared to the bottom state.
- When compared to the *Second Annual Patient Safety in American Hospitals* study, the rates of six key quality improvement focus areas remained unimproved in 2004. Focus areas include metabolic derangements, post-operative respiratory failure, decubitus ulcer, post-operative pulmonary embolus or deep vein thrombosis, and hospital-acquired infections. These six areas continued to worsen on average by almost 12 percent or more over three years (2002 through 2004).
- The PSIs with the highest incidence rates continued to be failure to rescue, decubitus ulcer, and post-operative sepsis. Failure to rescue improved 13 percent during the study period, while post-operative sepsis worsened by almost 25 percent.

- There were wide, highly significant gaps in individual PSI 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, an almost **50-percent lower occurrence** of experiencing one or more PSIs compared to patients at the bottom ranked hospitals. This finding was consistent across all 13 PSIs studied.
  - If all hospitals performed at the level of **Distinguished Hospitals** for Patient Safety, approximately **280,134 patient safety incidents and 44,153 Medicare deaths** could have been avoided while saving U.S. **$2.45 billion during** 2002-2004.

Methodology

In order to evaluate *overall* hospital performance and to identify the best-performing hospitals across the U.S., we used AHRQ's *Patient Safety Indicator Version 2.1, Revision 3a February 2005* software application[1] to evaluate every hospital in the country on 16 PSIs. We then developed a ranking methodology to evaluate overall patient safety performance for each hospital. To minimize the potential impact of variations in hospital coding of specific E codes when assessing overall hospital performance, we followed the recommendation of AHRQ[10] to exclude three PSIs (complications of anesthesia, accidental puncture or laceration, transfusion reaction) that included these specific E codes in their numerator definition. (See Appendix C.)

State rankings 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 summing the 13 rescaled z-scores. These summed z-scores by state were then rank ordered from most positive (best) to most negative (worst).

Mortality attributable to patient safety incidents were calculated using attributable charge and mortality data from previous PSI research by Zhan and Miller[7].

Findings

Patient Safety Incidents are Increasing

Using the *Patient Safety Indicator Version 2.1, Revision 3a April 2005* software application developed by AHRQ,[1] HealthGrades identified a total of 1.24 million patient safety incidents (PSIs) that occurred in approximately 40 million hospitalizations in the Medicare population from 2002 through 2004. This number is almost a 9-percent increase from our previous findings released July 2004.[11] (See Appendix D.)

Preventable Deaths from Patient Safety Incidents

There were 304,702 deaths that occurred among patients who developed one or more of the 16 patient safety incidents studied. (See Appendix D.) This represents a mortality rate of 24.59 percent among Medicare beneficiaries who developed one or more PSIs during their hospitalization during 2002-2004. Using previous research by Zhan and Miller[7], more than 82 percent of the mortalities were potentially preventable and accounted for 250,246 deaths. (See Appendix E.)

Common Patient Safety Incidents are Very Costly

The following PSIs were the most costly and accounted for 68 percent of all excess attributable costs from 2002 through 2004. (See Appendix E.)

- Decubitus ulcer ($2.94 billion)
- Selected infections due to medical care ($2.04 billion)
- Post-operative pulmonary embolism or deep vein thrombosis ($1.32 billion)

The most commonly occurring PSIs are noted in Table 1 below. These three PSIs accounted for almost 63 percent of all patient safety incidents from 2002 through 2004. Failure to rescue improved 13 percent during the study period while post-operative sepsis worsened by almost 25 percent. (See Appendix D.)

Table 1: Most Commonly Occurring Patient Safety Incidents per 1000 At-risk Hospitalizations

Patient Safety Indicator	Incident Rate per 1,000 At-risk Hospitalizations
Failure to Rescue	139
Decubitus Ulcer	33
Post-operative Sepsis	16

The rates of patient safety incidents that we identified were very similar to our previous study and those of many others. Decubitus ulcer alone accounted for $2.94 billion in, and 32 percent of, the total avoidable cost associated with the 16 PSIs. For the incident rates of all 16 PSIs, see Appendix D. For the excess mortality and cost attributable to each PSI, see Appendix E.

Rates of Patient Safety Incidents Continue to Worsen

When compared to the *Second Annual Patient Safety in American Hospitals* study that evaluated the Medicare population from 2001-2003, we determined that the rates of six key PSIs that are and have been national quality improvement focus areas (metabolic derangements, post-operative respiratory failure, decubitus ulcer, post-operative PE/DVT, and hospital-acquired infections) continued to increase, on average, by 12 percent or more from 2002 to 2004. (See Appendix D.)

One in Four Medicare Patients with Patient Safety Incidents Die

Although mortality attributable to medical errors and injury is relatively rare, and overall mortality rates among Medicare beneficiaries have been declining steadily, we determined that the 16 PSIs studied may still have contributed to 250,246 deaths from 2002 through 2004. This translates to an approximate 25-percent mortality rate in Medicare patients potentially attributable to patient safety incidents. (See Appendix E.) More simply stated, one in every four Medicare patients who were hospitalized from 2002 to 2004, and experienced a patient safety incident, died.

Variation Across the U.S.

Consistent with previous studies, there were marked differences in individual PSI and overall patient safety performance across the U.S. (See Appendices F and G1-G13.)

- Sixteen states performed statistically significantly better than expected.
- Ten states performed statistically significantly worse than expected.
- The remaining 25 states performed as expected.

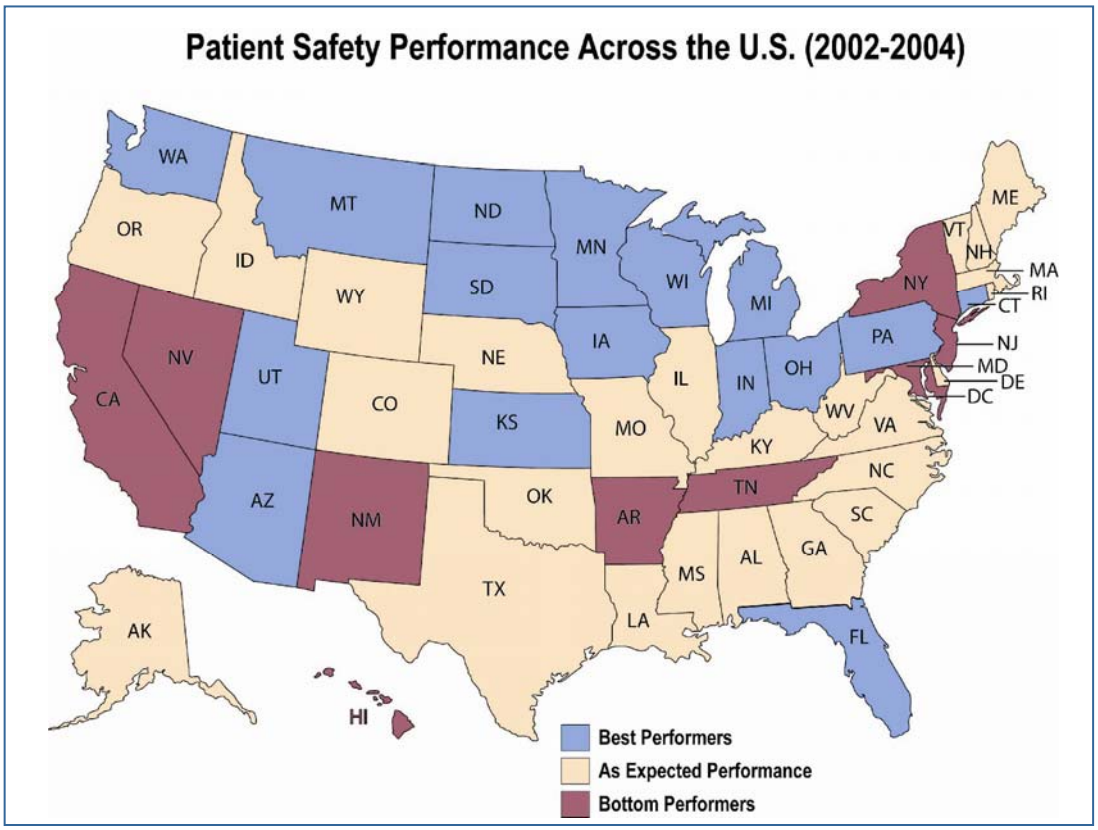

Figure 1. Patient Safety Performance Across the U.S. (2002 – 2004)

Minnesota Ranks As Best in the Nation

Minnesota ranked as the top state for hospital patient safety during 2002-2004. Minnesota's normalized overall z-score sum of 8.28 and average observed-to-expected ratio of 0.877 was better than expected and statistically significant. Wisconsin, Iowa, Michigan and Kansas, also ranked in the top five states that, also had normalized z-score sums and observed-to-expected ratios that were better than expected and statistically significant. (See Appendix F.)

New Jersey Ranks as Worst in the Nation

New Jersey, with a normalized overall z-score sum of -13.95, ranked last among the 50 states and the District of Columbia. This normalized overall z-score sum and New Jersey's associated average observed-to-expected ratio of 1.151 were worse than expected and statistically significant. New York, Nevada, Tennessee and District of Columbia joined New Jersey as having worse than expected patient safety

performance that was statistically significant. (See Appendix F.) However, being ranked at the bottom does not imply there are no top performing hospitals. There are Distinguished Hospitals for Patient Safety in most of these states. For example, New Jersey boasts Jersey Shore University Medical Center in Neptune; New York boasts St. Peters Hospital in Albany; and Tennessee has St. Thomas Hospital in Nashville. (See Appendix A.)

Compared to the worst state (N.J.), the best state (Minn.) had an overall 29.42-percent lower relative risk of developing one or more of the 13 patient safety incidents in its hospitals. However, performance variation between best and worst state was even more significant with individual patient safety incidents. For example, an almost 92-percent lower relative risk of developing post-operative physiologic and metabolic derangements (post-operative delirium) was observed in the top state compared to the bottom state. (See Appendices G1-G13.)

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 19 of 28 HealthGrades cohorts and have a current overall HealthGrades star rating of at least 2.5. The final ranking set included 761 teaching hospitals and 833 non-teaching hospitals. The top 15 percent represented less than five percent of all U.S. hospitals examined in this study. (See Appendix A and C.)

