

South Carolina Department of Health and Human Services  
Report to  
The Committee on Medical, Military, Public, and Municipal Affairs

In Response  
to  
Concurrent Resolution (S.1379)

# A Study of the Treatment of Obesity

Undertaken by  
The University of South Carolina  
Institute for Families in Society | Health Services Research Unit

January 2011



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### **Acknowledgement**

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The study investigators do not have any affiliations or financial involvement (e.g., employment, consultancies, honoraria, stock ownership or options, expert testimony, grants or patents received or pending, or royalties) that conflict with material presented in the report. This report is based on research conducted by the University of South Carolina, Institute for Families in Society, under contract to the South Carolina Department of Health and Human Services (DHHS). The findings and conclusions in this document are those of the author(s), who are responsible for its content, and do not necessarily represent the views of DHHS.

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## EXECUTIVE SUMMARY

The South Carolina Legislative concurrent resolution (S.1379) tasked the South Carolina Department of Health and Human Services (SCDHHS) and the Department of Insurance (DOI) jointly to undertake a study of the treatment of obesity, including the compilation of data on the treatment of obesity through bariatric surgery performed at facilities certified by the American Society for Bariatric Surgery (ASBS) as certified Bariatric Surgery Centers of Excellence (BSCOE) compared to facilities not certified by the American Society for Bariatric Surgery. Under contract with the SC Department of Health and Human Services, the Institute for Families in Society at the University of South Carolina conducted this study. For this report, obesity refers to a formula based on height and weight — called the body mass index (BMI)<sup>1</sup>. Adults with a BMI of 30 or higher are considered obese. Extreme obesity, also called severe obesity or morbid obesity, occurs with a BMI of 40 or more. Surgery is indicated for persons with severe obesity (body mass index (BMI) of 40 kg/m<sup>2</sup> or more) or for persons with a BMI of 35 kg/m<sup>2</sup> or more and serious co-morbidities such as diabetes, coronary heart disease, or obstructive sleep apnea.

### Alarming Trend: Obesity in the United States and South Carolina

Adult obesity rates have doubled over the past three decades, with more than 20 percent of the adult population in the United States now classified as obese<sup>1,2</sup>. The highest rates of obesity are in the southeast<sup>2</sup> with women and African-Americans reporting higher BMI rates compared to men and other racial ethnic groups<sup>2</sup>. Overall, obese individuals have poorer health outcomes and higher death rates than those with normal BMI rates<sup>1-21</sup>. In South Carolina, obesity is a major risk factor among the top ten chronic conditions associated with the leading causes of death.

### The Cost of Obesity

Obesity is associated with increased health use and costs<sup>2,4,6,23</sup>. The annual direct medical cost to treat obesity-related illness in South Carolina is estimated to be four billion dollars with Medicare and Medicaid financing half of the medical care<sup>23,24</sup>.

### Obesity and Bariatric Surgery

A review of research studies documenting the long-term effects of obesity treatments found that weight loss from surgical and non-surgical interventions - diet and exercise and pharmacotherapy - for people suffering from obesity was associated with decreased risk of development of diabetes, and a reduction in cholesterol and blood pressure<sup>25</sup>. While counseling and pharmacotherapy can promote weight loss, bariatric surgery-induced weight loss is a key intervention associated with sustained weight loss, health care costs savings and improving clinical health outcomes<sup>26,27,28</sup>. Bariatric surgery, a last intervention

for obese patients<sup>29, 30, 31</sup>, should be used as a treatment option for patients with morbid obesity who have first attempted medical therapy and other non-surgical options.

## **Bariatric Surgery Center of Excellence Designation**

The literature documents a growing body of research on the efficacy and safety of bariatric surgery procedures<sup>36-53</sup>. In 2005, responding to the growing rate of bariatric procedures, the American College of Surgeons and the American Society for Metabolic and Bariatric Surgery implemented programs for accrediting hospitals as centers of excellence (COE) in bariatric surgery<sup>33</sup>. Standards for COE certification vary somewhat between the programs, but they generally include minimum procedure volume standards, availability of specific protocols and resources for managing morbidly obese patients, and submission of outcomes data to a central registry<sup>54</sup>. In February 2006, the Centers for Medicare and Medicaid Services determined that bariatric surgery is covered when conducted at medical facilities that meet stringent quality and safety criteria in their bariatric surgery programs<sup>54</sup>. The facility must be recognized as a Bariatric Surgery Center of Excellence<sup>®</sup> (BSCOE) by the Centers for Medicare & Medicaid Services (CMS) as certified by the American Society for Metabolic and Bariatric Surgery or recognized by CMS as a Level One Bariatric Surgery Center as designated by the American College of Surgeons<sup>42</sup>.

