Third Annual Report on Women's Health Outcomes in U.S. Hospitals

A HealthGrades Study

HEALTHGRADES®

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Introduction

Heart disease and stroke remain the first and third leading causes of death among American women.[1] Overall, cardiovascular disease (CVD), which includes these two causes, continues to claim the lives of more than 500,000 women each year in the United States—this equates to approximately 40 percent of all female deaths, and more than all types of cancers combined.[2]

For nearly three decades, the focus on CVD diagnosis and treatment was oriented towards men. Although a recent study by Mosca et al. demonstrated that women have increased awareness of signs and symptoms of CVD unique to them, most of these women receive nearly 75 percent of this information through the media and other non-medical sources.[3, 4]

Women have worse outcomes than men

Most importantly, women fair worse from heart disease and stroke than their male counterparts, partly due to under-recognition by healthcare providers of atypical signs and symptoms associated with CVD, but also due to underutilization and timeliness of critical diagnostic tests and life-saving therapies. [5-8] In addition, hospitals vary widely in their processes of care, like timeliness of diagnosis and treatment, as well as their outcomes, such as mortality. Consequently, outcomes in women admitted to hospitals with heart disease or stroke can vary substantially from their male counterparts who received their care from the same institution.

Understanding the important need to specifically address women's health, HealthGrades has studied heart disease and stroke outcomes in women admitted to over 2,100 U.S. hospitals for the third year in a row. This study identifies the Best-performing hospitals for women's health and highlights the differences and trends in mortality outcomes between the top and bottom hospitals among 17 states during 2002 through 2004.

Identifying Outcome Trends and the 5-star Hospitals

Given the significant gap in awareness and outcomes, access to information regarding CVD outcomes is critical in raising awareness through transparency. The aim of this study was to:

- Identify the Best-performing U.S. hospitals in women's health from 2002 through 2004.
- Examine outcome trends for the inhospital treatment of heart disease and stroke in women from 2002 through 2004.

Assessing Women's Health Outcomes Performance

In order to assess comparative outcomes by hospital, risk-adjusted inhospital mortality was calculated for every hospital discharge related to cardiovascular disease from 17 states from 2002 through 2004. These 17 states represented 55.9 percent of the U.S. population (based on 2004 U.S. census) and more than 2.1 million hospitalizations. In this study, cardiovascular disease (CVD) includes:

- Coronary artery bypass graft (CABG) surgery
- Valve replacement surgery
- Percutaneous coronary interventions (PCI)
- Acute myocardial infarction (AMI)
- Heart failure (HF)
- Stroke

The 17 states evaluated were:

- Arizona
- California
- Florida
- Iowa
- Maine
- Maryland
- Massachusetts
- Nevada
- New Jersey
- New York
- North Carolina
- Pennsylvania
- Texas
- Utah
- Virginia
- Washington
- Wisconsin

In order for a hospital to be evaluated for overall women's health outcomes, the hospital had to have all of the following:

- An open heart program in 2004.
- At least 30 female discharges over the three years for at least four of the five cardiac disease cohorts and also at least 30 female stroke discharges over the same period.
- Transferred out less than 14.3 percent of stroke patients to another acute care hospital (implying that these transfer hospitals probably have onsite neurosurgical services).

Full details on the risk adjustment and overall women's health outcomes performance assessment can be found in the *Methodology* section of this study.

Summary of Findings

In our study, we analyzed more than 2.1 million hospitalizations and found:

- Women's cardiac and stroke risk-adjusted inhospital mortality rates for all hospitals in the 17 states studied improved, on average, 9.54 percent from 2002 through 2004. All performance levels (Best, Average and Poor) saw improvements.

  - The greatest improvement was seen in Heart Failure (15.34%).

- Best-performing hospitals in the 17 states studied showed a significantly lower risk-adjusted mortality across the cardiovascular disease cohorts studied from 2002 through 2004.