More specifically, we found that Distinguished Hospitals, as a group, significantly outperformed the bottom 15 percent hospitals on every PSI and also on overall patient safety performance, equating to, on average, a 43.27 percent lower risk of occurrence of developing one or more patient safety incidents compared to the bottom 15 percent hospitals. (See Appendix H.)

Distinguished Hospitals for Patient Safety™ Avoid Excess Patient Safety Incidents, Associated Deaths and Cost

If all other hospitals could have performed at the level of Distinguished Hospitals for Patient Safety, 280,134 patient safety incidents and 44,153 deaths that could have been avoided while saving U.S. $2.45 billion during 2002-2004. (See Appendix H.)

Interpretation of Results

This is our third study evaluating the potentially avoidable patient safety incidents and associated mortality and cost using AHRQ's PSIs[1] across all U.S. hospitals among the most vulnerable patient population—Medicare patients over the age of 65. This study identified that the adverse event rate is just over three percent and the total number of patient safety incidents has been increasing since 2001 and is associated with a significant chance of dying.

Minnesota Most Progressive State

Significant state-to-state variations in overall patient safety indicator performance exist. Of interest is that Minnesota, the top ranked state, is also the most progressive state regarding addressing the patient safety issue. Despite general lack of real improvement at a national level, it is not surprising that this state came out on top.

Minnesota was the first state to have legislated mandatory and public reporting, using the NQF's list of 27 reportable adverse events. Minnesota began its mandatory reporting in 2003 and released its first public report in January 2005. According to the Minnesota Commissioner of Health, Dianne Mandernach, Minnesota's adverse events reporting system "provides us with a wealth of information that healthcare facilities can use to improve patient care."[12]

Minnesota also boasts its Safest in America (www.safestinamerica.org) hospitals. Despite their fierce market competition, a collaborative of ten Twin Cities and Rochester hospital systems that include 23 hospitals and the Institute for Clinical Systems Improvement, work together to improve patient safety by learning from the aggregate experiences of all group members. Member institutions pay $10,000 per year to fund staffing, goal setting and needed operational changes. Together, they share data, highlight best practices, and implement evidence-based, community-tested solutions. Teams from the ten hospitals meet in monthly action groups to report data and discuss best practices. CEOs meet quarterly to make sure resources are allocated for projects. Another leadership group made of clinical and patient safety leaders meets every six weeks to help set direction.

Successes of this group include community-wide adoption of safer prescribing practices, prevention of wrong-site surgery, implementation of a weight-based dosing protocol for pediatric patients, and implementation of practices to reduce inpatient hyperglycemia and hypoglycemia. According to Gordon Mosser, M.D., executive director of the Institute for Clinical Systems Improvement, whose organization analyzes data and runs the work groups, the coalition has benefited by sharing data and other information because peer pressure helps keep the coalition on track with its goals. "None of the members want to look bad, so they go home and see that things get done."[13]

Distinguished Hospitals for Patient Safety Lead the Nation

Also not surprising is that Distinguished Hospitals for Patient Safety continue to lead the nation in providing safer care, by almost 50 percent more, and resulting in much lower costs to society. Of the eight non-children's hospital systems participating in the Minnesota Safest in America collaborative, four have one or more hospitals that ranked among the nation's best in this research.

Table 2: Safest in America Participant / Distinguished Hospital Award-Patient Safety Recipients

Safest in America System Participants	2006 Distinguished Hospitals for Patient Safety™*
Allina Hospitals & Clinics, Minneapolis	Abott Northwestern Hospital Inc., Minneapolis United Hospitals Inc. St. Paul
HealthEast Care System, St. Paul	St. Joseph's Hospital, St. Paul St. John's Hospital, Maplewood
Mayo Clinic, Rochester	St. Mary's Hospital, Rochester
Park Nicollet Health Services Minneapolis	Park Nicollet Health Services, St. Louis Park

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We believe that it is due to Distinguished Hospitals' evolution of quality of care and patient safety knowledge which has led to improvements in structure, policies and systems vital to patient safety. However, not all hospitals have been improving their structure, policies and systems. A recent study identified that nine percent of hospitals still reported regression of patient safety initiatives or no patient safety plan–more than half a decade after the IOM's call to action. When further evaluated, those that regressed admitted that the regression was the result of changes in hospital priorities, budgets, and patient safety system philosophies.[4]

Making Patient Safety a Priority

Medical errors are primarily an organizational issue resulting from inadequate or nonexistent systems that evidence suggest would reduce the probability of errors[4]. In our experience, Distinguished Hospitals for Patient Safety have made a commitment to ensure adequate systems are in place, or will soon to be in place, that effectively reduce errors. The successes from Minnesota underscore the importance of local and state collaboration, sharing, prioritization and action. The public must create urgency and demand that officials make patient safety a priority at local, state and national levels. Given the significant complexity of hospital care, quality should not be left to chance and fundamental systems must be in place that will increase the potential for good quality.

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

The following is a list hospitals who are recipients of this year's HealthGrades Distinguished Hospital Award for Patient Safety™*.

Hospital	City	State
Abbott Northwestern Hospital Inc	Minneapolis	MN
Adena Regional Medical Center	Chillicothe	OH
Alle Kiski Medical Center	Natrona Heights	PA
Allen Memorial Hospital	Waterloo	IA
Altru Hospital	Grand Forks	ND
Aspirus Wausau Hospital	Wausau	WI
Banner Good Samaritan Medical Center	Phoenix	AZ
Baptist Medical Center South	Montgomery	AL
Battle Creek Health System	Battle Creek	MI
Bay Area Medical Center	Marinette	WI
Bellin Memorial Hospital	Green Bay	WI
Bethesda North Hospital	Cincinnati	OH
Blake Medical Center	Bradenton	FL
Blanchard Valley Regional Health Center	Findlay	OH
Boone Hospital Center	Columbia	MO
Brigham and Womens Hospital	Boston	MA
Cape Cod Hospital	Hyannis	MA
Capital Medical Center	Olympia	WA
Carle Foundation Hospital	Urbana	IL
Central DuPage Hospital	Winfield	IL
Central Florida Regional Hospital	Sanford	FL
Charleston Area Medical Center	Charleston	WV
Christus Spohn Hospital Corpus Christi	Corpus Christi	TX
Citizens Medical Center	Victoria	TX
Clearfield Hospital	Clearfield	PA
Cleveland Clinic Florida Hospital Naples	Naples	FL
Cleveland Clinic Foundation	Cleveland	OH
Cleveland Clinic Hospital	Weston	FL
Columbia Hospital	Milwaukee	WI
Community Hospital of The Monterey Peninsula	Monterey	CA
Community Hospital, The	Munster	IN
Community Medical Center	Toms River	NJ

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Hospital	City	State
Community Medical Center	Scranton	PA
Community Memorial Hospital	Menomonee Falls	WI
Covenant Healthcare	Saginaw	MI
Danbury Hospital	Danbury	CT
Deaconess Hospital	Evansville	IN
Deaconess Hospital	Cincinnati	OH
Deaconess Medical Center	Spokane	WA
Decatur Memorial Hospital	Decatur	IL
Detar Hospital Navarro	Victoria	TX
Doctors Hospital of Dallas	Dallas	TX
Doctors Hospital of Sarasota	Sarasota	FL
Dubois Regional Medical Center	Dubois	PA
Duncan Regional Hospital Inc	Duncan	OK
Durham Regional Hospital	Durham	NC
E M H Regional Medical Center	Elyria	OH
East Texas Medical Center	Tyler	TX
East Texas Medical Center Athens	Athens	TX
Eisenhower Medical Center	Rancho Mirage	CA
El Centro Regional Medical Center	El Centro	CA
El Dorado Hospital	Tucson	AZ
Elkhart General Hospital	Elkhart	IN
Englewood Community Hospital	Englewood	FL
Enloe Medical Center	Chico	CA
Ephrata Community Hospital	Ephrata	PA
Evangelical Community Hospital	Lewisburg	PA
Fairview Park Hospital	Dublin	GA
Finley Hospital	Dubuque	IA
Firsthealth Moore Regional Hospital	Pinehurst	NC
Flagler Hospital	Saint Augustine	FL
Florida Hospital	Orlando	FL
Flowers Hospital	Dothan	AL
Fort Walton Beach Medical Center	Ft Walton Beach	FL
French Hospital Medical Center	San Luis Obispo	CA
Gadsden Regional Medical Center	Gadsden	AL
Genesys Regional Medical Center	Grand Blanc	MI
Glendale Memorial Hospital and Health Center	Glendale	CA

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Hospital	City	State
Good Samaritan Hospital	Lebanon	PA
Good Samaritan Hospital And Rehabilitation Center	Puyallup	WA
Good Samaritan Regional Health Center	Mount Vernon	IL
Grant Medical Center	Columbus	OH
Great River Medical Center	West Burlington	IA
Greenview Regional Hospital	Bowling Green	KY
Gulf Coast Medical Center	Panama City	FL
Hackley Hospital	Muskegon	MI
Healtheast St Johns Hospital	Maplewood	MN
Healtheast St Joseph's Hospital	Saint Paul	MN
Heartland Regional Medical Center	Saint Joseph	MO
Holland Community Hospital	Holland	MI
Holmes Regional Medical Center/Palm Bay Community Hospital	Melbourne	FL
Holy Family Hospital	Spokane	WA
Hospital of St Raphael	New Haven	CT
Indian River Memorial Hospital Inc	Vero Beach	FL
Innovis Health	Fargo	ND
Integris Bass Baptist Health Center	Enid	OK
Iowa Methodist Medical Center	Des Moines	IA
Jersey Shore University Medical Center	Neptune	NJ
JFK Medical Center	Atlantis	FL
Lancaster General Hospital	Lancaster	PA
Lapeer Regional Medical Center	Lapeer	MI
Lawrence And Memorial Hospital	New London	CT
Lee Memorial Hospital	Fort Myers	FL
Leesburg Regional Medical Center	Leesburg	FL
Lima Memorial Health System	Lima	OH
Lincoln General Hospital	Ruston	LA
Main Line Hospital Bryn Mawr Campus	Bryn Mawr	PA
Manatee Memorial Hospital	Bradenton	FL
Marquette General Health System	Marquette	MI
Martha Jefferson Hospital	Charlottesville	VA
Mary Greeley Medical Center	Ames	IA
Mayo Clinic Hospital	Phoenix	AZ
Mclaren Regional Medical Center	Flint	MI

