


# **The Fourth Annual HealthGrades Bariatric Surgery Trends In American Hospitals Study**



**July 2009**



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## The Fourth Annual HealthGrades Bariatric Surgery Trends in American Hospitals Study July 2009

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## The Fourth Annual HealthGrades Bariatric Surgery Trends in American Hospitals Study July 2009

*Obesity is recognized as a major public health problem in America. Obesity initiates and contributes to a wide variety of serious health problems. In this report, HealthGrades examines trends in obesity and bariatric surgery in the U.S. This analysis identifies patient outcomes for bariatric surgery using three years of data (2005-2007) from 19 all-payer states that make their data available. This analysis also identifies top-performing hospitals in bariatric surgery to establish a best-practice benchmark against which other hospitals can be evaluated. Individual hospital quality results from this study are available at [www.HealthGrades.com](http://www.HealthGrades.com).*

### Executive Summary

Obesity is recognized as a major public health problem in America. The number of overweight, obese, and morbidly obese Americans has steadily increased and now represents the most challenging public health issue in the U.S. Obesity initiates and contributes to a wide variety of serious health problems. Controlling and treating obesity through non-surgical interventions has proven largely unsuccessful for the majority of patients, leading to increasing interest in surgical procedures aimed at curbing hunger and reducing caloric intake.

In recent years, several surgical procedures have been developed to address obesity. As a group, these surgical procedures are collectively referred to as "bariatric surgery." In contrast to non-surgical treatments, bariatric surgery has been demonstrated to be highly effective in reducing a patient's weight with subsequent reduction or elimination of many of the health problems associated with obesity. This success has encouraged an explosion in the number of bariatric surgeries being performed annually in the U.S.

Among the findings, *The Fourth Annual HealthGrades Bariatric Surgery Trends in American Hospitals* study found that:

- Patients having bariatric surgery at five-star hospitals are 44.06% less likely to experience complications than patients at three-star programs, and 67.23% less likely compared to one-star programs.
- Of the 19 states studied, 61.42% of all procedures were performed in five states: New York, Texas, Pennsylvania, California, and Florida.
- California was, on average, the most expensive state for bariatric surgery (average charge per procedure = \$52,224) while Maryland was the least expensive (average charge per procedure = \$14,577).
- Patients having surgery at five-star hospitals spent, on average, less time in the hospital (2.15 days) compared to patients treated in three-star hospitals (2.41 days), and more than half a day less than patients having surgery in one-star hospitals (2.72 days).
- Nationwide, more bariatric surgeries are being performed overall, but an increasing percentage are being done as outpatient surgery.



## Morbid Obesity and Bariatric Surgery Trends in America

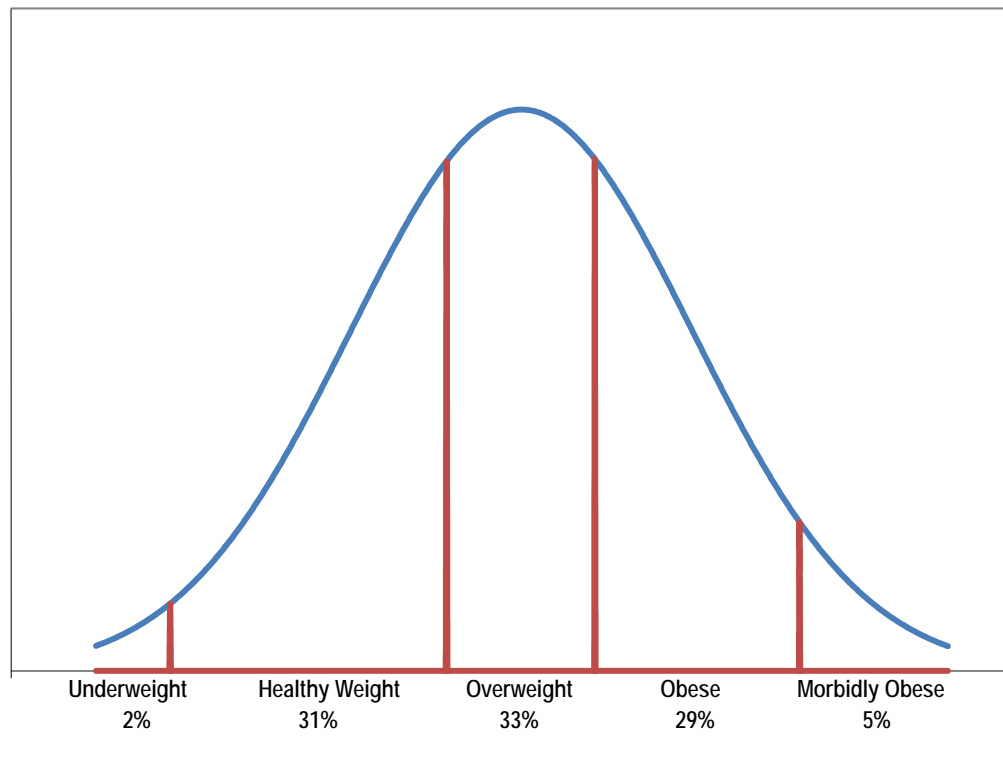
Bariatric surgery is recognized as an effective treatment for obesity, especially in those patients noted to have extreme obesity, also referred to as "morbid obesity."

**Table 1: Defining Overweight and Obesity**

Clinical Description	Body Mass Index	Example: Adult 5 ft 9 in Tall Weight Range	Approximate Percent of U.S. Population
Underweight	< 18.5	124 lbs or less	2%
Healthy Weight	18.5 to 24.9	125 to 168 lbs	31%
Overweight	25 to 29.9	169 to 202 lbs	33%
Obese	30 to 39.9	203 to 270 lbs	29%
Morbidly Obese	40 or more	271 lbs or more	5%

\*Centers for Disease Control and Prevention, November 2007 study. [www.cdc.gov/obesity/defining.html](http://www.cdc.gov/obesity/defining.html)

**Illustration 1: Distribution of Body Mass Index and U.S. Population**

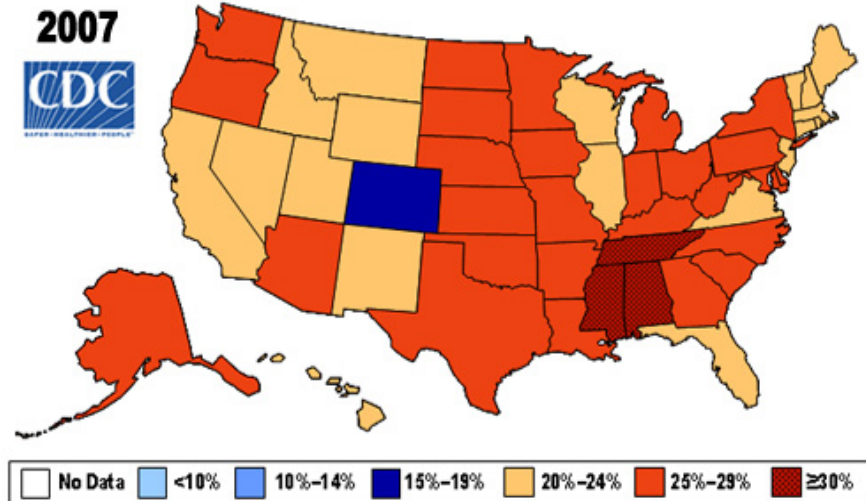


According to the Centers for Disease Control and Prevention, November 2007 study:

- More than one-third of U.S. adults—over 72 million people—were obese in 2005-2006. This includes 33.3% of men and 35.3% of women.<sup>1</sup>

More than one-third of U.S. adults (over 72 million people) were obese in 2005 – 2006.