  - Best-performing hospitals consistently outperformed other hospitals and had lower risk-adjusted mortality across cardiac and stroke cohorts studied as compared to Poor-performing hospitals for each of three years studied.

  - Women admitted with cardiovascular disease to **Best-performing** hospitals had an overall **risk-adjusted inhospital mortality rate that was almost 40 and 23 percent lower** than Poor and Average performing hospitals, respectively. If all other hospitals studied performed at the level of Best-performing hospitals, **30,548 additional women may have survived** their hospitalization for heart disease and stroke.

  - The **greatest quality gap** between Best and Poor performing hospitals was noted for **Coronary Bypass Surgery**, where there was a relative difference of almost 50 percent in risk-adjusted mortality associated with Best-performing hospitals as compared to Poor-performing hospitals.

  - Wide variations in risk-adjusted outcomes were found, ranging from 20 percent better than expected to almost 15 percent worse than expected. For example, Arizona hospitals had a 27.43-percent lower CVD risk-adjusted mortality compared to New York during 2002-2004.

Methodology

To help consumers evaluate and compare hospital performance for women's health, HealthGrades analyzed patient outcome data for virtually every hospital in 17 states. The state data contained inpatient records for all patients. The HealthGrades ratings are available on the Internet at www.healthgrades.com.

Data Acquisition

HealthGrades purchased the initial patient-level data from each individual state. The data represent three years of discharges. These data were chosen because they represent all discharges for the associated states. The 17 states were as follows:

- Arizona
- California
- Florida
- Iowa
- Maine
- Maryland
- Massachusetts
- Nevada
- New Jersey
- New York
- North Carolina
- Pennsylvania
- Texas
- Utah
- Virginia
- Washington
- Wisconsin

Methodology for Women's Health

The Women's Health ratings were based upon a hospital's inhospital risk-adjusted cardiac/stroke mortality and maternity care rating. (Maternity Care methodology can be found at www.HealthGrades.com.) Hospitals had to have an overall rating from each area to be considered; however, this particular study focused on our findings specific to cardiac and stroke mortality outcomes in women only. (Maternity care-related outcomes research will be published in July 2006.)

Methodology for Cardiac and Stroke Mortality Ratings for Women

HealthGrades analyzed the following six procedures/diagnoses (cohorts) for each hospital's female patients:

- Coronary bypass surgery (CABG)
- Valve replacement surgery
- Percutaneous coronary interventions (PCI)
- Acute myocardial infarction (AMI)
- Heart failure (HF)
- Stroke

Data Analysis

For each patient cohort, HealthGrades developed a list of specific procedures (e.g., quadruple bypass surgery), a list of risk factors, and a list of post-surgical complications. These latter two lists were developed in two steps:

1. HealthGrades identified all diagnoses occurring in more than 0.5 percent of the patients for the current analysis.

2. HealthGrades used a team of clinical and coding experts to identify the complications in the list created in step one.

3. Some diagnosis codes were merged together (e.g., primary and secondary pulmonary hypertension) to minimize the impact of coding differences. Outcomes were binary, with patients recorded as either alive or expired. A list of the codes used to identify patients in the six cohorts can be found in Appendix A.

Risk-Adjustment Methodology

The purpose of risk adjustment is to obtain fair statistical comparisons between disparate populations or groups. Significant differences in demographic and clinical risk factors are found among patients treated in different hospitals. Risk adjustment of the data is needed to make accurate and valid comparisons of clinical outcomes at different hospitals.

Fair and valid comparisons between hospital providers can be made only to the extent that the risk-adjustment methodology considers important differences in patient demographic and clinical characteristics. The risk-adjustment methodology used by HealthGrades defines risk factors as those clinical demographic variables that influence patient outcomes in significant and systematic ways. Risk factors may include age, specific procedure performed, and comorbid conditions such as hypertension, chronic renal failure, congestive heart failure, and diabetes.