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Hospital	City	State
Medical Center Beaver PA	Beaver	PA
Memorial Healthcare System Inc	Chattanooga	TN
Memorial Hospital of Burlington	Burlington	WI
Memorial Hospital of Carbondale	Carbondale	IL
Memorial Hospital of South Bend	South Bend	IN
Mercy General Hospital	Sacramento	CA
Mercy Hospital	Coon Rapids	MN
Mercy Hospital Anderson	Cincinnati	OH
Mercy Hospital Scranton	Scranton	PA
Mercy Hospital Western Hills	Cincinnati	OH
Mercy Medical Center Clinton	Clinton	IA
Mercy Medical Center Dubuque	Dubuque	IA
Mercy Medical Center North Iowa	Mason City	IA
Mercy Medical Center of Oshkosh Inc	Oshkosh	WI
Mercy Medical Center of Springfield	Springfield	OH
Mercy Medical Center Sioux City	Sioux City	IA
Mercy Memorial Health Center	Ardmore	OK
Meridia Euclid Hospital	Euclid	OH
Middletown Regional Hospital	Middletown	OH
MidMichigan Medical Center-Midland	Midland	MI
Mills Peninsula Health Services	Burlingame	CA
Mission Hospitals	Asheville	NC
Monongalia County General Hospital	Morgantown	WV
Morton Plant Hospital	Clearwater	FL
Mount Nittany Medical Center	State College	PA
Munroe Regional Medical Center	Ocala	FL
Munson Medical Center	Traverse City	MI
Naples Community Hospital	Naples	FL
North Arkansas Regional Medical Center	Harrison	AR
North Ridge Medical Center	Fort Lauderdale	FL
Northwest Medical Center UPMC	Seneca	PA
Oakwood Hospital and Medical Center Dearborn	Dearborn	MI
Ocean Medical Center	Brick	NJ
Oconee Memorial Hospital	Seneca	SC
O'Connor Hospital	San Jose	CA
Palos Community Hospital	Palos Heights	IL

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Hospital	City	State
Park Nicollet Health Services	Saint Louis Park	MN
Parma Community General Hospital	Parma	OH
Passavant Area Hospital	Jacksonville	IL
Piedmont Hospital	Atlanta	GA
Poudre Valley Hospital	Fort Collins	CO
Presbyterian Hospital of Dallas	Dallas	TX
Providence Everett Medical Center	Everett	WA
Providence Health Center	Waco	TX
Providence St Vincent Medical Center	Portland	OR
Queen of The Valley	Napa	CA
Rapides Regional Medical Center	Alexandria	LA
Reading Hospital and Medical Center	Reading	PA
Regional Medical Center Bayonet Point	Hudson	FL
Reid Hospital and Health Care Services	Richmond	IN
Resurrection Medical Center	Chicago	IL
Rex Hospital	Raleigh	NC
Rideout Memorial Hospital	Marysville	CA
Rio Grande Regional Hospital	Mcallen	TX
Riverside Medical Center	Kankakee	IL
Riverside Methodist Hospital	Columbus	OH
Rogue Valley Medical Center	Medford	OR
Rowan Regional Medical Center	Salisbury	NC
Sacred Heart Medical Center	Spokane	WA
Saint Josephs Hospital Of Atlanta	Atlanta	GA
Saint Luke's Hospital of Kansas City	Kansas City	MO
Saint Vincent Health System	Erie	PA
Salina Regional Health Center	Salina	KS
Salinas Valley Memorial Hospital	Salinas	CA
San Angelo Community Medical Center	San Angelo	TX
Sarasota Memorial Hospital	Sarasota	FL
Scott and White Memorial Hospital	Temple	TX
Sierra Nevada Memorial Hospital	Grass Valley	CA
Southeast Alabama Medical Center	Dothan	AL
Southwest General Health Center	Middleburg Heights	OH
SSM St Joseph Health Center	Saint Charles	MO
St Agnes Hospital	Fond Du Lac	WI

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Hospital	City	State
St Alexius Medical Center	Bismarck	ND
St Charles Medical Center Bend	Bend	OR
St Clair Memorial Hospital	Pittsburgh	PA
St Cloud Hospital	Saint Cloud	MN
St David's Hospital	Austin	TX
St Francis Health Center	Topeka	KS
St Francis Hospital and Health Center	Blue Island	IL
St Francis Hospital and Medical Center	Hartford	CT
St Francis Medical Center	Monroe	LA
St John West Shore Hospital	Westlake	OH
St John's Hospital	Springfield	IL
St Johns Mercy Hospital	Washington	MO
St Johns Regional Medical Center	Oxnard	CA
St Joseph Hospital	Bellingham	WA
St Joseph Medical Center	Towson	MD
St Joseph Mercy Hospital	Ann Arbor	MI
St Joseph's Hospital	Marshfield	WI
St Jude Medical Center	Fullerton	CA
St Luke's Hospital	Jacksonville	FL
St Luke's Hospital	Maumee	OH
St Luke's Hospital of Duluth	Duluth	MN
St Luke's Medical Center	Milwaukee	WI
St Luke's Regional Medical Center	Boise	ID
St Marks Hospital	Salt Lake City	UT
St Mary Medical Center	Walla Walla	WA
St Marys Hospital	Rochester	MN
St Mary's Hospital Medical Center	Madison	WI
St Mary's Hospital Medical Center	Green Bay	WI
St Mary's Medical Center	Duluth	MN
St Mary's Medical Center Hobart	Hobart	IN
St Mary's Regional Medical Center	Enid	OK
St Peters Hospital	Albany	NY
St Thomas Hospital	Nashville	TN
St Vincent Hospital and Health Services	Indianapolis	IN
St Vincent Medical Center	Los Angeles	CA
St Vincents Mercy Medical Center	Toledo	OH

*May not be used without a licensing agreement from Health Grades, Inc.

Hospital	City	State
St. Mary Mercy Hospital	Livonia	MI
Summa Health System	Akron	OH
Texoma Medical Center	Denison	TX
Thibodaux Regional Medical Center	Thibodaux	LA
Toledo Hospital, The	Toledo	OH
Trinity Hospitals	Minot	ND
Tuomey Healthcare System	Sumter	SC
United Hospitals Inc	Saint Paul	MN
United Regional Health Care System	Wichita Falls	TX
UPMC Lee Regional	Johnstown	PA
UPMC Mckeesport Hospital	Mc Keesport	PA
UPMC Passavant	Pittsburgh	PA
UPMC Presbyterian Shadyside	Pittsburgh	PA
UPMC St Margaret	Pittsburgh	PA
Virginia Baptist Hospital and Lynchburg General	Lynchburg	VA
Walls Regional Hospital	Cleburne	TX
Watauga Medical Center	Boone	NC
Waukesha Memorial Hospital	Waukesha	WI
Wellmont Holston Valley Medical Center	Kingsport	TN
Wesley Medical Center	Wichita	KS
Willis Knighton Bossier Health Center	Bossier City	LA
Willis-Knighton Medical Center	Shreveport	LA
Winchester Medical Center Inc	Winchester	VA
Wooster Community Hospital	Wooster	OH
WVHCS Hospital Inc	Wilkes-Barre	PA
Yavapai Regional Medical Center	Prescott	AZ
York Hospital	York	PA

*May not be used without a licensing agreement from Health Grades, Inc.

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 (2002 – 2004 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 CMS MedPAR data 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 Version 2.1, Revision 3a, of the Patient Safety Indicator (PSI) software developed by the Agency for Healthcare Research and Quality (AHRQ) and downloaded from www.qualityindicators.ahrq.gov/data/hcup/psi.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 (2002–2004).

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

Based on AHRQ's recommendation, HealthGrades excluded three additional indicators:

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

Data Exclusions

Because of a recent DRG reclassification by CMS, HealthGrades made one modification to the data. Because ICD-9 diagnosis code 436—acute but ill-defined cerebrovascular disease—was recently reclassified from DRG 14 to DRG 15, this relatively high mortality patient group was included in AHRQ's PSI "Low Mortality DRG" denominator in Version 2.1, Revision 3a. In order to be consistent with AHRQ's definition of "Low Mortality DRG" (which is a DRG with an average inhospital mortality rate less than 0.5% nationally), HealthGrades excluded patients with ICD-9 436 from this PSI. Also, 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.

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 adjusts 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 (2002–2004) 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 in to two peer groups: teaching and non-teaching. To identify the teaching peer group, HealthGrades used the Medicare Cost Report (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 2004 were also classified as teaching hospitals. Independent verification by phone was used for a few hospitals.

5. To be ranked on overall patient safety performance assessment, hospitals had to be rated in at least 19 of 28 HealthGrades cohorts and have a current overall HealthGrades star rating of at least 2.5. The final data set included 761 teaching hospitals and 833 non-teaching hospitals.

6. HealthGrades identified both teaching and non-teaching hospitals in the top 15 percent as "best performing." These 238 hospitals represent less than five percent of the total hospitals evaluated.

	Number of Best-Performing Providers
Teaching Hospitals	114
Non-Teaching Hospitals	124

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 levels for case mix index. Hospitals were categorized according to their 2004 index as follows.