Illustration 2: Percent of U.S. Adults that are Obese (BMI  $\geq 30$ )



Centers for Disease Control and Prevention (CDC). *Behavioral Risk Factor Surveillance System Survey Data*. Atlanta, Georgia: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2007. [www.cdc.gov/obesity/data/trends.html](http://www.cdc.gov/obesity/data/trends.html).

- Adults age 40-59 had the highest obesity prevalence compared with other age groups. Approximately 40% of men in this age group were obese, compared with 28% of men age 20-39, and 32% of men age 60 and older.<sup>1</sup>
- Among women, 41% of those age 40-59 were obese compared with 30.5% of women age 20-39. Women age 65 and older had obesity prevalence rates comparable with women in the 20-39 age group.<sup>1</sup>
- Large race-ethnic disparities in obesity are prevalent among women. Approximately 53% of non-Hispanic black women and 51% of Mexican-American women age 40-59 were obese compared with about 39% of non-Hispanic white women of the same age. Among women 60 and older, 61% of non-Hispanic black women were obese compared with 37% of Mexican-American women and 32% of non-Hispanic white women.<sup>1</sup>

Health issues associated with obesity include life-threatening conditions like diabetes, heart disease, and high blood pressure, and functional problems like sleep apnea and severe orthopedic and joint problems.

Health issues associated with obesity include life-threatening conditions like diabetes, heart disease, and high blood pressure, and functional problems like sleep apnea and severe orthopedic and joint problems. In general, the amount of excess weight carried by a patient correlates with the number and severity of the associated health problems. The patients with the most severe health problems tend to be those with morbid obesity. It is this subset of patients for whom bariatric surgery is frequently recommended. Morbid obesity affects approximately 4.7% of the U.S. population.<sup>1</sup>

The striking weight loss noted after bariatric surgery (frequently equivalent to one-third of a patient's body weight or more) has been shown to lead to impressive and rapid improvements in the patient's overall health status. Many patients are noted to have either significant improvement or to be completely cured of a variety of major health problems including diabetes, high blood pressure, and sleep apnea.<sup>2</sup> Because of these favorable outcomes, the number of bariatric surgeries has continued to steadily increase in recent years. In 2008, an estimated 220,000 bariatric surgeries were performed in the U.S.<sup>3</sup> The number of bariatric surgeries performed in the United States increased by

more than 500% between 1998 and 2002, from 13,386 to 71,733, according to a study published in the July/August 2005 issue of *Health Affairs*.<sup>4</sup>

Like most major and invasive surgeries, bariatric surgery has many benefits that must be weighed against the associated risks. These risks include death, a variety of minor to extremely serious complications, and long-term risks such as nutritional absorption deficiencies (the inability to adequately absorb enough nutrients from the food consumed). In addition, patients who are appropriate candidates for bariatric surgery frequently have other conditions such as heart disease, high blood pressure, diabetes, and lung problems that increase their surgical risks. To assure the best short-term and long-term outcomes for patients undergoing bariatric surgery, it is imperative that bariatric surgery programs:

- Ensure appropriate patient selection
- Identify individual patient risks
- Provide appropriate interventions to reduce these risks
- Have surgeons with adequate experience and/or appropriate supervision

The explosion in demand for bariatric surgery has led to rapid expansion in the number of hospitals offering these programs and procedures. Unfortunately, this has led to significant variation in the experience of bariatric surgeons and the sophistication of programs, with resulting wide variation in quality and outcomes.

Fortunately, patients considering bariatric surgery have several advantages:

- 1 Because essentially all bariatric surgeries are performed electively, patients have the time to thoroughly investigate their surgeon and hospital before they make a final decision on where to have a surgery performed.
- 2 Most hospitals are required to report extensive data on a variety of aspects of bariatric surgery (including complications and outcomes) in a standardized format.
- 3 Rapid advances in the science of data analysis and quality measurement have allowed organizations with the appropriate clinical expertise and data processing capabilities to be able to collect, analyze, and present this huge mass of data in a clear, concise format which all patients can understand.

Clearly, bariatric surgery offers potentially life-changing treatments for patients who suffer with obesity, but this marvelous potential must be weighed against the serious risks. Therefore, it is particularly important for patients to have access to reliable quality information when selecting a bariatric program.

Since 1998, HealthGrades has studied and measured outcomes associated with a wide array of common inpatient procedures and diagnoses at the nation's approximately 5,000 hospitals, and has published results on the Web to assist consumers in choosing a hospital and physician that are right for them. In this fourth annual study, HealthGrades studied and measured the risk-adjusted in-hospital complication rate associated with bariatric surgery programs affiliated with hospitals in all of the 19 states where data are publicly available. We analyzed over 66 million all-payer discharges from 2005 through 2007 and calculated risk-adjusted complication rates to assign hospitals a one-star (poor), three-star (as expected), or five-star (best) quality rating for bariatric surgery. Individual hospital quality results from this study are available at [www.HealthGrades.com](http://www.HealthGrades.com).

Additionally for this study, we analyzed overall trends associated with bariatric surgery from 2005 through 2007 among 664 hospitals located in 19 states and evaluated and analyzed the differences in in-hospital complications between the one-star, three-star, and five-star hospitals. The 19 states



included in this study are: Arizona, California, Florida, Iowa, Maine, Maryland, Massachusetts, Nevada, New Jersey, New York, Oregon, Pennsylvania, Rhode Island, Texas, Utah, Vermont, Virginia, Washington, and Wisconsin.

## Summary of Findings

Key findings of this study include:

Five-star rated hospitals, as a group, had few complications, had shorter amount of time spent in the hospital, and charged less for their procedures compared to one-star or three-star hospitals.

- Despite the fact that the expected complication rate was approximately the same (6.83%-7.13%), patients having bariatric surgery at five-star hospitals were 42.16% less likely to experience actual complications than patients having bariatric surgery at three-star programs and 67.52% less likely to experience complications compared to one-star programs (*Table 10*).
- Five-star rated hospitals, as a group, had fewer complications, had shorter amount of time spent in the hospital (length of stay), and charged less for their procedures compared to one-star or three-star hospitals (*Table 10*).
- Overall, there was no significant difference in transfusion rates between one-, three-, and five-star hospitals.

### Procedure Volume and Costs

Of the 19 states studied, 61.42% of all procedures were performed in five states: New York, Texas, Pennsylvania, California, and Florida.

- Of the 19 states studied, 61.42% of all procedures were performed in five states: New York (16.29%), Texas (13.58%), Pennsylvania (12.35%), California (10.22%), and Florida (8.98%) (*Table 3*).
- California was, on average, the most expensive state for bariatric surgery (average charge per procedure = \$52,224) while Maryland was the least expensive (average charge per procedure = \$14,577).

### Lengths of Stay

- Patients having surgery at five-star hospitals spent, on average, less time in the hospital (2.15 days) compared to patients treated in three-star hospitals (2.41 days), and more than half a day less than patients having surgery in one-star hospitals (2.72 days) (*Table 10*).
- Patients in Vermont, on average, spent the most time in the hospital (3.26 days). Patients in Nevada, on average, spent the least amount of time in the hospital (1.56 days).

### Number of Self-pay Patients Increased

Of all patients, 6.88% paid for their surgery out-of-pocket. This represents a 63.48% increase in the number of self-pay patients from 2005 through 2007.