Statistical Models for Predicting Mortality

1. Unique statistical, female only models were developed for each patient cohort using logistic regression.

2. Comorbid diagnoses (e.g., hypertension, chronic renal failure, anemia, diabetes), demographic characteristics (e.g., age), and specific procedures (for procedure-based cohorts) were classified as possible risk factors. HealthGrades used logistic regression to determine which of these were actually risk factors and to what extent they were correlated with mortality. A risk factor stayed in the model if it had a positive odds ratio and was also statistically significant in explaining variation. Potential risk factors with odds ratios less than one are removed from the model except in a few cases where the risk has been previously accepted in the medical literature. Complications were not counted as risk factors as they were considered a result of care received during the admission.

3. The statistical models were checked for validity and finalized. All of the models were highly significant, with p values not greater than 0.0001. These cohort specific models were then used to estimate the probability of death for each patient in the cohort.

4. Patients were then aggregated for each hospital to obtain the predicted outcome for each hospital.

Assignment of Ratings for Cardiac/Stroke Services for Women

For each hospital, the actual mortality was summed for all of the six patient cohorts and the predicted mortality (risk adjusted) was summed for all of the six patient cohorts. The predicted mortality rate was compared to the actual mortality rate for each hospital and tested for statistical significance at 90 percent (using a z-score and a two-tailed test).

The following rating system was applied to the comparison of the actual mortality for all six patient cohorts and the predicted mortality rate for all six patient cohorts.

- **Best performing** – Actual performance was better than predicted and the difference was statistically significant.
- **Average performing** – Actual performance was not significantly different from what was predicted.
- **Poor performing** – Actual performance was worse than predicted and the difference was statistically significant.

In order for a hospital to be evaluated for overall women's health outcomes, the hospital had to have all of the following:

- An open heart program in 2004.
- At least 30 female discharges over the three years for at least four of the five cardiac disease cohorts and also at least 30 female stroke discharges over the same period.
- Transferred out less than 14.3 percent of stroke patients to another acute care hospital (implying that these transfer hospitals probably have onsite neurosurgical services).

Findings

Using 17 states of all-payer hospital discharge data, we were able to identify important trends in women's health specific to cardiovascular disease (CVD-heart disease and stroke). Our third annual Women's Health study identified that cardiac and stroke risk-adjusted inhospital mortality rates continue to improve nationwide, but very large differences in outcomes persist.

Overall cardiac and stroke risk-adjusted inhospital mortality improved 9.54 percent from 2002 through 2004. The greatest improvement of 15.34 percent was noted in heart failure. (See Appendix B.) These improvements are likely attributable to both advances in diagnosis and treatment of heart disease and stroke and the quality improvements made by hospitals during this same time.

However, although these 17 states' hospitals saw a combined average overall improvement of 9.54 percent, some hospitals had consistently better outcomes and improved at a greater rate than other hospitals. (See Appendix B and C.) For example,

- Best-performing hospitals demonstrated significantly lower risk-adjusted inhospital mortality across all six cohorts and three years studied compared to all other hospitals.
- Women admitted with cardiovascular disease to Best-performing hospitals had an overall risk-adjusted inhospital mortality rate that was 39.20 and 22.45 percent lower than Poor and Average performing hospitals, respectively.
- If all hospitals performed at the level of Best-performing hospitals, 30,548 additional women could have survived their hospitalization for heart disease and stroke. (Data not shown.)

- Best-performing hospitals had a 47.44-percent lower risk-adjusted CABG mortality and improved 32.85 percent more compared to Poor-performing hospitals.

These differences in outcomes were also noted across the 17 states studied. Wide variations in risk-adjusted outcomes, ranging from 20 percent *better* than expected to almost 15 percent *worse* than expected, were noted. For example, Arizona hospitals had a 27.43-percent lower CVD risk-adjusted mortality compared to New York during 2002-2004. (See Appendix D.)

Interpretation of Results

Cardiovascular Outcomes Improving for Women

In this our third annual study on cardiovascular outcomes in women, we identified that improvements have continued over the last three years, validating the efforts of several national organizations such as the American Heart Association, to increase women's awareness of their lifetime cardiovascular disease risk, timeliness of diagnosis, and delivery of appropriate treatment.