CMI Index

CMI Index	CMI Group	Number of "Best-Performing" Hospitals
0.00 < CMI < 1.25	1	16
1.25 < CMI < 1.35	2	43
1.35 < CMI < 1.45	3	31
1.45 < CMI < 1.55	4	33
1.55 < CMI < 1.65	5	40
1.65 < CMI < 1.75	6	27
1.75 < CMI < 1.90	7	29
CMI > 1.90	8	19

Appendix D. Patient Safety Incident Rates and Associated Mortality Among Medicare Beneficiaries 2002-2004

Patient Safety Incident	Year	Number of Incidents	Total Cases Evaluated	Rate per 1000	Associated Mortality*	% Change in Rate (2002 - 2004)
Complications of Anesthesia	2002	821	3,260,499	0.252	11	16.72%
	2003	749	3,369,858	0.222	8	
	2004	729	3,476,578	0.210	7	
	2002-2004	2,299	10,106,935	0.227	26	
Death in low mortality DRGs	2002	3,585	1,265,606	2.833	3,585	4.07%
	2003	3,158	1,131,631	2.791	3,158	
	2004	3,140	1,155,546	2.717	3,140	
	2002-2004	9,883	3,552,783	2.782	9,883	
Decubitus ulcer	2002	169,642	5,445,497	31.153	21,668	-9.44%
	2003	181,658	5,521,181	32.902	22,338	
	2004	191,529	5,617,917	34.093	22,390	
	2002-2004	542,829	16,584,595	32.731	66,396	
Failure to rescue	2002	66,905	446,934	149.698	66,905	13.00%
	2003	67,727	485,249	139.572	67,727	
	2004	69,912	536,810	130.236	69,912	
	2002-2004	204,544	1,468,993	139.241	204,544	
Foreign body left in during procedure	2002	898	12,956,574	0.069	48	-0.18%
	2003	879	13,237,825	0.066	31	
	2004	945	13,609,568	0.069	41	
	2002-2004	2,722	39,803,967	0.068	120	
Iatrogenic pneumothorax	2002	11,313	11,775,191	0.961	1,950	4.44%
	2003	11,370	12,017,371	0.946	1,961	
	2004	11,358	12,371,447	0.918	1,854	
	2002-2004	34,041	36,164,009	0.941	5,765	
Selected infections due to medical care	2002	32,748	10,758,229	3.044	4,219	-7.21%
	2003	35,638	11,000,539	3.240	4,348	
	2004	36,968	11,327,699	3.264	4,206	
	2002-2004	105,354	33,086,467	3.184	12,773	
Post-operative hip fracture	2002	1,190	2,103,195	0.566	138	-2.18%
	2003	1,252	2,147,390	0.583	147	
	2004	1,267	2,191,536	0.578	142	
	2002-2004	3,709	6,442,121	0.576	427	

Patient Safety Incident	Year	Number of Incidents	Total Cases Evaluated	Rate per 1000	Associated Mortality*	% Change in Rate (2002 - 2004)
Post-operative hemorrhage or hematoma	2002	7,704	3,243,491	2.375	481	8.60%
	2003	7,730	3,352,256	2.306	443	
	2004	7,507	3,457,975	2.171	384	
	2002-2004	22,941	10,053,722	2.282	1,308	
Post-operative physiologic and metabolic derangements	2002	2,268	1,681,737	1.349	507	-16.88%
	2003	2,575	1,752,708	1.469	536	
	2004	2,857	1,812,573	1.576	575	
	2002-2004	7,700	5,247,018	1.468	1,618	
Post-operative respiratory failure	2002	9,659	1,251,697	7.717	2,891	-9.03%
	2003	10,517	1,298,538	8.099	2,930	
	2004	11,297	1,342,764	8.413	2,951	
	2002-2004	31,473	3,892,999	8.085	8,772	
Post-operative pulmonary embolism or deep vein thrombosis	2002	37,224	3,223,939	11.546	4,468	-9.83%
	2003	40,605	3,328,082	12.201	4,430	
	2004	43,498	3,430,149	12.681	4,430	
	2002-2004	121,327	9,982,170	12.154	13,328	
Post-operative sepsis	2002	8,025	574,983	13.957	2,286	-24.69%
	2003	8,973	584,236	15.359	2,501	
	2004	10,128	581,952	17.403	2,555	
	2002-2004	27,126	1,741,171	15.579	7,342	
Post-operative wound dehiscence in abdominopelvic surgical patients	2002	2,167	573,204	3.781	325	10.39%
	2003	2,025	571,688	3.542	276	
	2004	1,934	570,861	3.388	250	
	2002-2004	6,126	1,715,753	3.570	851	
Accidental puncture or laceration	2002	39,798	12,939,946	3.076	2,966	7.24%
	2003	38,158	13,220,563	2.886	2,681	
	2004	38,776	13,591,093	2.853	2,578	
	2002-2004	116,732	39,751,602	2.937	8,225	
Transfusion Reaction	2002	66	12,956,713	0.005	4	13.45%
	2003	69	13,237,988	0.005	7	
	2004	60	13,609,739	0.004	1	
	2002-2004	195	39,804,440	0.005	12	
Totals	-	1,239,001	-	-	341,390	
			Less Double Counts		304,702	

Legend	
Improvement	
No Change	
Worsening	

*This is all-cause inhospital mortality among all U.S. patients that developed one or more patient safety incidents during hospitalization from 2002-2004.
** This is all U.S. inhospital mortality that is directly attributable to a patient safety incident as per Zhan and Miller's previous research11

Appendix E. Patient Safety Incidents and Their Attributable Mortality and Excess Charge Among Medicare Beneficiaries by PSI from 2002 - 2004

Patient Safety Indicator	Actual Number of National Incidents	Percentage of Total Number of Incidents	Attributable Mortality Rates**	Number of Deaths Attributable to a PSI (Attributable Mortality**)	Attributable Charge **	Excess Charge Attributable to a PSI** In Millions	Excess Cost Attributable to a PSI ^^ In Millions
Decubitus ulcer	542,829	43.81%	7.23%	39,247	$10,845	$5,886.98	$2,943.49
Failure to rescue*	204,544	16.51%	NA*	204,544	NA*	NA*	NA*
Post-op pulmonary embolism or deep vein thrombosis	121,327	9.79%	6.56%	7,959	$21,709	$2,633.89	$1,316.94
Accidental puncture or laceration	116,732	9.42%	2.16%	2,521	$8,271	$965.49	$482.75
Selected infections due to medical care	105,354	8.50%	4.31%	4,541	$38,656	$4,072.56	$2,036.28
Iatrogenic pneumothorax	34,041	2.75%	6.99%	2,379	$17,312	$589.32	$294.66
Post-op respiratory failure	31,473	2.54%	21.84%	6,874	$53,502	$1,683.87	$841.93
Post-op hemorrhage or hematoma	22,941	1.85%	3.01%	691	$21,431	$491.65	$245.82
Post-op hip fracture	3,709	0.30%	4.52%	168	$13,441	$49.85	$24.93
Post-op sepsis	27,126	2.19%	21.92%	5,946	$57,727	$1,565.90	$782.95
Death in low mortality DRGs*	9,883	0.80%	NA*	9,883	NA*	NA*	NA*
Post-op physiologic and metabolic derangements	7,700	0.62%	19.81%	1,525	$54,818	$422.10	$211.05
Post-op abdominal wound dehiscence	6,126	0.49%	9.63%	590	$40,323	$247.02	$123.51
Foreign body left in during procedure	2,722	0.22%	2.14%	58	$13,315	$36.24	$18.12
Complications of anesthesia	2,299	0.19%	0.00%	0	$1,598	$3.67	$1.84
Transfusion reaction	195	0.02%	4.31%	8	$18,929	$3.69	$1.85
Totals	1,239,001	-	-	286,934	-	$18,652.24	$9,326.12
Less Double Counts	-	-	-	250,246	-	-	-

*By definition, all patients with the event died and were excluded from Zahn and Miller's analysis on attributable mortality and cost associated with PSI incidents. Also, 0.5% of total deaths associated with Death in Low Mortality DRGs were excluded from the total.

**Based on previous research done by Zhan C and Miller MR. 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, McKenzie D. Practical options for estimating cost of hospital inpatient stays. J Health Care Finance. 2002; 29(1): 1-13.

Appendix F. Patient Safety Performance Across the U.S. (2002 – 2004)

State	Overall Safety Ranking*	Z-score Sum of 13 PSIs**	Avg O/E of 13 PSIs	Statistically Significant
MN	1	8.28	0.877	Yes
WI	2	8.16	0.879	Yes
IA	3	7.50	0.858	Yes
MI	4	7.07	0.934	Yes
KS	5	6.91	0.878	Yes
IN	6	6.27	0.936	Yes
OH	7	6.12	0.951	Yes
PA	8	5.80	0.956	Yes
SD	9	4.78	0.851	Yes
ND	10	4.77	0.839	Yes
MT	11	4.10	0.865	Yes
UT	12	4.08	0.885	Yes
FL	13	3.98	0.976	Yes
WA	14	3.92	0.932	Yes
CT	15	2.39	0.939	Yes
AZ	16	2.37	0.962	Yes
WV	17	2.33	0.960	No
ID	18	2.19	0.906	No
GA	19	1.44	0.989	No
ME	20	1.32	0.926	No
IL	21	.61	1.005	No
MA	22	.44	0.969	No
CO	23	.38	0.970	No
OK	24	.35	0.999	No
WY	25	.34	1.000	No
OR	26	.19	0.970	No
RI	27	-.02	0.975	No
LA	28	-.24	1.006	No
NC	29	-.75	0.998	No
MO	30	-.89	1.004	No
AL	31	-1.14	1.005	No
SC	32	-1.41	1.018	No

Appendix F. Patient Safety Performance Across the U.S. (2002 – 2004)—continued

State	Overall Safety Ranking*	Z-score Sum of 13 PSIs**	Avg O/E of 13 PSIs	Statistically Significant
DE	33	-1.48	1.005	No
MS	34	-1.53	1.015	No
VT	35	-1.65	1.011	No
AK	36	-1.90	1.101	No
NH	37	-1.97	1.015	No
TX	38	-2.40	1.016	No
VA	39	-2.42	1.024	No
KY	40	-2.75	1.045	No
NE	41	-2.76	1.042	No
CA	42	-3.05	1.020	Yes
HI	43	-3.78	1.128	Yes
AR	44	-4.31	1.043	Yes
MD	45	-4.57	1.060	Yes
NM	46	-5.53	1.153	Yes
DC	47	-5.55	1.157	Yes
TN	48	-7.16	1.077	Yes
NV	49	-12.01	1.295	Yes
NY	50	-12.88	1.084	Yes
NJ	51	-13.95	1.151	Yes

* Ranking was determined by most positive z-score sum (best) to most negative z- score sum (worst).