- Of all patients, 6.88% paid for their surgery out-of-pocket (self-pay) and did not utilize any type of insurance. This represents a 63.48% increase in the number of self-pay patients from 2005 through 2007 (*Table 4*).
- There was large variance between states in the number of self-pay patients. Nevada had the highest percentage of self-pay patients at 26.3%, followed by Florida, Arizona, Utah, and Washington. Vermont had the lowest self-pay percentage at 0.3%.
- There appeared to be no correlation between the amount charged for the procedure and the likelihood that a patient would pay for the procedure out-of-pocket.
- Medicare and Medicaid combined paid for 14.68% of bariatric surgeries nationwide.



### Center of Excellence Designation Compared to Star Ratings

- In this HealthGrades study, Bariatric Centers of Excellence (COE) programs were more likely to receive a five-star rating than non-COE programs (29.5% of COE programs were five-star rated while only 12.3% of non-COE programs received a five-star rating).

Hospitals and surgeons may qualify for designation as an American Society for Metabolic and Bariatric Surgery (ASMBS) Bariatric Surgery Center of Excellence (BSCOE) by participating in a rigorous evaluation process designed to document that they have a comprehensive program and meet the established program requirements for providing safe bariatric surgical care with excellent short- and long-term outcomes. The evaluation verifies processes such as equipment, supplies, training of surgeons and staff, and the availability of consultant services, and records the results.

Specific requirements for Center of Excellence designation include:

- Ongoing education in bariatric surgery
- Minimum number of surgeries performed for the hospital (at least 125 bariatric surgical cases per year), and for each surgeon in the program (at least 125 total bariatric cases lifetime, with at least 50 cases performed in the preceding 12-month period)
- A full complement of support staff including staff certified in Advanced Cardiac Life Support
- A full line of equipment and instruments for the care of bariatric surgical patients
- Ongoing involvement in the field of bariatric surgery by the program's surgeons
- Use of clinical pathways and orders
- Use of nurses dedicated to serving bariatric surgical patients
- Organized and supervised support groups
- Provision for long-term patient follow-up

Note: This study looked at 19 states where data were available. In these 19 states, there were a total of 451 bariatric programs with adequate volume to be included in this study. Of these 451 programs, there were 190 COE-designated programs and 29.5% of these were rated as five-stars. Of the 261 non-COE programs, only 12.3% were rated as five-stars. Nationally, there are 378 programs which have received the Bariatric Center of Excellence designation. (Information on Bariatric Centers of Excellence was downloaded from [www.surgicalreview.org](http://www.surgicalreview.org) in June 2009.)

### The Number of Inhospital Procedures was Unchanged

Nationwide, more bariatric surgeries are being performed overall, but an increasing percentage is being done as outpatient surgery. This is reflected in the fact that despite the overall increase in procedures, the number of inpatient procedures performed from 2005 through 2007 showed no significant change. Additionally, the number of self-pay patients has increased.

- In the 19 states evaluated, 153,355 inpatient procedures were performed. Of these, 29,526 procedures were gastric bypass procedures, 2,113 were malabsorptive procedures, and 121,716 were laparoscopic procedures (*Table 5*). See *Appendix A* for detailed descriptions of each of these types of procedures.
- During this study period, the number of inpatient procedures from 2005 through 2007 showed virtually no change.
- Eleven states, Arizona, Florida, Iowa, Maine, Massachusetts, Nevada, New Jersey, New York, Oregon, Rhode Island and Texas, showed increases in the number of procedures performed (0.06% - 69.2%) but all other states studied showed a decline (*Table 3*).

An increasing percentage of bariatric surgeries are being done as outpatient surgery. Additionally, the number of self-pay patients has increased from 2005 through 2007.

**Table 2: Total Number of Procedures Performed by Year**

(Includes inpatient and outpatient surgeries from all 50 states)

Year	Number of Procedures Performed
1992	16,200
1998	13,386
2002	63,100
2004	140,640
2008	220,000

American Society for Metabolic & Bariatric Surgery, [www.asbs.org](http://www.asbs.org)

- In the 19 states evaluated in this study, 664 hospitals had at least one bariatric surgery case, but only 451 hospitals met the minimum volume of 30 cases over three years with at least five cases in 2007 required to receive a star rating.

**A Trend Toward Less-invasive Laparoscopic Procedures Continues**

- In our previous study (looking at 2004 through 2006), laparoscopic procedures accounted for 54% of all procedures. In this year's analysis (looking at 2005 through 2007), the percentage of bariatric surgery procedures done using the laparoscope surged further and accounted for 79.4% of all procedures. Gastric bypass procedures accounted for 19.3%, and malabsorptive procedures accounted for just 1.4%.
- The lower complication rate may be one reason for the popularity of laparoscopic procedures. On average, laparoscopic procedures had a complication rate of 5.9%, while gastric bypass procedures had a complication rate of 11.3%, and malabsorptive procedures had a complication rate of 9.7%.

**Higher Volume Programs and Five-star Hospitals have Better Outcomes**

- Patients had a 47% greater risk of experiencing one or more complications if they selected a low-volume program (less than 75 cases over three years) versus a very high volume program (greater than 375 cases over three years).
- Five-star hospitals had an average case volume of 540 surgeries performed over three years, while one-star hospitals averaged 292 cases over three years (*Table 6*).
- While in-hospital mortality is generally an uncommon complication, the death rate at five-star rated hospitals was about one-third the rate at one-star rated hospitals (0.05% versus 0.16%) (*Table 6*).

**Risk-adjusted In-hospital Complication Rates Decreased**

Risk-adjusted in-hospital complication rates decreased during the study period, but there were wide variations in quality among the best-performing and worst-performing hospitals.

- From 2005 through 2007, the risk-adjusted complication rate decreased 7.31% for all procedures. Malabsorptive procedures had the largest decrease in risk-adjusted complications with a 34.22% decrease. Gastric bypass procedures had a slight increase in risk-adjusted complications of 1.17% (*Table 7*).
- Out of the 451 hospitals rated in the 19 states studied, 88 received a five-star rating, 267 received a three-star rating, and 96 received a one-star rating (*Table 6*).

Laparoscopic bariatric surgery procedures account for 79.4% of all procedures.

While in-hospital mortality is generally an uncommon complication, five-star rated hospitals had an in-hospital death rate associated with bariatric surgery one-third that of one-star rated hospitals.

Patients having a bariatric surgical procedure at a five-star hospital had on average a 67.23% lower chance of experiencing one or more in-hospital complications compared to a one-star rated hospital.

If all bariatric programs performed at the level of five-star hospitals, 4,510 patients could have avoided complications across the 19 states studied (2005 – 2007).

- A typical patient having a bariatric surgical procedure at a five-star rated hospital in one of the 19 states studied had, on average, a 67.23% lower chance of experiencing one or more in-hospital complications than at a one-star rated hospital and a 44.06% lower chance than at a three-star rated hospital from 2005 through 2007.
- If all patients had received their bariatric surgery procedure at five-star hospitals (from 2005 through 2007), 4,510 in-hospital complications could have potentially been avoided in the 19 states studied.
- Over the three years studied (2005 through 2007), 143 patients receiving bariatric surgery died during their hospital stay. This represents 0.093% or about one patient in 1000. Fortunately, these outcomes are improving with the rate for 2007 (0.059%) being less than half the rate for 2005 (0.127%).