Large Quality Gaps Persist

Despite these improvements over the last several years, large disparities in outcomes persist. This is seen at the community, regional and national levels. Our study concluded that if all hospitals performed at the Best-performing hospitals' average, more than 30,000 additional women in 17 states, or extrapolated to the entire U.S., approximately 54,000 additional women would have survived their heart disease or stroke hospitalization during 2002-2004.

These astounding numbers underscore the prevalence of cardiovascular disease in women in the U.S. – ranking #1 (heart disease) and #3 (stroke) leading cause of death. One can easily determine that small variations in outcomes can translate to large number of potentially preventable deaths. Compound this with the prevalence of variation of care among U.S. hospitals and death from cardiovascular disease treated in women admitted to Average and Poor performing hospitals ranks just behind death from sepsis. [9]

Implications for Women

Women need to know that cardiovascular disease continues to be the leading cause of death for women, and so, they must work with their physician to assess their cardiovascular risk and devise risk-reduction strategies. They also need to be aware of the atypical symptoms unique to women and that timeliness of diagnosis is critical. Lastly, women need to understand that their chances of surviving their heart disease or stroke hospitalization is significantly better, on average, at Best-performing hospitals, and consequently, they should use available hospital quality information to identify the Best-performing hospitals in their area and discuss this information with their physician.

Limitations of the Risk-adjustment Models for Women's Health Performance Assessment

It must be understood that while these models may be valuable in identifying hospital groups that perform better than others, one should recognize that these models are limited by the following factors:

- Cases may have been coded incorrectly or incompletely by the hospital.
- The models can only account for risk factors that are coded into the billing data. If a particular risk factor was not coded into the billing data, such as a patient's socioeconomic status and health behavior, then it was not accounted for with these models.

Although HealthGrades has taken steps to carefully compile these data using its proprietary methodology, no techniques are infallible, and therefore some information may be missing, outdated, or incorrect.

Although the 17 states we studied represented a large percentage of all U.S. hospital discharges from 2002-2004, our findings may not be generalizable to the entire United States or to states that we did not study.

References

1. American Heart Association. *Heart Disease and Stroke Statistics-2005 Update*. Dallas, Tex: American Heart Association; 2004. Available at: http://www.americanheart.org/downloadable/heart/1105390918119HDSStats2005Update.pdf. Accessed May 27, 2005.

2. American Heart Association. *Facts about women and cardiovascular disease*. Available at: http://www.americanheart.org/presenter.jhtml?identifier=2876. Accessed May 27, 2005.

3. Miller CL, Kollauf CR. Evolution of information on women and heart disease 1957-2000: a review of archival records and secular literature. *Heart Lung*. 2002; 31:253-261.

4. Mosca L, Ferris A, Rosalind F, Robertson RM. Tracking Women's Awareness of Heart Disease. An American Heart Association National Study. *Circulation*. 2004; 109:573-579.

5. Kim C, Hofer TP, Kerr EA. Review of evidence and explanations for suboptimal screening and treatment of dyslipidemia in women: a conceptual model. *J Gen Intern Med*. 2004; 18:854-863.

6. Sueta CA, Chowdhury M, Boccuzzi SJ, Smith SC Jr, Alexander CM, Londhe A, Lula A, Simpson RJ Jr. Analysis of the degree of undertreatment of hypderlipidemia and congestive heart failure secondary to coronary artery disease. *Am J Cardiol*. 1999; 83:1303-1307.

7. Pearson TA, Laurora I, Chu H, Kafonek S. The Lipid Treatment Assessment Project (L-TAP): a multicenter survey to evaluate the percentages of dyslipidemic patients receiving lipid-lowering therapy and achieving low-density lipoprotein cholesterol goals. *Arch Intern Med*. 2000;160:459-467

8. Jha A, Varosy PD, Kanaya AM, Hunnighake DB, Hlatky MA, Waters DD, Furberg CD, Shlipak MG. Differences in medical care and disease outcomes among black and white women with heart disease. *Circulation*. 2004;108:1089-1094.