** Z-scores were calculated for each state for 13 PSIs and the 13 z-scores were summed.

Appendix G1. Death in Low Mortality DRG

State	Rate per 1000	Observed-to-Expected Ratio	Confidence Interval
AK	2.165	1.024	0.387 - 1.661
AL	2.190	0.866	0.766 - 0.966
AR	2.610	1.001	0.860 - 1.142
AZ	1.529	0.598	0.484 - 0.713
CA	2.564	0.933	0.868 - 0.999
CO	2.679	0.937	0.775 - 1.100
CT	2.515	0.883	0.736 - 1.031
DC	2.050	0.698	0.441 - 0.954
DE	2.836	0.998	0.676 - 1.320
FL	2.375	0.845	0.789 - 0.902
GA	3.122	1.209	1.088 - 1.331
HI	4.622	1.781	1.271 - 2.291
IA	2.663	1.023	0.872 - 1.174
ID	3.296	1.348	1.024 - 1.671
IL	2.230	0.765	0.701 - 0.829
IN	3.487	1.132	1.017 - 1.247
KS	2.751	0.934	0.792 - 1.076
KY	2.217	0.886	0.770 - 1.002
LA	3.042	1.021	0.906 - 1.136
MA	2.296	0.839	0.739 - 0.940
MD	2.233	0.803	0.694 - 0.912
ME	2.651	1.033	0.804 - 1.262
MI	2.645	0.859	0.785 - 0.934
MN	1.998	0.737	0.635 - 0.840
MO	2.456	0.920	0.814 - 1.025
MS	3.275	1.306	1.146 - 1.465
MT	2.785	0.959	0.715 - 1.202
NC	2.802	1.184	1.079 - 1.290
ND	4.056	1.180	0.865 - 1.495
NE	3.048	1.072	0.867 - 1.277
NH	3.087	1.053	0.764 - 1.342
NJ	3.569	1.130	1.037 - 1.224
NM	2.912	1.198	0.894 - 1.502

Appendix G1. Death in Low Mortality DRG—continued

State	Rate per 1000	Observed-to-Expected Ratio	Confidence Interval
NV	2.705	1.143	0.882 - 1.403
NY	3.427	1.229	1.156 - 1.303
OH	2.802	0.906	0.832 - 0.981
OK	2.711	1.005	0.870 - 1.139
OR	2.700	1.094	0.900 - 1.288
PA	2.588	0.854	0.789 - 0.918
RI	2.186	0.790	0.513 - 1.068
SC	3.034	1.323	1.167 - 1.479
SD	3.108	1.080	0.816 - 1.345
TN	3.169	1.245	1.124 - 1.366
TX	3.053	1.080	1.014 - 1.146
UT	2.941	1.130	0.861 - 1.398
VA	2.833	1.084	0.969 - 1.198
VT	3.704	1.566	1.017 - 2.115
WA	2.354	0.895	0.747 - 1.043
WI	2.588	0.870	0.764 - 0.976
WV	2.854	1.031	0.872 - 1.191
WY	1.904	0.718	0.362 - 1.073

Relative Risk Reduction Associated with Best State Compared to Worst State	66.41%

Appendix G2. Decubitus Ulcer

State	Rate per 1000	Observed-to-Expected Ratio	Confidence Interval
AK	27.589	1.048	0.961 - 1.134
AL	28.751	0.885	0.870 - 0.899
AR	29.379	0.923	0.904 - 0.941
AZ	26.790	0.840	0.821 - 0.860
CA	37.852	1.128	1.119 - 1.137
CO	24.807	0.821	0.796 - 0.846
CT	25.555	0.788	0.769 - 0.806
DC	59.768	1.588	1.544 - 1.632
DE	31.695	0.900	0.864 - 0.936
FL	33.035	1.020	1.011 - 1.028
GA	34.140	0.963	0.950 - 0.976
HI	20.607	0.640	0.602 - 0.678
IA	14.215	0.497	0.480 - 0.514
ID	17.442	0.620	0.583 - 0.657
IL	36.044	1.075	1.064 - 1.085
IN	25.031	0.743	0.731 - 0.755
KS	22.126	0.707	0.688 - 0.726
KY	29.890	0.920	0.904 - 0.935
LA	43.747	1.138	1.123 - 1.152
MA	25.708	0.904	0.889 - 0.919
MD	40.424	1.148	1.130 - 1.166
ME	20.158	0.728	0.699 - 0.757
MI	37.237	1.057	1.045 - 1.068
MN	15.479	0.551	0.535 - 0.567
MO	28.120	0.901	0.887 - 0.915
MS	32.491	1.058	1.039 - 1.078
MT	13.501	0.485	0.452 - 0.518
NC	32.940	1.042	1.029 - 1.055
ND	13.513	0.451	0.420 - 0.482
NE	18.318	0.616	0.591 - 0.640
NH	17.943	0.625	0.594 - 0.656
NJ	39.690	1.204	1.191 - 1.217
NM	30.070	1.001	0.963 - 1.039
NV	37.458	1.177	1.143 - 1.211

Appendix G2. Decubitus Ulcer—continued

State	Rate per 1000	Observed-to-Expected Ratio	Confidence Interval		
NY	46.332	1.459	1.449	-	1.470
OH	27.410	0.810	0.801	-	0.820
OK	33.475	0.930	0.913	-	0.947
OR	22.469	0.773	0.746	-	0.800
PA	27.702	0.848	0.840	-	0.857
RI	39.079	1.253	1.208	-	1.299
SC	31.062	0.958	0.942	-	0.974
SD	12.339	0.449	0.419	-	0.479
TN	33.747	1.038	1.025	-	1.052
TX	38.601	1.097	1.089	-	1.105
UT	22.488	0.731	0.698	-	0.765
VA	34.252	1.021	1.006	-	1.035
VT	14.101	0.535	0.490	-	0.579
WA	24.594	0.769	0.750	-	0.788
WI	22.473	0.749	0.734	-	0.765
WV	28.405	0.966	0.944	-	0.988
WY	25.025	0.907	0.837	-	0.977

Relative Risk Reduction Associated with Best State Compared to Worst State	71.73%

Appendix G3. Failure To Rescue

State	Rate per 1000	Observed-to-Expected Ratio	Confidence Interval
AK	142.489	1.221	1.076 - 1.366
AL	131.849	1.121	1.094 - 1.148
AR	131.721	1.165	1.124 - 1.205
AZ	107.918	0.844	0.814 - 0.874
CA	142.547	1.072	1.057 - 1.087
CO	97.114	0.811	0.774 - 0.848
CT	128.596	0.962	0.927 - 0.996
DC	130.893	1.024	0.966 - 1.083
DE	125.757	1.011	0.948 - 1.074
FL	118.114	0.908	0.894 - 0.922
GA	129.887	1.037	1.017 - 1.057
HI	175.359	1.310	1.220 - 1.400
IA	107.015	0.919	0.876 - 0.963
ID	117.725	1.022	0.939 - 1.105
IL	106.299	0.849	0.832 - 0.865
IN	113.445	0.921	0.898 - 0.945
KS	117.922	1.029	0.981 - 1.077
KY	104.600	0.857	0.832 - 0.881
LA	111.358	0.929	0.904 - 0.954
MA	114.594	0.922	0.894 - 0.949
MD	119.726	0.899	0.875 - 0.924
ME	118.820	0.997	0.934 - 1.059
MI	108.278	0.846	0.830 - 0.863
MN	95.881	0.782	0.751 - 0.813
MO	114.835	0.965	0.941 - 0.990
MS	137.706	1.227	1.189 - 1.264
MT	112.500	0.934	0.853 - 1.014
NC	124.571	1.047	1.027 - 1.067
ND	93.050	0.756	0.681 - 0.830
NE	121.730	1.037	0.980 - 1.094
NH	137.298	1.154	1.075 - 1.233
NJ	149.823	1.155	1.132 - 1.179
NM	126.076	1.045	0.985 - 1.105
NV	133.223	1.020	0.974 - 1.067

Appendix G3. Failure To Rescue—continued

State	Rate per 1000	Observed-to-Expected Ratio	Confidence Interval
NY	162.822	1.255	1.237 - 1.274
OH	99.514	0.791	0.775 - 0.806
OK	118.008	1.014	0.980 - 1.047
OR	133.662	1.060	1.009 - 1.110
PA	119.819	0.977	0.958 - 0.996
RI	129.115	0.971	0.901 - 1.041
SC	135.586	1.133	1.104 - 1.163
SD	107.299	0.912	0.834 - 0.990
TN	130.198	1.074	1.052 - 1.096
TX	123.299	0.980	0.966 - 0.994
UT	105.905	0.846	0.795 - 0.897
VA	133.761	1.067	1.043 - 1.091
VT	117.374	1.073	0.949 - 1.196
WA	129.812	0.991	0.958 - 1.024
WI	109.997	0.945	0.914 - 0.976
WV	104.269	0.903	0.867 - 0.938
WY	106.645	0.893	0.773 - 1.013

Relative Risk Reduction Associated with Best State Compared to Worst State	42.30%

Appendix G4. Foreign Body Left in During Procedure

State	Rate per 1000	Observed-to-Expected Ratio	90% Confidence Interval
AK	0.222	3.022	1.264 - 4.779
AL	0.075	1.145	0.917 - 1.374
AR	0.050	0.813	0.560 - 1.065
AZ	0.088	1.111	0.842 - 1.381
CA	0.088	1.246	1.109 - 1.384
CO	0.086	1.172	0.820 - 1.524
CT	0.073	1.011	0.726 - 1.296
DC	0.105	1.045	0.568 - 1.522
DE	0.059	0.784	0.296 - 1.271
FL	0.065	0.914	0.802 - 1.026
GA	0.063	0.888	0.712 - 1.063
HI	0.131	1.711	0.862 - 2.559
IA	0.070	1.047	0.751 - 1.342
ID	0.078	1.107	0.558 - 1.655
IL	0.063	1.029	0.874 - 1.184
IN	0.053	0.769	0.592 - 0.946
KS	0.064	0.968	0.667 - 1.269
KY	0.059	0.880	0.671 - 1.089
LA	0.051	0.846	0.631 - 1.061
MA	0.065	1.089	0.859 - 1.318
MD	0.102	1.422	1.157 - 1.687
ME	0.078	1.144	0.688 - 1.601
MI	0.062	0.873	0.727 - 1.019
MN	0.102	1.383	1.107 - 1.659
MO	0.065	0.914	0.728 - 1.101
MS	0.041	0.710	0.467 - 0.954
MT	0.113	1.556	0.916 - 2.196
NC	0.075	1.093	0.912 - 1.274
ND	0.075	0.874	0.395 - 1.353
NE	0.131	1.575	1.131 - 2.019
NH	0.066	0.893	0.428 - 1.357
NJ	0.054	0.859	0.687 - 1.032
NM	0.092	1.439	0.828 - 2.050
NV	0.102	1.357	0.858 - 1.856