## Hospital Bariatric Surgery Ratings Results

HealthGrades' ratings of 451 hospitals, based on *The Fourth Annual HealthGrades Bariatric Surgery Trends in American Hospitals Study*, can be found at [www.HealthGrades.com](http://www.HealthGrades.com). For bariatric surgery,

- 88 hospitals (19.51%) stand out as "best" performers (five-star rated)
- 267 hospitals (59.20%) were rated as "as expected" performers (three-star rated)
- 96 hospitals (21.29%) were rated as "poor" performers (one-star rated)

## Bariatric Surgery Trends

The purpose of the second part of the study was to evaluate trends in bariatric surgery procedures performed in the inpatient setting in hospitals located within 19 states. Procedure type and volume, payer type, and observed mortality and complication rates were also evaluated for trends. Overall performance comparisons between five-, three- and one-star rated hospitals were compared using observed-to-expected ratios (O/E ratios).

- An **O/E ratio of less than one** means that the patient population measured had **fewer complications** than expected.
- An **O/E of greater than one** means that the patient population measured had **more complications** than expected.

## The Number of Inpatient Procedures is Steady Nationally

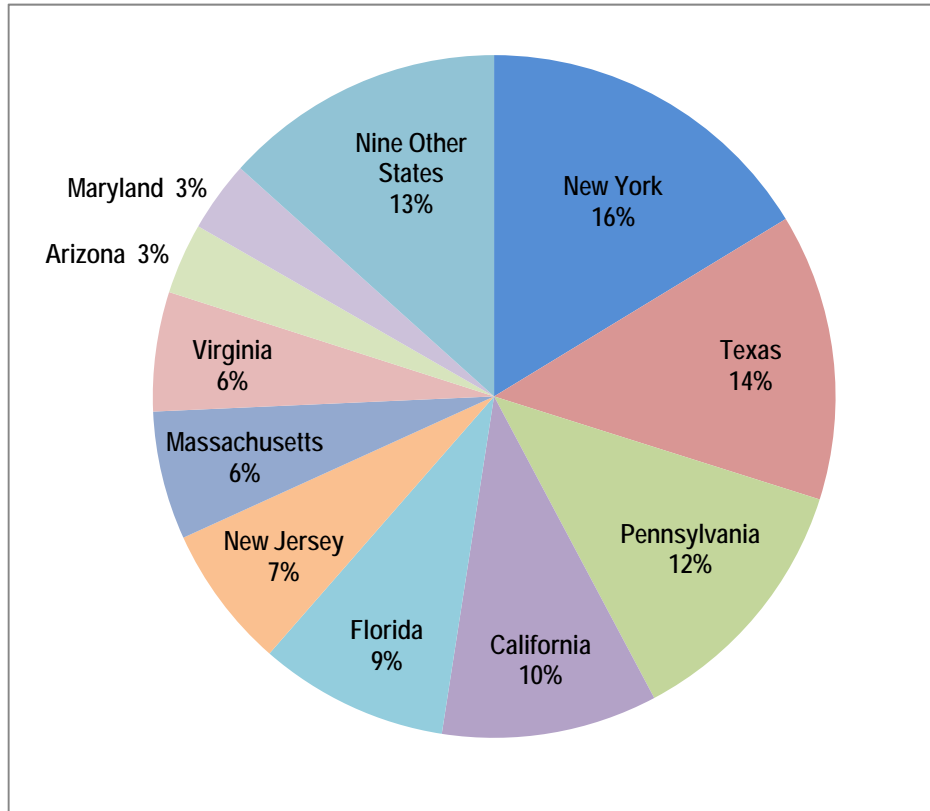
In the 19 states studied, there was a total of 153,355 bariatric inpatient surgery procedures performed in 664 hospitals from 2005 through 2007 (*Table 3*). During this time, there was essentially no change in the number of inpatient procedures (less than 1% increase) with 51,871 procedures performed in 2005 and 52,287 procedures in 2007. These procedure volumes declined slightly from 2005 to 2006, before increasing slightly in 2007.

## Majority of Procedures Performed in Five States (State Trends)

In evaluating procedures by state:

- Just five states—New York (16.29%), Texas (13.58%), Pennsylvania (12.35%), California (10.22%), and Florida (8.98%)—accounted for 61.42% of the total cases from the 19 states studied (*Table 3*).
- Rhode Island had the single largest increase in procedures over the study period with a 69.20% increase in procedures performed (*Table 3*).

Illustration 3: Percent of Total Cases by State



Of the 19 states studied, 61.42% of all procedures were performed in five states: New York, Texas, Pennsylvania, California, and Florida.

Table 3: Bariatric Surgery Hospital Volume Trends by State and Year (2005 – 2007)

State	2005	2006	2007	2005-2007	Percent of Total Cases (2005-2007)	Percent Change 2005 to 2007
Arizona	1,753	1,605	1,798	5,156	3.36%	2.57%
California	5,476	5,309	4,889	15,674	10.22%	-10.72%
Florida	4,529	4,368	4,880	13,777	8.98%	7.75%
Iowa	761	758	816	2,335	1.52%	7.23%
Maine	552	505	592	1,649	1.08%	7.25%
Maryland	1,745	1,807	1,588	5,140	3.35%	-9.00%
Massachusetts	2,736	3,329	3,262	9,327	6.08%	19.23%
Nevada	1,055	1,066	1,197	3,318	2.16%	13.46%
New Jersey	3,418	3,292	3,687	10,397	6.78%	7.87%
New York	8,434	8,115	8,439	24,988	16.29%	0.06%
Oregon	746	891	1,115	2,752	1.79%	49.46%
Pennsylvania	6,724	5,746	6,471	18,941	12.35%	-3.76%
Rhode Island	263	314	445	1,022	0.67%	69.20%
Texas	6,785	6,523	7,518	20,826	13.58%	10.80%
Utah	781	597	588	1,966	1.28%	-24.71%
Vermont	134	111	86	331	0.22%	-35.82%
Virginia	3,124	2,760	2,777	8,661	5.65%	-11.11%
Washington	1,362	836	982	3,180	2.07%	-27.90%
Wisconsin	1,493	1,265	1,157	3,915	2.55%	-22.51%
All	51,871	49,197	52,287	153,355	100.00%	0.80%

### Patients with Commercial Insurance Represent Majority of Patients

In evaluating payer mix, patients with commercial insurance represent the majority of patients undergoing bariatric procedures in the U.S. today. Worker's Compensation and VA/Government plans had the largest percentage increase in procedures from 2005 through 2007.

- Commercial insurance accounted for 74.38% of the patients undergoing the procedure, followed by Government insurance at 18.04% and self-pay at 6.88% (*Table 4*).
- The largest increases in rate of procedures were among those patients in Worker's Compensation (154.17%) and VA/Government plans (119.48%) followed by self-pay patients (63.48%) (*Table 4*).
- The highest rates of self-pay patients were in Nevada (26.3%), Florida (23.9%), Arizona (17.9%), Utah (15.5%), and Washington (14.3%), with Vermont being the lowest.

The highest rates of self-pay patients were in Nevada, Florida, Arizona, Utah and Washington.

**Table 4: Bariatric Surgery Hospital Volume Trends by Payer and Year (2005 - 2007)**

Payer	2005	2006	2007	2005-2007	Percent of Total Cases 2005-2007	Percent Change from 2005 to 2007
Blue Cross	9,338	8,822	10,523	28,683	18.70%	12.69%
Blue Cross HMO	3,907	3,711	3,302	10,920	7.12%	-15.49%
Champus	1,115	1,000	927	3,042	1.98%	-16.86%
Commercial, Self Insur	6,359	5,774	6,060	18,193	11.86%	-4.70%
HMO	11,845	11,711	11,389	34,945	22.79%	-3.85%
HMO/PPO	1,111	946	757	2,814	1.83%	-31.86%
Medicaid	3,236	3,330	3,307	9,873	6.44%	2.19%
Medicare	4,313	3,595	4,721	12,629	8.24%	9.46%
PPO	6,807	6,007	5,713	18,527	12.08%	-16.07%
Self-pay	2,653	3,561	4,337	10,551	6.88%	63.48%
Unknown/Other	660	316	86	1,062	0.69%	-86.97%
VA/Government	503	400	1,104	2,007	1.31%	119.48%
Worker's Compensation	24	24	61	109	0.07%	154.17%
<b>All</b>	<b>51,871</b>	<b>49,197</b>	<b>52,287</b>	<b>153,355</b>	<b>100.00%</b>	<b>0.80%</b>

### Movement Toward Less Invasive Laparoscopic Procedures

In the 19 states evaluated from 2005 through 2007, there was a shift in the number of inpatient procedures from traditional invasive procedures to less-invasive laparoscopic procedures.