## **KEY FINDINGS**

A total of 98,658 patients were included in the study with 5,576 in the bariatric surgery cohort and 93,082 patients in the obesity group. The bariatric surgery groups are matched by gender and race across certification status.

### **Patient Characteristics**

- Patients undergoing procedures in BSCOE were more likely to have private and other federal insurance programs. Severely obese individuals were more likely to have public insurance (Medicaid and Medicare) and other federal sources of insurance.
- The average age of the study population ranged between 40 and 49 years. Across all age groups, the volume of procedures was greater for facilities not certified as a BSCOE and for patients between the ages of 40 and 49.
- The rate of bariatric surgery procedures substantially increased for each of the study anchor years, i.e., 2000 to 2006. Procedures performed at BSCOE have grown at a higher rate than procedures at non-BSCOE facilities.

## Bariatric Surgery Outcomes

- Complication Rates: The seven-year average 180-day complication rate for gastroplasty procedures was statistically higher for patients undergoing procedures at facilities not accredited as a Bariatric Surgery Center of Excellence (BSCOE) compared to facilities with the designation.
- Comorbid Conditions: The percent of patients with claims associated with obesity related comorbid conditions declined substantially for patients who underwent bariatric surgery compared to severely obese patients who did not undergo bariatric surgery.
- Health Care Service Use and Paid Charges: In the two-years after the bariatric surgery or severe obesity diagnosis, there was no statistically significant difference in the increase in visit rate per 1,000 patients for the three outcome measures, i.e., emergency department (ED), inpatient hospital stays (IP), and outpatient visits (OP). During the same period, the average number of inpatient hospital stays and paid charges increased for all groups. These findings would suggest the need to examine these outcomes beyond two-years of the index event to determine adequately the cost effectiveness of bariatric surgery. The index event is not included in the analysis (Tables 4-5).
- Outcomes and paid charges for bariatric and non-bariatric patients: Excluding the index event pre and post charges for OP, IP, and ED visits, the analysis found inpatient hospital stays to be significantly higher for patients undergoing bariatric procedures.
- Inpatient hospital stay charges and visits were significantly higher for bariatric surgery patients. As previously noted, this study examined post-charges within two-years of the index or anchor year limiting potential cost gains associated with reduced outpatient, inpatient, and emergency department visits resulting from improved health outcomes.
- Paid insurance charges based on bariatric surgery facility status: Patients undergoing bariatric surgery at non-BSCOE facilities were more likely to have higher rates of comorbid obesity-related conditions with Medicaid or Medicare as their primary source of insurance. Table 6 indicates an association between source of insurance and paid charges excluding the bariatric surgery procedure. The findings indicate higher paid charges for patients with Medicare insurance. Conversely, the lowest paid charges were for patients with Medicaid as their source of insurance. This pattern of difference between paid charges and source of insurance remains true for bariatric surgery procedures. Several factors associated with Medicare and Medicaid insured patients influence paid charges. Medicare and Medicaid insured patients have higher inpatient hospital days, comorbidities, emergency room visits, and mortality compared to privately insured and other sources of insurance. In order to adequately address differences in patient populations, future studies must adequately control for these factors.

## CONCLUSION

Overall, this study supports the growing body of evidence documenting bariatric surgery as a promising practice in the treatment of severe obesity<sup>36-60</sup>. It is a preliminary study requiring further examination of bariatric procedures to adequately document the efficacy and cost effectiveness of these surgical procedures across differing segments of the population. As the initial retrospective study on bariatric surgery in South Carolina, it documents several key findings. First, the rapid growth of bariatric surgery in South Carolina among BSCOE facilities in South Carolina provides a viable option to meet the needs of severely obese patients. Second, documenting 180-day complication and mortality rates provides a baseline from which future long-term studies can document outcome changes. Although some differences were identified, our study suggests the need for further analysis to document the difference in outcomes associated with bariatric procedures undertaken at Bariatric Surgery Centers of Excellence compared to other facilities.