Appendix G4. Foreign Body Left in During Procedure—continued

State	Rate per 1000	Observed-to-Expected Ratio	90% Confidence Interval
NY	0.060	0.910	0.784 - 1.036
OH	0.069	0.967	0.823 - 1.112
OK	0.070	1.123	0.838 - 1.409
OR	0.104	1.368	0.976 - 1.759
PA	0.068	1.041	0.897 - 1.186
RI	0.049	0.808	0.265 - 1.351
SC	0.069	0.997	0.758 - 1.237
SD	0.069	0.991	0.475 - 1.506
TN	0.061	0.873	0.696 - 1.050
TX	0.052	0.747	0.645 - 0.849
UT	0.110	1.224	0.774 - 1.675
VA	0.070	0.999	0.800 - 1.199
VT	0.070	1.009	0.267 - 1.751
WA	0.106	1.343	1.048 - 1.638
WI	0.071	0.962	0.749 - 1.176
WV	0.043	0.742	0.454 - 1.029
WY	0.250	4.104	2.300 - 5.908

Relative Risk Reduction Associated with Best State Compared to Worst State	82.69%

Appendix G5. Iatrogenic Pneumothorax

State	Rate per 1000	Observed-to-Expected Ratio	90% Confidence Interval
AK	1.539	1.530	1.174 - 1.886
AL	0.759	0.900	0.841 - 0.960
AR	1.216	1.452	1.356 - 1.548
AZ	1.120	1.059	0.983 - 1.135
CA	0.970	0.961	0.928 - 0.994
CO	1.369	1.435	1.321 - 1.548
CT	1.255	1.184	1.099 - 1.268
DC	1.429	1.277	1.111 - 1.442
DE	1.351	1.305	1.126 - 1.484
FL	1.026	1.014	0.981 - 1.047
GA	0.865	0.926	0.875 - 0.978
HI	0.957	0.908	0.732 - 1.084
IA	0.818	0.950	0.867 - 1.032
ID	0.864	1.028	0.866 - 1.190
IL	0.749	0.854	0.815 - 0.893
IN	0.793	0.820	0.768 - 0.871
KS	0.921	1.032	0.943 - 1.121
KY	0.790	0.882	0.822 - 0.942
LA	0.716	0.817	0.760 - 0.875
MA	1.082	1.249	1.181 - 1.316
MD	1.060	1.105	1.038 - 1.171
ME	1.123	1.272	1.131 - 1.413
MI	0.963	0.951	0.909 - 0.993
MN	0.828	0.866	0.802 - 0.930
MO	1.045	1.114	1.054 - 1.173
MS	0.598	0.801	0.726 - 0.875
MT	0.697	0.765	0.630 - 0.899
NC	0.896	1.001	0.951 - 1.051
ND	1.061	0.967	0.818 - 1.116
NE	1.423	1.323	1.203 - 1.442
NH	1.125	1.146	0.993 - 1.300
NJ	0.923	0.946	0.898 - 0.994
NM	0.924	1.130	0.970 - 1.289
NV	1.014	0.953	0.835 - 1.071

Appendix G5. Iatrogenic Pneumothorax—continued

State	Rate per 1000	Observed-to-Expected Ratio	90% Confidence Interval
NY	0.981	1.048	1.011 - 1.085
OH	1.068	1.063	1.021 - 1.105
OK	0.869	0.951	0.879 - 1.023
OR	1.126	1.167	1.060 - 1.274
PA	0.915	0.974	0.935 - 1.013
RI	1.071	1.171	0.995 - 1.348
SC	0.874	0.945	0.879 - 1.012
SD	0.727	0.847	0.703 - 0.990
TN	1.021	1.054	0.999 - 1.109
TX	0.949	1.001	0.967 - 1.034
UT	1.017	1.027	0.894 - 1.159
VA	0.866	0.926	0.871 - 0.982
VT	1.172	1.413	1.146 - 1.680
WA	1.043	0.998	0.924 - 1.073
WI	1.031	1.131	1.061 - 1.200
WV	0.793	0.979	0.887 - 1.071
WY	1.269	1.627	1.293 - 1.962

Relative Risk Reduction Associated with Best State Compared to Worst State	53.02%

Appendix G6. Selected Infections due to Medical Care

State	Rate per 1000	Observed-to-Expected Ratio	90% Confidence Interval
AK	2.857	0.999	0.822 - 1.176
AL	2.692	0.849	0.818 - 0.879
AR	2.608	0.990	0.944 - 1.036
AZ	4.143	1.161	1.116 - 1.206
CA	3.888	1.094	1.074 - 1.114
CO	3.788	1.277	1.214 - 1.340
CT	3.386	1.082	1.032 - 1.132
DC	5.393	0.918	0.853 - 0.984
DE	4.828	1.418	1.310 - 1.526
FL	3.367	1.064	1.045 - 1.084
GA	3.403	0.860	0.834 - 0.885
HI	4.012	1.075	0.969 - 1.181
IA	1.679	0.706	0.662 - 0.751
ID	1.673	0.715	0.631 - 0.799
IL	3.023	1.035	1.010 - 1.060
IN	2.778	0.834	0.805 - 0.863
KS	1.871	0.706	0.662 - 0.750
KY	2.512	0.827	0.794 - 0.859
LA	3.390	0.935	0.904 - 0.966
MA	3.218	1.305	1.261 - 1.348
MD	4.167	1.157	1.120 - 1.194
ME	2.452	0.946	0.872 - 1.020
MI	3.576	0.997	0.972 - 1.021
MN	2.149	0.767	0.730 - 0.804
MO	2.984	0.961	0.930 - 0.993
MS	2.744	0.987	0.942 - 1.031
MT	2.093	0.886	0.792 - 0.979
NC	3.300	0.971	0.945 - 0.998
ND	2.320	0.689	0.614 - 0.764
NE	2.372	0.782	0.724 - 0.839
NH	3.208	1.139	1.045 - 1.233
NJ	3.673	1.211	1.179 - 1.244
NM	2.814	0.918	0.841 - 0.994
NV	4.814	1.386	1.305 - 1.467

Appendix G6. Selected Infections due to Medical Care—continued

State	Rate per 1000	Observed-to-Expected Ratio	90% Confidence Interval
NY	3.215	1.130	1.106 - 1.153
OH	3.447	0.959	0.937 - 0.981
OK	2.316	0.781	0.744 - 0.819
OR	2.509	0.851	0.796 - 0.906
PA	2.907	0.999	0.976 - 1.023
RI	3.397	1.309	1.192 - 1.426
SC	3.327	0.992	0.955 - 1.030
SD	1.909	0.779	0.693 - 0.865
TN	3.502	1.086	1.055 - 1.118
TX	3.454	0.973	0.956 - 0.991
UT	2.524	0.805	0.737 - 0.873
VA	3.286	0.986	0.955 - 1.018
VT	2.291	1.007	0.865 - 1.149
WA	2.914	0.830	0.791 - 0.869
WI	2.922	1.034	0.995 - 1.074
WV	2.071	0.792	0.744 - 0.840
WY	1.320	0.634	0.502 - 0.767

Relative Risk Reduction Associated with Best State Compared to Worst State	55.29%

Appendix G7. Post-operative Hip Fracture

State	Rate per 1000	Observed-to-Expected Ratio	90% Confidence Interval
AK	0.172	0.378	0.000 - 0.999
AL	0.521	1.025	0.836 - 1.213
AR	0.481	0.918	0.682 - 1.154
AZ	0.613	1.098	0.873 - 1.324
CA	0.530	0.899	0.799 - 0.998
CO	0.384	0.725	0.471 - 0.979
CT	0.525	0.826	0.614 - 1.038
DC	0.489	0.872	0.489 - 1.256
DE	0.563	0.911	0.459 - 1.363
FL	0.662	1.123	1.020 - 1.227
GA	0.442	0.795	0.647 - 0.943
HI	0.779	1.648	0.831 - 2.466
IA	0.309	0.587	0.394 - 0.780
ID	0.348	0.727	0.304 - 1.150
IL	0.588	0.943	0.822 - 1.064
IN	0.563	0.955	0.785 - 1.126
KS	0.542	0.925	0.678 - 1.172
KY	0.605	1.184	0.957 - 1.410
LA	0.596	0.972	0.788 - 1.157
MA	0.701	1.197	0.988 - 1.406
MD	0.692	1.152	0.944 - 1.360
ME	0.568	1.095	0.682 - 1.508
MI	0.562	0.918	0.794 - 1.043
MN	0.481	0.936	0.730 - 1.142
MO	0.660	1.174	0.988 - 1.360
MS	0.445	0.891	0.647 - 1.135
MT	0.485	0.983	0.516 - 1.449
NC	0.576	1.141	0.970 - 1.312
ND	0.448	0.774	0.390 - 1.158
NE	0.439	0.786	0.510 - 1.061
NH	0.757	1.398	0.871 - 1.926
NJ	0.657	0.979	0.836 - 1.122
NM	0.542	1.126	0.648 - 1.604
NV	1.029	1.870	1.326 - 2.414

Appendix G7. Post-operative Hip Fracture—continued

State	Rate per 1000	Observed-to-Expected Ratio	90% Confidence Interval
NY	0.679	1.083	0.971 - 1.196
OH	0.598	1.002	0.877 - 1.127
OK	0.573	1.005	0.776 - 1.234
OR	0.433	0.851	0.571 - 1.130
PA	0.637	0.966	0.853 - 1.079
RI	0.651	0.976	0.492 - 1.460
SC	0.456	0.883	0.684 - 1.083
SD	0.358	0.664	0.300 - 1.028
TN	0.497	0.997	0.821 - 1.173
TX	0.674	1.156	1.049 - 1.263
UT	0.478	0.986	0.593 - 1.380
VA	0.543	0.963	0.789 - 1.137
VT	0.839	1.664	0.752 - 2.577
WA	0.471	0.885	0.665 - 1.104
WI	0.343	0.597	0.453 - 0.740
WV	0.608	1.114	0.809 - 1.420
WY	0.254	0.521	0.000 - 1.126

Relative Risk Reduction Associated with Best State Compared to Worst State	79.80%