- From 2005 through 2007, open gastric bypass procedures declined by 57.43% while during the same time period, laparoscopic procedures increased 21.94% (*Table 5*).
- In 2005, laparoscopic procedures represented 70.80% of all procedures, and by 2007 they represented 85.65% of all bariatric procedures (*Table 5*).

From 2005 through 2007, laparoscopic procedures increased by 21.94%.

Table 5: Frequency of Bariatric Surgery Codes by Year

ICD-9 Principle Procedure Code	Procedure Type	2005	2006	2007	Total	Percent Change
<b>Gastric Bypass</b>						
44.31	High Gastric Bypass	3,762	1,933	955	6,650	-74.61%
44.39	Other Gastroenterostomy	11,028	6,507	5,341	22,876	-51.57%
<b>Totals (&amp; Average Percent Change)</b>		<b>14,790</b>	<b>8,440</b>	<b>6,296</b>	<b>29,526</b>	<b>-57.43%</b>
<b>Laparoscopic</b>						
44.38	Laparoscopic Gastroenterostomy	30,166	30,475	29,970	90,611	-0.65%
44.68	Laparoscopic Gastroplasty	1,379	1,287	1,370	4,036	-0.65%
44.95	Laparoscopic Gastric Restrictive Procedure	5,181	8,444	13,444	27,069	159.49%
<b>Totals (&amp; Average Percent Change)</b>		<b>36,726</b>	<b>40,206</b>	<b>44,784</b>	<b>121,716</b>	<b>21.94%</b>
<b>Malabsorptive</b>						
45.91	Small-to-Small Intestinal Anastomosis	162	159	196	517	20.99%
43.89	Other Partial Gastrectomy	193	392	1,011	1,596	423.83%
<b>Totals (&amp; Average Percent Change)</b>		<b>355</b>	<b>551</b>	<b>1,207</b>	<b>2,113</b>	<b>240.00%</b>
<b>Totals All Procedures</b>		<b>51,871</b>	<b>49,197</b>	<b>52,287</b>	<b>153,355</b>	<b>0.80%</b>

### Large Gaps in Quality Between Best and Worst Providers

In the first part of this study, hospital bariatric surgery programs were evaluated on their risk-adjusted in-hospital complications and assigned a one-star (poor performance), a three-star (average performance), or five-star (best performance). Out of the 664 hospitals initially evaluated in this study, 451 hospitals met the volume criteria of 30 cases over the three years and five cases in 2007 to receive a star rating. Of these 451 hospitals, 88 received a five-star rating, 267 received a three-star rating, and 96 received a one-star rating (*Table 6*). Hospitals were aggregated into their appropriate peer group by star rating and evaluated as a group for differences in performance.

- Overall, in-hospital mortality is low with an average of less than 0.1% (1 in 1,000) across all 19 states (*Table 6*).
- Laparoscopic bariatric procedures had the lowest overall complication rates, while gastric bypass and malabsorptive procedures had higher overall complication rates (*Table 7*).

Table 6: Bariatric Surgery Mortality and Age Across U.S. Hospitals (2005 - 2007)

Hospital Bariatric Surgery Star Rating	Number of Hospitals	Average Patient Age (Years)	Average Volume (2005-2007)	In-hospital Unadjusted Mortality Rate	P-value (Mortality Compared to U.S.)
One-star	96	43.62	292	0.16%	< 0.001
Three-star	267	43.51	276	0.09%	NS
Five-star	88	42.98	540	0.05%	< 0.001
U.S. Total*	664				
U.S. Average*		43.34	231	0.09%	

\*U.S. total and average includes all hospitals (rated and not rated).

Out of 664 hospitals, 451 met the volume criteria to be rated. Out of these 451 hospitals, 88 received a five-star rating.

Patients had a three times higher risk of dying if they had a bariatric surgery performed at a one-star hospital compared to a five-star hospital.



From 2005 through 2007, there was a (statistically significant) 7.31% decrease in risk-adjusted complications for inpatient bariatric procedures. Malabsorptive procedures had the largest decrease in risk-adjusted complications (-34.22%) followed by laparoscopic procedures with a decrease of 10.40% (Table 7).

**Table 7: Risk-adjusted Complications for Inpatient Bariatric Procedures**

Principle Procedure Type	Year	Case	Observed Rate of Inhospital Complications	Expected Rate of Inhospital Complications	Observed -to- Expected Ratio	95% Confidence Interval Observed-to-Expected Ratio	Observed-to-Expected Percent Change 2005 to 2007
<b>Gastric Bypass</b>							
	2005	14,790	11%	11%	.98	(.94-1.03)	1.17%
	2006	8,440	12%	11%	1.03	(.97-1.09)	
	2007	6,296	12%	12%	.99	(.93-1.06)	
	2005-2007	29,526	11%	11%	1.00	(.97-1.03)	
<b>Laparoscopic</b>							
	2005	36,726	6%	6%	1.04	(1.00-1.07)	-10.40%
	2006	40,206	6%	6%	1.03	(1.00-1.07)	
	2007	44,784	5%	6%	.93	(.89-.96)	
	2005-2007	121,716	6%	6%	1.00	(.97-1.02)	
<b>Malabsorptive</b>							
	2005	355	17%	12%	1.50	(1.22-1.78)	-34.22%
	2006	551	10%	10%	1.01	(.76-1.26)	
	2007	1,207	7%	8%	.99	(.79-1.18)	
	2005-2007	2,113	10%	9%	1.11	(.97-1.24)	
<b>All Bariatric Surgery Procedures</b>							
	2005	51,871	8%	8%	1.02	(.99-1.05)	-7.31%
	2006	49,197	7%	7%	1.03	(1.00-1.07)	
	2007	52,287	6%	6%	.94	(.91-.98)	
	2005-2006	153,355	7%	7%	1.00	(.98-1.02)	

The most frequently occurring complications were respiratory complications (lungs failing to function adequately before and after surgery) followed by hemorrhages (excessive or uncontrolled bleeding).

The most frequently occurring complications among patients undergoing bariatric surgery were respiratory complications (lungs failing to function adequately during and after surgery) followed by hemorrhages (excessive or uncontrolled bleeding), operative lacerations (arteries, nerves, and/or other structures inadvertently cut or damaged during surgery), and gastrointestinal complications (Table 8).

**Table 8: Top Five Inhospital Complications Associated with Bariatric Surgery (2005 – 2007)**

Complication	Rate
Surgical Complication of Respiratory System	0.88%
Post-operative Pulmonary Insufficiency	0.88%
Hemorrhage Complicating a Procedure	1.03%
Accidental Operative Laceration	0.90%
Surgical Complication of Gastrointestinal System	1.02%
<b>Overall</b>	<b>6.98%</b>



During the study period, **volume was an important indicator of inhospital complications**. As volume increased, risk-adjusted complications had statistically significant decreases. Hospitals with highest volume (375 cases or more during the three years of study) had the lowest rate of risk-adjusted inhospital complications overall with an observed-to-expected ratio of 0.92 (8% fewer complications than expected). Hospitals with the lowest volumes (less than 75 cases over three years) had the highest rate of risk-adjusted inhospital complications with an observed-to-expected ratio of 1.35 (35% more complications than expected) (*Table 9*).