9. National Vital Statistics Reports, Vol. 53, No. 17, March 7, 2005. http://www.cdc.gov/nchs/data/nvsr/nvsr53/nvsr53_17.pdf. Downloaded 5/23/06.

Appendix A. Patient Cohorts and Related ICD-9-CM Codes

Patient Definitions	ICD-9-CM Procedure/Diagnosis Codes and Criteria
Women's Cardiac and Stroke Mortality	
Coronary Bypass Surgery	Procedure Codes: 36.10 through 36.16 or 36.19, excluding patients with procedure codes like 35.2*, like 35.1*, like 37.5*, or 38.12; excluding patients with diagnosis code 414.06 or 414.07
Valve Replacement Surgery	Procedure Codes: 35.20 through 35.28, excluding patients with procedure codes like 35.1*, like 37.5*, 35.33, 38.12; excluding patients with diagnosis codes 441.2, 414.06, 414.07
Interventional Cardiology Procedures	Procedure Codes: 36.01, 36.02, 36.05, 36.06, 36.07, 36.09, excluding patients with procedure codes like 37.5*; excluding patients with diagnosis codes 414.06, 414.07
Acute Myocardial Infarction (Heart Attack)	Principal Diagnoses: 410.00 through 410.91 (where fifth digit is one), excluding patients with procedure codes like 37.5*; excluding patients with diagnosis codes 414.06, 414.07
Heart Failure	Principal Diagnoses: 428.0 through 428.9, 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, excluding patients with procedure codes like 37.5*; excluding patients with diagnosis codes 414.06, 414.07
Stroke	Principal Diagnoses: 430, 431, 432.0, 432.1, 432.9, 433.01, 433.11, 433.21, 433.31, 433.81, 433.91, 434.01, 434.11, 434.91, 436, excluding patients with procedure codes like 37.5*

Appendix B. Cardiovascular Disease Outcomes Performance by Year (2002-2004)

Women's Health Outcomes Performance	Year	Observed Inhospital Mortality Rate	Expected Inhospital Mortality Rate	Observed-to-Expected Ratio	95% CI for Ratio	Relative Improvement from 2002
Coronary Artery Bypass Surgery (U.S. relative improvement of **13.99%** from 2002 through 2004)*						
Best	2002	2.74%	3.28%	0.84	(0.73-0.95)	
	2003	2.24%	3.34%	0..65	(0.55-0.76)	
	2004	2.28%	3.42%	0.66	(0.56-0.77)	21.43%
Average	2002	3.29%	3.05%	1.08	(1.01-1.15)	
	2003	3.05%	3.09%	0.99	(0.92-1.06)	
	2004	3.07%	3.24%	0.95	(0.88-1.02)	12.04%
Poor	2002	3.81%	2.74%	1.39	(1.20-1.58)	
	2003	4.39%	2.83%	1.55	(1.34-1.76)	
	2004	3.89%	3.26%	1.19	(1.01-1.37)	14.39%
Valve Replacement Surgery (U.S. relative improvement of **14.72%** from 2002 through 2004)*						
Best	2002	6.89%	7.95%	0.87	(0.76-0.98)	
	2003	7.31%	8.34%	0.88	(0.77-0.98)	
	2004	6.16%	8.51%	0.72	(0.63-0.82)	17.24%
Average	2002	8.10%	7.54%	1.07	(1.01-1.14)	
	2003	7.74%	7.78%	0.99	(0.93-1.06)	
	2004	7.51%	7.89%	0.95	(0.89-1.02)	11.21%
Poor	2002	10.30%	7.36%	1.40	(1.22-1.58)	
	2003	9.57%	7.47%	1.28	(1.10-1.46)	
	2004	8.17%	7.45%	1.10	(0.93-1.26)	21.43%
Acute Myocardial Infarction (U.S. relative improvement of **4.47%** from 2002 through 2004)*						
Best	2002	7.71%	9.38%	0.82	(0.78-0.86)	
	2003	7.20%	9.45%	0.76	(0.72-0.80)	
	2004	6.91%	9.04%	0.76	(0.72-0.81)	7.32%
Average	2002	9.34%	9.13%	1.02	(1.00-1.05)	
	2003	8.89%	8.89%	1.00	(0.97-1.03)	
	2004	8.41%	8.50%	0.99	(0.96-1.02)	2.94%
Poor	2002	11.27%	8.81%	1.28	(1.22-1.34)	
	2003	11.04%	8.46%	1.31	(1.24-1.37)	
	2004	10.01%	8.11%	1.23	(1.17-1.30)	3.91%