Appendix G8. Post-operative Hemorrhage or Hematoma

State	Rate per 1000	Observed-to-Expected Ratio	90% Confidence Interval
AK	2.698	1.326	0.898 - 1.754
AL	2.926	1.242	1.163 - 1.321
AR	2.496	1.133	1.030 - 1.237
AZ	1.838	0.817	0.739 - 0.895
CA	2.484	1.084	1.040 - 1.128
CO	2.201	1.113	0.992 - 1.235
CT	2.450	1.048	0.949 - 1.147
DC	3.108	1.169	0.995 - 1.342
DE	2.891	1.268	1.047 - 1.489
FL	2.122	0.922	0.884 - 0.960
GA	2.296	0.985	0.920 - 1.050
HI	2.801	1.210	0.953 - 1.466
IA	2.274	1.119	1.015 - 1.223
ID	2.000	1.104	0.909 - 1.298
IL	2.380	1.040	0.987 - 1.094
IN	2.011	0.893	0.827 - 0.960
KS	1.952	0.889	0.791 - 0.987
KY	2.593	1.129	1.044 - 1.215
LA	2.480	1.010	0.931 - 1.089
MA	2.135	0.930	0.856 - 1.004
MD	2.675	1.091	1.011 - 1.171
ME	2.459	1.123	0.964 - 1.282
MI	2.374	1.033	0.978 - 1.087
MN	2.692	1.249	1.160 - 1.338
MO	2.284	1.005	0.937 - 1.073
MS	2.246	1.004	0.903 - 1.105
MT	2.043	1.044	0.862 - 1.226
NC	2.245	1.006	0.945 - 1.067
ND	2.165	0.958	0.787 - 1.128
NE	2.521	1.153	1.022 - 1.284
NH	2.873	1.267	1.076 - 1.459
NJ	2.291	0.936	0.875 - 0.997
NM	2.473	1.143	0.963 - 1.323
NV	2.489	1.127	0.960 - 1.293

Appendix G8. Post-operative Hemorrhage or Hematoma—continued

State	Rate per 1000	Observed-to-Expected Ratio	90% Confidence Interval
NY	2.150	0.913	0.870 - 0.957
OH	2.076	0.889	0.841 - 0.937
OK	2.298	1.057	0.961 - 1.154
OR	2.878	1.351	1.220 - 1.482
PA	2.017	0.862	0.817 - 0.907
RI	2.230	0.980	0.772 - 1.188
SC	2.126	0.949	0.868 - 1.029
SD	1.616	0.785	0.632 - 0.938
TN	2.143	0.936	0.872 - 1.001
TX	2.062	0.889	0.851 - 0.927
UT	1.980	0.992	0.848 - 1.136
VA	2.451	1.065	0.994 - 1.137
VT	2.483	1.246	0.944 - 1.548
WA	2.667	1.225	1.128 - 1.321
WI	2.346	1.067	0.991 - 1.143
WV	2.117	0.895	0.787 - 1.004
WY	1.837	0.997	0.681 - 1.313

Relative Risk Reduction Associated with Best State Compared to Worst State	41.91%

Appendix G9. Post-operative Physiologic and Metabolic Derangements

State	Rate per 1000	Observed-to-Expected Ratio	90% Confidence Interval
AK	0.979	0.704	0.231 - 1.177
AL	1.943	1.168	1.031 - 1.304
AR	1.310	0.971	0.806 - 1.136
AZ	1.434	1.092	0.932 - 1.251
CA	1.768	1.139	1.063 - 1.214
CO	0.927	0.772	0.605 - 0.939
CT	0.842	0.662	0.514 - 0.810
DC	1.980	1.020	0.752 - 1.289
DE	0.916	0.707	0.396 - 1.017
FL	1.349	1.032	0.957 - 1.106
GA	1.694	0.995	0.889 - 1.101
HI	1.215	0.640	0.348 - 0.932
IA	0.905	0.823	0.663 - 0.984
ID	0.356	0.416	0.200 - 0.633
IL	1.424	0.997	0.906 - 1.088
IN	2.071	1.279	1.150 - 1.407
KS	1.136	0.865	0.702 - 1.028
KY	2.124	1.367	1.214 - 1.520
LA	2.522	1.206	1.077 - 1.335
MA	1.010	0.810	0.674 - 0.946
MD	1.169	0.795	0.673 - 0.917
ME	0.576	0.539	0.317 - 0.761
MI	0.999	0.702	0.623 - 0.782
MN	1.158	0.819	0.708 - 0.931
MO	1.410	0.901	0.794 - 1.007
MS	1.298	0.979	0.788 - 1.171
MT	0.499	0.501	0.263 - 0.739
NC	1.124	0.798	0.695 - 0.900
ND	2.142	1.288	0.994 - 1.582
NE	1.464	1.099	0.896 - 1.303
NH	1.222	0.995	0.691 - 1.298
NJ	2.060	1.370	1.235 - 1.505
NM	2.121	1.330	1.020 - 1.639
NV	2.054	1.472	1.156 - 1.787

Appendix G9. Post-operative Physiologic and Metabolic Derangements—continued

State	Rate per 1000	Observed-to-Expected Ratio	90% Confidence Interval
NY	1.259	0.952	0.866 - 1.038
OH	1.169	0.763	0.687 - 0.839
OK	1.695	1.115	0.952 - 1.278
OR	0.980	0.804	0.637 - 0.970
PA	1.437	1.031	0.940 - 1.122
RI	1.102	0.888	0.483 - 1.293
SC	1.302	0.901	0.755 - 1.048
SD	1.517	1.228	0.909 - 1.547
TN	1.593	1.076	0.959 - 1.192
TX	2.128	1.130	1.065 - 1.195
UT	0.893	0.633	0.429 - 0.837
VA	1.358	0.883	0.773 - 0.993
VT	0.351	0.353	0.018 - 0.689
WA	1.275	0.834	0.715 - 0.953
WI	1.317	1.021	0.892 - 1.149
WV	1.833	1.248	1.008 - 1.488
WY	0.116	0.122	-0.079 - 0.323

Relative Risk Reduction Associated with Best State Compared to Worst State	91.70%

Appendix G10. Post-operative Respiratory Failure

State	Rate per 1000	Observed-to-Expected Ratio	90% Confidence Interval
AK	8.467	0.939	0.695 - 1.184
AL	7.745	0.925	0.862 - 0.988
AR	11.004	1.329	1.238 - 1.421
AZ	5.723	0.802	0.733 - 0.870
CA	6.890	0.907	0.872 - 0.942
CO	4.941	0.605	0.542 - 0.668
CT	7.734	1.061	0.971 - 1.151
DC	12.863	1.620	1.408 - 1.832
DE	8.525	1.079	0.905 - 1.253
FL	8.448	1.055	1.019 - 1.090
GA	9.400	1.056	1.000 - 1.112
HI	7.277	1.061	0.830 - 1.292
IA	5.859	0.821	0.748 - 0.893
ID	5.091	0.782	0.664 - 0.899
IL	9.078	1.084	1.038 - 1.130
IN	10.188	1.037	0.983 - 1.092
KS	6.769	0.817	0.744 - 0.890
KY	13.908	1.418	1.343 - 1.493
LA	12.027	1.083	1.018 - 1.148
MA	5.763	0.793	0.731 - 0.856
MD	7.162	0.909	0.844 - 0.974
ME	4.848	0.765	0.645 - 0.886
MI	6.670	0.852	0.810 - 0.895
MN	5.151	0.690	0.640 - 0.741
MO	11.926	1.292	1.229 - 1.356
MS	8.653	1.102	1.006 - 1.198
MT	6.533	0.862	0.736 - 0.987
NC	6.437	0.861	0.809 - 0.914
ND	3.187	0.390	0.303 - 0.476
NE	8.163	1.003	0.911 - 1.096
NH	5.372	0.715	0.593 - 0.837
NJ	8.170	1.080	1.014 - 1.145
NM	6.713	0.832	0.707 - 0.956
NV	8.742	1.047	0.921 - 1.174

Appendix G10. Post-operative Respiratory Failure—continued

State	Rate per 1000	Observed-to-Expected Ratio	90% Confidence Interval
NY	6.536	0.911	0.870 - 0.952
OH	9.547	1.126	1.079 - 1.172
OK	10.054	1.134	1.055 - 1.214
OR	5.375	0.741	0.668 - 0.815
PA	7.454	0.952	0.909 - 0.995
RI	5.843	0.925	0.723 - 1.126
SC	8.876	1.124	1.045 - 1.204
SD	5.214	0.747	0.631 - 0.862
TN	10.929	1.270	1.208 - 1.332
TX	11.533	1.236	1.200 - 1.273
UT	3.656	0.528	0.435 - 0.622
VA	8.505	1.056	0.996 - 1.116
VT	4.785	0.855	0.617 - 1.092
WA	6.197	0.810	0.751 - 0.870
WI	4.138	0.562	0.516 - 0.608
WV	8.839	1.036	0.930 - 1.143
WY	2.609	0.382	0.238 - 0.526

Relative Risk Reduction Associated with Best State Compared to Worst State	76.41%

Appendix G11. Post-operative Deep Vein Thrombosis and Pulmonary Embolus

State	Rate per 1000	Observed-to-Expected Ratio	90% Confidence Interval		
AK	7.364	0.651	0.524	-	0.778
AL	10.422	0.901	0.870	-	0.931
AR	9.639	0.880	0.839	-	0.921
AZ	11.402	0.950	0.913	-	0.986
CA	11.778	0.956	0.938	-	0.974
CO	12.154	1.053	1.004	-	1.102
CT	11.279	0.907	0.867	-	0.947
DC	19.996	1.326	1.248	-	1.404
DE	13.410	1.047	0.962	-	1.132
FL	10.805	0.900	0.883	-	0.916
GA	13.536	1.042	1.014	-	1.071
HI	8.549	0.654	0.574	-	0.733
IA	7.462	0.679	0.644	-	0.713
ID	8.619	0.847	0.775	-	0.919
IL	16.010	1.317	1.291	-	1.343
IN	11.075	0.875	0.847	-	0.903
KS	8.825	0.761	0.721	-	0.800
KY	10.949	0.906	0.872	-	0.939
LA	11.773	0.940	0.906	-	0.974
MA	10.830	0.898	0.866	-	0.930
MD	13.400	1.023	0.990	-	1.057
ME	9.293	0.794	0.736	-	0.852
MI	11.236	0.922	0.900	-	0.945
MN	9.944	0.840	0.809	-	0.871
MO	12.288	1.011	0.981	-	1.041
MS	10.978	0.966	0.922	-	1.010
MT	6.063	0.551	0.495	-	0.606
NC	11.807	0.991	0.965	-	1.017
ND	5.914	0.481	0.429	-	0.533
NE	10.897	0.874	0.826	-	0.922
NH	10.655	0.853	0.786	-	0.920
NJ	19.420	1.509	1.475	-	1.544
NM	15.890	1.446	1.356	-	1.536
NV	13.800	1.140	1.068	-	1.212