Hospitals with lowest volumes had 35% more complications than expected.

**Table 9: Inhospital Complication Rates by Volume of Procedures Performed (2005 – 2007)**

Procedure Volume 2005 to 2007	Observed Rate of Inhospital Complications	Expected Rate of Inhospital Complications	Cases	Observed-to-Expected Ratio	Confidence Interval
< 75	10.14%	7.52%	6,074	1.35	(1.26-1.43)
75-149	8.99%	7.65%	11,398	1.18	(1.11-1.24)
150-374	7.43%	6.86%	39,183	1.08	(1.05-1.12)
375 +	6.36%	6.92%	96,700	.92	(.90- .94)

**Five-star hospitals had lower risk-adjusted and unadjusted complications rates** than their three-star and one-star counterparts. The inhospital unadjusted complication rate in five-star hospitals was 3.94%, compared to 6.80% at three-star hospitals, and 12.12% at one-star hospitals (*Table 10*). After adjusting for patient risk factors, a typical patient having a bariatric surgical procedure at a five-star rated hospital has, on average, a 67.23% lower chance of experiencing one or more inhospital complications than at a one-star rated hospital, and a 44.06% lower chance than at a three-star rated hospital (*Table 10*).

Patients having a bariatric surgical procedure at a five-star hospital have, on average, a 67.23% lower chance of experiencing one or more inhospital complications compared to a one-star hospital.

**Table 10: Bariatric Surgery Complications and Length of Stay Across U.S. Hospitals (2005 - 2007)**

Hospital Bariatric Surgery Star Rating	Observed Inhospital Complication Rate	Expected Inhospital Complication Rate	Observed-to-Expected Complication Ratio	Pvalue (O:E Compared to U.S.)	Average Length of Stay (Days)
One-star	12.12%	7.13%	1.70	< 0.001	2.72
Three-star	6.80%	6.83%	1.00		2.41
Five-star	3.94%	7.07%	0.56	< 0.001	2.15
U.S. Average*	6.98%	6.98%	1.00		2.40
Relative difference between five-star compared to one-star	67.52%	0.90%	67.23%		20.82%
Relative difference between five-star compared to three-star	42.16%	-3.40%	44.06%		10.65%

A patient having a procedure at a one-star hospital could, on average, expect to extend their length of stay by one-half day.

If all bariatric programs performed at the level of five-star hospitals, 4,510 patients could have avoided complications across the 19 states studied (2005 – 2007).

Five-star hospitals also had lower overall in-hospital complication rates than their three-star and one-star counterparts across every procedure type, both laparoscopic and open procedures (*Table 11*). The largest variation in complication rates was associated with other gastroenterostomy procedures among five-star and one-star hospitals, 20.53% complications versus 6.19% (*Table 11*).

In addition, consistent with increased rates of complications, a patient having a procedure at a one-star hospital could, on average, expect to extend their length of stay by one-half day compared to having their procedure at a five-star hospital (2.72 days compared to 2.15 days) (*Table 10*).

To quantify the impact of this variation in quality, if all bariatric programs from 2005 through 2007 had performed at the level of five-star hospitals, 4,510 patients could have avoided complications across the 19 states studied (*Table 11*).

Table 11: Bariatric Surgery Hospital Outcomes by Procedure Type

ICD-9 Principle Procedure Code	Procedure Type	Star Rating	Case Volume	Observed Inhospital Complication Rate	Expected Inhospital Complication Rate	Observed- to- Expected Ratio	95% CI (O/E Ratio)	Relative Difference of Five-star Compared to One-star	Relative Difference of Five-star Compared to Three-star	Number of Patients with Potentially Avoidable Inhospital Complications (as Compared to Five-star)
Gastric Bypass										
44.31	High Gastric Bypass	1	1,152	18.75%	9.50%	1.97	(1.80-2.15)	70.61%	48.70%	235
		3	1,576	10.79%	9.54%	1.13	(.98-1.28)			
		5	3,429	4.75%	8.19%	0.58	(.47- .69)			
		U.S.*	6,650	8.81%	8.79%	1.00	(.93-1.08)			
44.39	Other Gastroenterostomy	1	4,247	20.53%	12.77%	1.61	(1.53-1.68)	66.61%	46.69%	1,150
		3	9,969	12.24%	12.15%	1.01	(.96-1.06)			
		5	7,580	6.19%	11.53%	0.54	(.48- .60)			
		U.S.*	22,876	12.02%	12.03%	1.00	(.96-1.03)			
Laparoscopic										
44.38	Laparoscopic Gastroenterostomy	1	16,239	12.18%	6.95%	1.75	(1.70-1.81)	67.46%	42.08%	2,620
		3	44,741	6.83%	6.94%	0.98	(.95-1.02)			
		5	27,924	3.95%	6.94%	0.57	(.53- .61)			
		U.S.*	90,611	6.95%	6.94%	1.00	(.98-1.02)			
44.68	Laparoscopic Gastroplasty	1	725	6.90%	4.46%	1.55	(1.22-1.88)	71.46%	55.95%	78
		3	2,130	3.62%	3.61%	1.00	(.78-1.22)			
		5	1,080	1.67%	3.77%	0.44	(.14- .74)			
		U.S.*	4,036	3.67%	3.79%	0.97	(.81-1.12)			
44.95	Laparoscopic Gastric Restrictive Procedure	1	5,156	4.19%	2.74%	1.53	(1.37-1.69)	65.51%	45.35%	310
		3	14,109	2.64%	2.74%	0.96	(.87-1.06)			
		5	7,076	1.43%	2.71%	0.53	(.39- .67)			
		U.S.*	27,069	2.65%	2.73%	0.97	(.90-1.04)			

Table 11: Bariatric Surgery Hospital Outcomes by Procedure Type (continued)

ICD-9 Procedure Code	Procedure Type	Star Rating	Case Volume	Observed Inhospital Complication Rate	Expected Inhospital Complication Rate	Observed-to-Expected Ratio	95% CI (O/E Ratio)	Relative Difference of Five-star Compared to One-star	Relative Difference of Five-star Compared to Three-star	Number of Patients with Potentially Avoidable Inhospital Complications (as Compared to Five-star)
<b>Malabsorptive</b>										
45.91	Small-to-Small Intestinal Anastomosis	1	111	19.82%	11.72%	1.69	(1.19-2.19)	72.14%	63.20%	46
		3	280	17.14%	13.39%	1.28	(.99-1.57)			
		5	100	6.00%	12.74%	0.47	(.00- .97)			
		U.S.*	517	15.86%	12.89%	1.23	(1.01-1.45)			
43.89	Other Partial Gastrectomy	1	432	10.65%	7.64%	1.39	(1.07-1.71)	70.37%	60.00%	71
		3	835	7.90%	7.66%	1.03	(.80-1.26)			
		5	307	2.61%	6.31%	0.41	(.00- .84)			
		U.S.*	1,596	7.71%	7.41%	1.04	(.87-1.21)			
<b>All Bariatric Surgery Procedures</b>		1	28,062	12.12%	7.13%	1.70	(1.66-1.74)	67.23%	44.06%	4,510
		3	73,640	6.80%	6.83%	1.00	(.97-1.02)			
		5	47,496	3.94%	7.07%	0.56	(.52- .59)			
		U.S.*	153,355	6.98%	6.98%	1.00	(.98-1.02)			

\*U.S. includes aggregate performance of all hospitals (rated or unrated) that performed one or more bariatric surgery cases during the study period within the 19 states studied.