Appendix B. Cardiovascular Disease Outcomes Performance by Year (2002-2004) (continued)

Women's Health Outcomes Performance	Year	Observed Inhospital Mortality Rate	Expected Inhospital Mortality Rate	Observed-to-Expected Ratio	95% CI for Ratio	Relative Improvement from 2002
Percutaneous Coronary Interventions (Angioplasty/Stent) (U.S. relative improvement of -12.27% from 2002 through 2004)*						
Best	2002	1.36%	1.85%	0.74	(0.66-0.82)	
	2003	1.23%	1.76%	0.70	(0.62-0.78)	
	2004	1.34%	1.50%	0.89	(0.80-0.98)	-20.27%
Average	2002	1.63%	1.70%	0.96	(0.91-1.01)	
	2003	1.59%	1.60%	0.99	(0.94-1.05)	
	2004	1.49%	1.40%	1.06	(1.01-1.12)	-10.42%
Poor	2002	2.00%	1.71%	1.17	(1.05-1.30)	
	2003	2.06%	1.55%	1.33	(1.20-1.47)	
	2004	1.89%	1.37%	1.38	(1.24-1.52)	17.95%
Heart Failure (U.S. relative improvement of 15.34% from 2002 through 2004)*						
Best	2002	3.32%	4.27%	0.78	(0.73-0.83)	
	2003	3.36%	4.41%	0.76	(0.71-0.81)	
	2004	2.90%	4.51%	0.64	(0.60-0.69)	17.95%
Average	2002	4.07%	3.91%	1.04	(1.01-1.08)	
	2003	3.94%	4.04%	0.97	(0.94-1.01)	
	2004	3.68%	4.20%	0.88	(0.85-0.91)	15.38%
Poor	2002	4.99%	3.77%	1.32	(1.25-1.40)	
	2003	5.25%	3.86%	1.36	(1.28-1.44)	
	2004	4.64%	3.91%	1.19	(1.12-1.26)	9.85%
Stroke (U.S. relative improvement of 9.87% from 2002 through 2004)*						
Best	2002	9.61%	12.38%	0.78	(0.74-0.82)	
	2003	9.24%	12.50%	0.74	(0.70-0.78)	
	2004	9.54%	13.09%	0.73	(0.69-0.77)	6.41%
Average	2002	12.18%	12.19%	1.00	(1.02-0.98)	
	2003	12.35%	12.73%	0.97	(0.95-0.99)	
	2004	11.68%	12.79%	0.91	(0.89-0.94)	9.00%
Poor	2002	15.56%	12.28%	1.27	(1.21-1.32)	
	2003	15.80%	12.97%	1.22	(1.17-1.27)	
	2004	14.22%	12.76%	1.11	(1.07-1.16)	12.60%

Average Improvement from 2002 through 2004 (* includes all U.S. hospitals in 17 states regardless of whether they were eligible to receive a Women's Health rating)		
	All*	9.54%
	Best	8.34%
	Average	7.79%
	Poor	8.07%

Appendix C. Differences in Cardiovascular Inhospital Mortality Outcomes by Performance Category for 3 Years Combined (2002-2004)