Appendix G11. Post-operative Deep Vein Thrombosis and Pulmonary Embolus—continued

State	Rate per 1000	Observed-to-Expected Ratio	90% Confidence Interval		
NY	15.286	1.230	1.208	-	1.252
OH	13.825	1.089	1.066	-	1.111
OK	8.068	0.695	0.662	-	0.729
OR	8.900	0.797	0.753	-	0.841
PA	13.782	1.121	1.098	-	1.143
RI	10.493	0.900	0.812	-	0.989
SC	11.707	1.000	0.963	-	1.036
SD	12.502	1.128	1.049	-	1.207
TN	11.683	0.964	0.935	-	0.992
TX	12.167	0.974	0.956	-	0.991
UT	11.853	1.011	0.951	-	1.071
VA	14.594	1.166	1.134	-	1.199
VT	10.682	0.946	0.835	-	1.056
WA	10.968	0.914	0.878	-	0.949
WI	9.711	0.819	0.790	-	0.848
WV	10.331	0.896	0.846	-	0.945
WY	8.726	0.877	0.750	-	1.005

Relative Risk Reduction Associated with Best State Compared to Worst State	68.13%

Appendix G12. Post-operative Sepsis

State	Rate per 1000	Observed-to-Expected Ratio	90% Confidence Interval
AK	7.333	0.475	0.296 - 0.654
AL	15.046	0.938	0.868 - 1.008
AR	16.723	1.020	0.937 - 1.102
AZ	15.135	1.024	0.934 - 1.113
CA	15.801	1.054	1.013 - 1.094
CO	10.858	0.770	0.683 - 0.856
CT	10.427	0.764	0.672 - 0.857
DC	13.852	0.907	0.753 - 1.061
DE	16.739	1.007	0.813 - 1.201
FL	16.479	1.120	1.079 - 1.161
GA	20.390	1.095	1.038 - 1.152
HI	10.261	0.686	0.500 - 0.871
IA	10.032	0.784	0.705 - 0.863
ID	9.448	0.826	0.675 - 0.976
IL	17.024	1.108	1.059 - 1.158
IN	19.956	1.081	1.022 - 1.141
KS	10.618	0.695	0.626 - 0.764
KY	21.995	1.350	1.273 - 1.428
LA	28.305	1.252	1.186 - 1.317
MA	8.572	0.630	0.566 - 0.695
MD	19.037	1.264	1.166 - 1.362
ME	6.700	0.551	0.435 - 0.667
MI	14.330	0.963	0.910 - 1.016
MN	6.910	0.525	0.476 - 0.573
MO	17.743	1.074	1.014 - 1.134
MS	16.839	0.971	0.888 - 1.053
MT	10.350	0.829	0.678 - 0.979
NC	11.605	0.818	0.763 - 0.874
ND	7.840	0.584	0.462 - 0.706
NE	12.111	0.862	0.768 - 0.956
NH	10.063	0.707	0.577 - 0.838
NJ	21.975	1.390	1.312 - 1.469
NM	20.568	1.295	1.140 - 1.450
NV	18.953	1.234	1.079 - 1.388

Appendix G12. Post-operative Sepsis—continued

State	Rate per 1000	Observed-to-Expected Ratio	90% Confidence Interval
NY	11.563	0.910	0.863 - 0.957
OH	13.970	0.897	0.850 - 0.943
OK	18.680	1.032	0.953 - 1.112
OR	7.770	0.575	0.498 - 0.651
PA	13.472	0.886	0.838 - 0.933
RI	10.258	0.850	0.626 - 1.074
SC	17.993	1.066	0.988 - 1.143
SD	6.871	0.523	0.409 - 0.637
TN	19.486	1.200	1.137 - 1.263
TX	22.381	1.162	1.129 - 1.196
UT	8.863	0.688	0.566 - 0.810
VA	17.021	1.053	0.990 - 1.117
VT	5.064	0.505	0.304 - 0.707
WA	9.801	0.674	0.612 - 0.736
WI	8.106	0.623	0.569 - 0.678
WV	13.183	0.864	0.760 - 0.969
WY	4.767	0.392	0.220 - 0.565

Relative Risk Reduction Associated with Best State Compared to Worst State	71.79%

Appendix G13. Post-operative Abdominal Wound Dehiscence

State	Rate per 1000	Observed-to-Expected Ratio	90% Confidence Interval
AK	3.819	1.000	0.418 - 1.581
AL	3.734	1.095	0.937 - 1.252
AR	3.127	0.960	0.770 - 1.151
AZ	4.097	1.115	0.938 - 1.292
CA	2.696	0.783	0.710 - 0.857
CO	4.083	1.118	0.899 - 1.336
CT	3.791	1.027	0.845 - 1.208
DC	5.018	1.580	1.113 - 2.047
DE	2.471	0.636	0.357 - 0.916
FL	2.896	0.768	0.699 - 0.837
GA	3.601	1.004	0.875 - 1.133
HI	4.429	1.341	0.835 - 1.847
IA	4.290	1.206	1.005 - 1.406
ID	4.349	1.239	0.879 - 1.599
IL	3.516	0.970	0.871 - 1.068
IN	3.154	0.834	0.717 - 0.951
KS	3.988	1.082	0.876 - 1.287
KY	3.685	0.981	0.829 - 1.133
LA	3.353	0.928	0.771 - 1.085
MA	3.666	1.025	0.882 - 1.169
MD	3.681	1.011	0.859 - 1.163
ME	3.883	1.056	0.788 - 1.325
MI	4.421	1.164	1.055 - 1.274
MN	4.208	1.250	1.084 - 1.416
MO	2.968	0.817	0.697 - 0.936
MS	3.806	1.191	0.966 - 1.416
MT	3.153	0.890	0.578 - 1.202
NC	3.501	1.022	0.904 - 1.139
ND	5.489	1.520	1.091 - 1.949
NE	4.802	1.369	1.092 - 1.646
NH	4.715	1.250	0.907 - 1.593
NJ	4.362	1.197	1.062 - 1.332
NM	3.710	1.083	0.752 - 1.414
NV	7.600	1.914	1.524 - 2.305

Appendix G13. Post-operative Abdominal Wound Dehiscence—continued

State	Rate per 1000	Observed-to-Expected Ratio	90% Confidence Interval
NY	3.587	1.059	0.967 - 1.151
OH	4.240	1.101	1.000 - 1.201
OK	4.111	1.139	0.952 - 1.325
OR	4.231	1.184	0.966 - 1.402
PA	3.315	0.916	0.824 - 1.007
RI	2.931	0.848	0.500 - 1.197
SC	3.257	0.964	0.803 - 1.125
SD	3.223	0.925	0.614 - 1.236
TN	4.080	1.185	1.038 - 1.332
TX	2.743	0.783	0.710 - 0.856
UT	3.188	0.897	0.648 - 1.147
VA	3.746	1.035	0.900 - 1.171
VT	3.418	0.969	0.509 - 1.429
WA	3.292	0.945	0.789 - 1.101
WI	3.659	1.050	0.908 - 1.191
WV	3.739	1.010	0.786 - 1.234
WY	3.018	0.819	0.343 - 1.296

Relative Risk Reduction Associated with Best State Compared to Worst State	66.76%

Appendix H. Comparisons Between Different Performance Categories (2002 through 2004)

		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* Associated with Excess Patient Safety Incidents Among All Non-Distinguished Hospitals	Excess Cost^^ Associated with Excess Patient Safety Incidents Among All Non-Distinguished Hospitals
Death in low mortality DRGs	0.947	0.717 (0.679-0.755)	1.018	1.234 (1.176-1.291)	41.90%	2,787	2,787	NA*	NA*
Decubitus ulcer	0.934	0.691 (0.686-0.696)	1.010	1.249 (1.241-1.257)	44.68%	167,719	12,126	$1,819	$909
Failure to rescue	0.961	0.862 (0.852-0.873)	1.012	1.056 (1.045-1.067)	18.37%	21,507	21,507	NA*	NA*
Foreign body left in during procedure	0.981	0.670 (0.606-0.735)	0.996	1.456 (1.348-1.565)	53.98%	897	19	$12	$6
Iatrogenic pneumothorax	1.008	0.831 (0.810-0.852)	0.987	1.296 (1.267-1.326)	35.88%	5,749	402	$100	$50
Selected infections due to medical care	0.991	0.696 (0.685-0.707)	1.004	1.348 (1.331-1.365)	48.37%	31,997	1,379	$1,237	$618
Post-op hip fracture	0.975	0.738 (0.681-0.796)	1.004	1.343 (1.252-1.434)	45.05%	970	44	$13	$7
Post-op hemorrhage or hematoma	0.997	0.783 (0.760-0.807)	1.009	1.240 (1.206-1.274)	36.85%	4,966	149	$106	$53
Post-op physiologic and metabolic derangements	0.981	0.656 (0.620-0.692)	0.979	1.500 (1.440-1.559)	56.27%	2,647	524	$145	$73

Appendix H. Comparisons Between Different Performance Categories (2002 through 2004)—continued

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* Associated with Excess Patient Safety Incidents Among All Non-Distinguished Hospitals	Excess Cost^^ Associated with Excess Patient Safety Incidents Among All Non-Distinguished Hospitals
Post-op respiratory failure	1.012	0.741 (0.721-0.760)	0.995	1.368 (1.337-1.398)	45.83%	8,149	1,780	$436	$218
Post-op pulmonary embolism or deep vein thrombosis	1.000	0.811 (0.800-0.821)	0.982	1.367 (1.350-1.380)	40.67%	22,960	1,506	$498	$249
Post-op sepsis	0.977	0.704 (0.682-0.725)	1.003	1.346 (1.313-1.379)	47.70%	8,027	1,760	$463	$232
Post-op wound dehiscence in abdominopelvic surgical patients	0.944	0.712 (0.667-0.758)	1.005	1.344 (1.273-1.416)	47.02%	1,759	169	$71	$35
Average relative risk increase in and # of potentially avoidable patient safety incidents, death, charge and cost associated with All Non-Distinguished hospitals compared to Distinguished Hospitals.					43.27%	280,134	44,153	$4,901	$2,450

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

**Based on previous research done by Zhan C and Miller MR. 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, McKenzie D. Practical options for estimating cost of hospital inpatient stays. J Health Care Finance. 2002; 29(1): 1-13.