## Interpretation of Results

The increase in prevalence of obesity and extreme obesity has been described as an epidemic, with an estimated 60 million people meeting the criteria for obesity and 9 million people meeting the criteria for morbid obesity.<sup>5</sup> Individuals with obesity and extreme obesity are at greater risk for premature mortality and increased incidence of comorbid conditions such as diabetes, hypertension, arthritis and asthma.<sup>6</sup> These individuals have also reported a decreased quality of life.<sup>7</sup> For these individuals, bariatric surgery is largely accepted as the most successful long-term treatment. As such, there has been an increase in the number of procedures performed in the U.S. in recent years. Because individual patient outcomes are highly dependent on the quality of the organization where the procedure is performed, this *Fourth Annual HealthGrades Bariatric Surgery Trends in American Hospitals Study* evaluates the differences in quality between inpatient bariatric surgery programs at hospitals across the country.

Overall, there has been a substantial increase in the total number of bariatric surgeries being performed annually in the U.S. with the number of inpatient procedures remaining steady, but with an approximately 50% increase in the number of bariatric procedures being performed in an outpatient setting.

The majority of procedures being performed are among patients with commercial insurance but the largest increase was seen among patients in government sponsored programs, both Medicare and Medicaid. Perhaps this shift is due in part to the economic impact of obesity and obesity-related health issues. Obesity has been associated with more healthcare costs than any other condition with one study estimating that obesity contributes to 9.1% of total U.S. medical expenditures.<sup>7</sup>

HealthGrades' study also found a major shift away from traditional open bariatric procedures (which use a single large incision) to less invasive laparoscopic procedures (which use three to six incisions each less than three-quarter inches in length). Laparoscopic procedures are attractive to potential patients because these procedures:

- Have lower risk during and after surgery
- Have fewer short-term complications
- Require a shorter amount of time spent in the hospital (length of stay)
- Have a faster recovery time

Therefore, the trend towards these procedures is not surprising. However, while our study shows that laparoscopic surgery has lower inpatient (short-term) complication rates, some research suggests that these laparoscopic procedures may have substantial rates of long-term complications which may require revision of the procedure. Additionally, there is evidence to support that these procedures may have inferior weight loss compared to open gastric bypass.<sup>2</sup> As longer-term outcome data become available, it will be interesting to see if this trend towards laparoscopic procedures continues.

This fourth annual study also found that the risk-adjusted rate of in-hospital complications had a statistically significant decrease of 7.31% from 2005 to 2007. This study also suggests large variation in quality among providers. The quality gaps are wide and consistent regardless of the type of procedure performed. Variation in quality between providers contributes to increased complication rates, longer lengths of stay, and more deaths.

The largest increase of procedures was seen among patients in government risk programs, both Medicare and Medicaid. Perhaps this shift is due in part to the economic impact of obesity and obesity-related health issues.

Variation in quality between providers contributes to increased complication rates, longer lengths of stay, and more deaths.

Volume is an important indicator of quality.

Finally, in this study, volume was an important indicator of quality. As volume increased, risk-adjusted complication rates showed statistically significant decreases. The American College of Surgeons Bariatric Surgery Center Network Program requires a minimum volume of 125 procedures annually to receive their highest accreditation.<sup>8</sup> In this study, hospitals that had a three-year volume consistent with this yearly volume requirement had the lowest risk-adjusted complications rates, supporting the link between volume and outcomes.

In the 19 states studied, if all hospitals performed at the level of five-star hospitals, 4,510 patients could have potentially avoided in-hospital complications.

Five-star hospitals had nearly twice the volume of the three-star hospitals and one-star hospitals (*Table 11*). This may be one key to their consistent high-quality performance. In this study, five-star hospitals have mortality rates statistically better than the average of all hospitals studied while one-star hospitals had mortality rates that were statistically worse than the average of all hospitals studied. Five-star hospitals also had lower overall in-hospital risk-adjusted complication rates than their three-star and one-star counterparts across every procedure type, both laparoscopic and open procedures. The largest gap between five-star hospitals and their one-star counterparts surprisingly was not seen in the open, more-invasive procedures but in the laparoscopic vertical-banded gastroplasties.

The variation in quality that exists between providers reiterates the importance of readily available quality data to help consumers choose an appropriate provider to meet their individual needs. This study found that in the 19 states studied, if all hospitals performed at the level of five-star hospitals, 4,510 patients could have potentially avoided in-hospital complications. Since this study is limited to 19 states, clearly this represents the need to increase the availability in quality data in all states to provide consumers with the information they need to make a truly informed decision.

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Health Grades Inc. is the leading independent healthcare ratings organization, providing quality ratings, profiles and cost information on the nation's hospitals, physicians, nursing homes and prescription drugs.

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## Appendix A: Types of Bariatric Surgery Procedures

### Gastric Bypass

- Smaller stomach is attached to the middle of the small intestine, bypassing the section of the small intestine (duodenum) that absorbs the most calories.
- Stomach is reduced from size of football to size of golf ball.
- Patients eat less because stomach is smaller, and they absorb fewer calories because food does not travel through duodenum.

### Laparoscopic

#### Adjustable Gastric Banding (also known as Swedish Adjustable Gastric Band or SAGB)

- Silicone band filled with saline is wrapped around the upper part of stomach to create a small pouch and cause restriction. The procedure is like putting a belt around the stomach. The band forms the stomach into two sections, with a small opening between the sections allowing food to pass through.
- Food collects quickly in the small upper section causing most patients to feel full faster and eat less.
- Size of restriction can be adjusted after surgery by adding or removing saline from band.

### Malabsorptive Procedures

- Biliopancreatic Diversions (BPD)
- Biliopancreatic Diversion with 'Duodenal Switch'
  - Similar to gastric bypass, but surgeon creates a sleeve-shaped stomach.
  - Smaller stomach is attached to the final section of the small intestine, bypassing the duodenum.
  - Patients eat less because the stomach is smaller and they absorb fewer calories because food does not travel through the duodenum.
- Extended (Distal) Roux-en-Y Gastric Bypass (RYGBP-E)
- Vertical Sleeve Gastrectomy
  - Emerging procedure which is a type of restrictive weight loss surgery.
  - Approximately 85% of the stomach is removed, leaving a sleeve-shaped stomach.
  - No published studies on long-term results.

### Combined Malabsorptive/Restrictive Procedures

- Roux-en-Y Gastric Bypass (RYGBP)

## Appendix B: Methodology for Rating Hospitals

To help consumers evaluate and compare hospital performance in bariatric surgery, HealthGrades analyzed patient outcome data for all patients (all-payer data) provided by 19 individual states for years 2005 through 2007. Ratings were based on HealthGrades' risk-adjustment methodology, and the HealthGrades ratings are available on the Internet at [www.healthgrades.com](http://www.healthgrades.com).

The purpose of risk adjustment is to obtain fair statistical comparisons among 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.

### Data Acquisition

For the bariatric surgery hospital ratings, all-payer state data were used in those states where state data are available. For multivariate logistic regression-based ratings (see below), HealthGrades conducted a series of data quality checks to preserve the integrity of the ratings. Based on the results of these checks, we excluded a limited number of cases because they were inappropriate for inclusion in the database or miscoded.

Examples of excluded patient records were:

- Patients who left the hospital against medical advice or who were transferred to another acute care hospital.
- Patients who were still in the hospital when the claim was filed.
- Patients with an invalid gender.
- Patients with an invalid age.