Women's Health Outcomes Performance	Observed Inhospital Mortality Rate	Expected Inhospital Mortality Rate	Observed-to-Expected Ratio	95% CI	Relative Mortality Risk Reduction Associated with Best to Poor Performing Women's Health Hospitals	Relative Mortality Risk Reduction Associated with Best to Average Performing Women's Health Hospitals
Coronary Artery Bypass Graft Surgery						
Best	2.44%	3.37%	0.72	(0.66-0.79)	47.44%	28.00%
Average	3.15%	3.12%	1.00	(0.97-1.05)		
Poor	4.02%	2.93%	1.37	(1.26-1.48)		
Valve Replacement Surgery						
Best	6.78%	8.27%	0.82	(0.76-0.88)	34.92%	18.81%
Average	7.78%	7.74%	1.01	(0.97-1.04)		
Poor	9.35%	7.43%	1.26	(1.16-1.36)		
Acute Myocardial Infarction						
Best	7.28%	9.29%	0.78	(0.76-0.81)	38.58%	22.00%
Average	8.88%	8.84%	1.00	(0.99-1.02)		
Poor	10.78%	8.46%	1.27	(1.24-1.31)		
Percutaneous Coronary Interventions (Angioplasty/Stent)						
Best	1.31%	1.69%	0.77	(0.72-0.82)	40.31%	23.00%
Average	1.56%	1.56%	1.00	(0.97-1.03)		
Poor	1.98%	1.53%	1.29	(1.22-1.37)		
Heart Failure						
Best	3.19%	4.40%	0.73	(0.70-0.75)	43.41%	23.96%
Average	3.89%	4.05%	0.96	(0.94-0.98)		
Poor	4.96%	3.85%	1.29	(1.25-1.33)		
Stroke						
Best	9.47%	12.65%	0.75	(0.73-0.77)	37.50%	21.89%
Average	12.07%	12.56%	0.96	(0.95-0.97)		
Poor	15.18%	12.67%	1.20	(1.17-1.23)		
Overall Cardiovascular Disease (Heart Disease and Stroke)						
Best	4.41%	5.81%	0.76	(0.75-0.77)	39.20%	22.45%
Average	5.52%	5.63%	0.98	(0.97-0.99)		
Poor	6.95%	5.55%	1.25	(1.23-1.27)		

Appendix D. Cardiovascular Outcomes Performance by State Studied for 3 Years Combined (2002-2004)

State	Number of Hospitals Evaluated per State	Number of 5-star Hospitals per State	Inhospital Observed Mortality Rate	Inhospital Expected Mortality Rate	Observed-to-Expected Ratio	Z-score (most positive is best performance)	p value (2-tailed)
AZ	20	6	4.53%	5.54%	0.82	11.55	0.0000
CA	104	14	6.31%	6.69%	0.99	1.85	0.0650
FL	63	20	5.28%	5.95%	0.89	16.46	0.0000
IA	7	0	5.49%	5.18%	1.06	-2.77	0.0057
MA	13	2	6.04%	5.83%	1.04	-2.70	0.0070
MD	9	1	5.06%	5.70%	0.89	8.07	0.0000
ME	3	0	5.71%	5.41%	1.05	-1.67	0.0941
NC	21	2	6.05%	5.52%	1.10	-7.73	0.0000
NJ	17	2	5.92%	5.80%	1.02	-1.96	0.0501
NV	8	0	6.75%	6.56%	1.03	-1.20	0.2287
NY	34	2	6.45%	5.69%	1.13	-15.43	0.0000
PA	60	13	5.37%	5.67%	0.95	6.71	0.0000
TX	97	6	5.76%	5.37%	1.07	-8.57	0.0000
UT	7	1	5.76%	5.88%	0.98	0.64	0.5190
VA	18	2	5.84%	5.71%	1.02	-1.79	0.0735
WA	17	2	6.59%	6.74%	0.98	1.49	0.1356
WI	25	5	5.42%	5.56%	0.98	1.55	0.1207