### Multivariate Logistic Regression-Based Ratings

The initial analysis of the data utilized 19 states of all-payer data from 2005 through 2007. Bariatric surgery patients were identified by their ICD-9 (International Classification of Diseases, 9th Revision) principal procedure of a bariatric surgical procedure and a principal diagnosis of obesity (ICD-9 code 278.00) or morbid obesity (ICD-9 Code 278.01)—a definition previously described by Santry et al.<sup>2</sup> Patients under the age of 18 were excluded.

For this population, potential risk factors and the outcome measure (complications) were then defined.

- 1 Potential risk factors were defined as all clinically relevant diagnoses occurring in more than 0.5% of the patients. In addition, patient demographic factors such as age and gender and the specific procedure performed on the patient were also considered. Some diagnosis codes were merged together (e.g., primary and secondary pulmonary hypertension) to minimize the impact of coding variations.
- 2 Complications were identified using previous peer-reviewed research<sup>2,3</sup> and through input from clinical and coding experts.

In some cases, an ICD-9 code can be either a risk or a complication. In these cases, a code is differentiated by the presence or absence of a 900 post-operative complication code. For example, in the case where a patient record contains "427.31 Atrial Fibrillation," that code is considered a risk if it occurs by itself and a complication if there is a corresponding "997.1 Cardiac Complications NEC" code also present in the patient record. Outcomes were binary, with documented major complications either present or not. Mortality is considered a major complication.

## Bariatric Surgery Cohort and Related ICD-9 Codes

### Principal Procedures and Diagnoses – Inclusions

Procedure 43.89, 44.31, 44.38, 44.39, 44.68, 44.95, or 45.91

Diagnosis 278.00 (obesity), 278.01 (morbid obesity)

### Procedures – Exclusions

44.5, 44.94, 44.96, 44.97

### Demographic – Exclusions

Patients under the age of 18 years

For a complete list of the over 400 diagnosis exclusion codes, please see the *Hospital Report Cards™ Bariatric Surgery Methodology* at [www.HealthGrades.com](http://www.HealthGrades.com).

## Bariatric Surgery Major Complications

### Major Complications – Bariatric Surgery

#### Respiratory Complications

31.1, 31.29, 480, 480.0, 480.1, 480.2, 480.3, 480.8, 481, 482, 482.0, 482.1, 482.2, 482.3, 482.30, 482.31, 482.32, 482.39, 482.4, 482.40, 482.41, 482.49, 482.8, 482.81, 482.82, 482.83, 482.84, 482.89, 482.9, 483, 483.0, 483.1, 483.8, 484, 484.1, 484.3, 484.5, 484.6, 484.7, 484.8, 485, 486, 518.5, 518.7, 518.81, 518.0, 997.3

#### Cardiac Complications

410.01, 410.11, 410.21, 410.31, 410.41, 410.51, 410.61, 410.71, 410.81, 410.91, 427.0, 427.1, 427.41, 427.31, 427.89, 997.1

#### Urinary Complications/Acute Renal Failure

38.95, 39.95, 584.5, 584.8, 584.9, 599.0, 997.5

#### Splenic Injury

41.2, 41.43, 41.5, 41.95

#### Pulmonary/Venous Embolism

415.11, 415.19, 453.8, 453.9

#### Stroke

431, 433.00, 433.01, 433.10, 433.11, 433.20, 433.21, 433.30, 433.31, 433.80, 433.81, 433.90, 433.91, 434.00, 434.01, 434.10, 434.11, 434.90, 434.91, 436, 437.1

#### Digestive System Complications

560.0, 560.1, 560.2, 560.30, 560.39, 560.81, 560.89, 560.9, 564.2, 578.9, 997.4, 998.6

#### Hemorrhage/Surgical Wound Complications

44.61, 54.12, 54.61, 54.91, 54.92, 998.0, 998.11, 998.12, 998.2, 998.30, 998.31, 998.32

#### Post-Operative Infections

038, 038.0, 038.1, 038.10, 038.11, 038.19, 038.2, 038.3, 038.4, 038.40, 038.41, 038.42, 038.43, 038.44, 038.49, 038.8, 038.9, 998.51, 998.59

For more details regarding the specific ICD-9 codes identified as complications, please see the *Hospital Report Cards™ Bariatric Surgery Methodology* at [www.HealthGrades.com](http://www.HealthGrades.com).

## Developing HealthGrades Bariatric Surgery Ratings

Developing the HealthGrades bariatric surgery ratings involved four steps.

- 1 First, the predicted value (predicted complications) was obtained using a logistic regression model discussed in the next section.
- 2 Second, the predicted value was compared with the actual or observed number of complications. Only hospitals with at least 30 cases across three years of data and at least five cases in the most current year were included.
- 3 Third, a test was conducted to determine whether the difference between the predicted and actual values was statistically significant. This test was performed to make sure that differences were very unlikely to be caused by chance alone.

- 4 Fourth, a star rating was assigned based upon the outcome of the statistical test.

The following rating system was applied to the data for all procedures and diagnoses:

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

### Statistical Models

Using the list of potential risk factors described above, we used logistic regression to determine to what extent each one was correlated with the quality measure (complications). A risk factor stayed in the model if it had an odds ratio greater than one (except clinically relevant procedures, cohort defining principal diagnoses, and some protective factors as documented in the medical literature were allowed to have an odds ratio less than one) and was also statistically significant ( $p < 0.05$ ).

Complications were *not* counted as risk factors as they were considered a result of care received during the admission. Risk factors are those diagnoses that are the most highly correlated with the outcomes studied (complications). The most highly correlated risk factors are not necessarily those with the highest volume.

The statistical model was checked for validity and finalized. The final model was highly significant, with a C-statistic of 0.683. This model was then used to estimate the probability of a complication for each patient in the cohort. Patients were then aggregated for each hospital to obtain the predicted number of complications for each hospital. Statistical significance tests were performed to identify, by hospital, whether the actual and predicted rates were significantly different.

### Top Five Risk Factors

Diagnosis or Procedure Code	Description
Diag 518.0	PULMONARY COLLAPSE
Diag 428.0	CONGESTIVE HEART FAILURE
Diag V64.41	LAP PROC CONVERT TO OPEN
Diag 285.9	ANEMIA, UNSPECIFIED
Diag 250.02	TYPE II DIABETES-UNCMP/UNCONTROLLED

### 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—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 Health Grades, Inc. has taken steps to carefully compile these data using its methodology, no techniques are infallible, and therefore some information may be missing, outdated or incorrect.

Please note that a high ranking for a particular hospital is not a recommendation or endorsement by Health Grades, Inc. of a particular hospital; it means that the data associated with a particular hospital has met the foregoing qualifications. Only individual patients can decide whether a particular hospital is suited for their unique needs.

Also note that if more than one hospital reported to CMS under a single provider ID, HealthGrades analyzed patient outcomes data for those hospitals as a single unit. Throughout this document, therefore, "hospital" refers to one hospital or a group of hospitals reporting under a single provider ID.

### Methodology References

- 1 Buchwald, H. et al., Bariatric Surgery: A Systematic Review and Meta-Analysis. JAMA. 2004; 92: 1724–1737.
- 2 Santry HP, Gillen DL, Lauderdale DS. Trends in bariatric surgical procedures. JAMA. 2005;294:1909-1917.
- 3 Nguyen NT, Paya M, Stevens CM, et al. The relationship between hospital volume and outcome in bariatric surgery at academic medical centers. Ann of Surg. 2004;240(4):586-594.