## Study Limitations

A major strength of this study is the design and use of a large claims database from all sources of insurance, allowing for better generalizability of bariatric surgery outcomes to severely obese patients in South Carolina. This study has several limitations that affect the study findings. The claims database does not allow the confirmation of information in the medical record, such as body mass index, diagnosis of either obesity or comorbid conditions necessary to establish a matched cohort population. While the retrospective study design seems to be the best way to answer the study questions, picking a comparison group may introduce other confounders that may skew the results. The baseline health status of patients seeking bariatric surgery, as compared with that of control subjects, is also unknown. A limitation of the claims database provided by the SC Budget and Control Board is the lack of identifiable information for each facility that would allow the research team to match the facility to COE designation with patient volume. Finally, given the highly competitive marketplace for bariatric surgery, BSCOE certification may provide a distinct advantage in the types of patients served by the facility, e.g. Medicare and Medicaid patients. Future studies must find mechanisms to receive identifiable data for each facility while protecting their identity by grouping them into categories to assist sensitivity analysis.

In conclusion, the study findings provide baseline data supporting the efficacy of bariatric surgery as a viable option for severely obese patients. It suggests the need for long-term data collection linked to medical records and follow-up with patients regarding quality of life, patient satisfaction, and health care resource use.



## INTRODUCTION

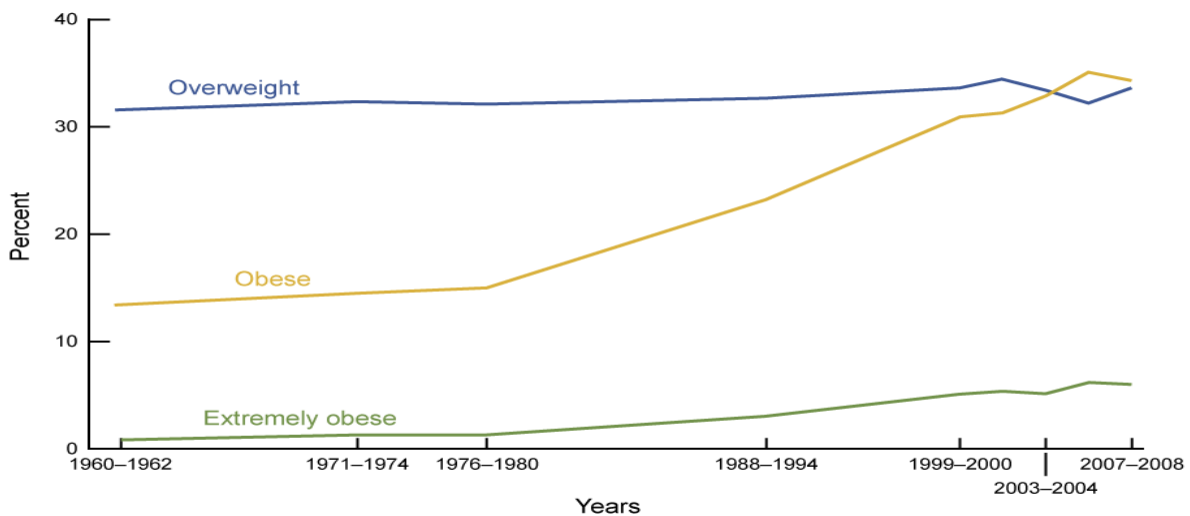
Under a concurrent resolution (S.1379), the South Carolina Department of Health and Human Services and the Department of Insurance are jointly tasked to undertake a study to examine the treatment of obesity. The study is to include the compilation of data on the treatment of obesity through bariatric surgery performed at facilities certified by the American Society for Bariatric Surgery (ASBS) as certified Bariatric Surgery Centers of Excellence (BSCOE) compared to facilities not certified by the American Society for Bariatric Surgery. Under contract with the SC Department of Health and Human Services, the Institute for Families in Society at the University of South Carolina undertook this study.

For this report, obesity refers to a formula based on height and weight — called the body mass index (BMI)<sup>1</sup>. Adults with a BMI of 30 or higher are considered obese. Extreme obesity, also called severe obesity or morbid obesity, occurs with a BMI of 40 or more. Surgery is indicated for persons with severe obesity (body mass index (BMI) of 40 kg/m<sup>2</sup> or more) or for persons with a BMI of 35 kg/m<sup>2</sup> or more and serious co-morbidities such as diabetes, coronary heart disease, or obstructive sleep apnea.

### Alarming Trend: Obesity in the United States and South Carolina

Adult obesity rates have doubled over the past three decades, with more than 20 percent of the adult population now classified as obese<sup>1,2</sup>. Historical data indicate a slight increase in the rate of obesity between 1960 and 1980, followed by a marked increase over the subsequent three decades up to today<sup>2</sup>.

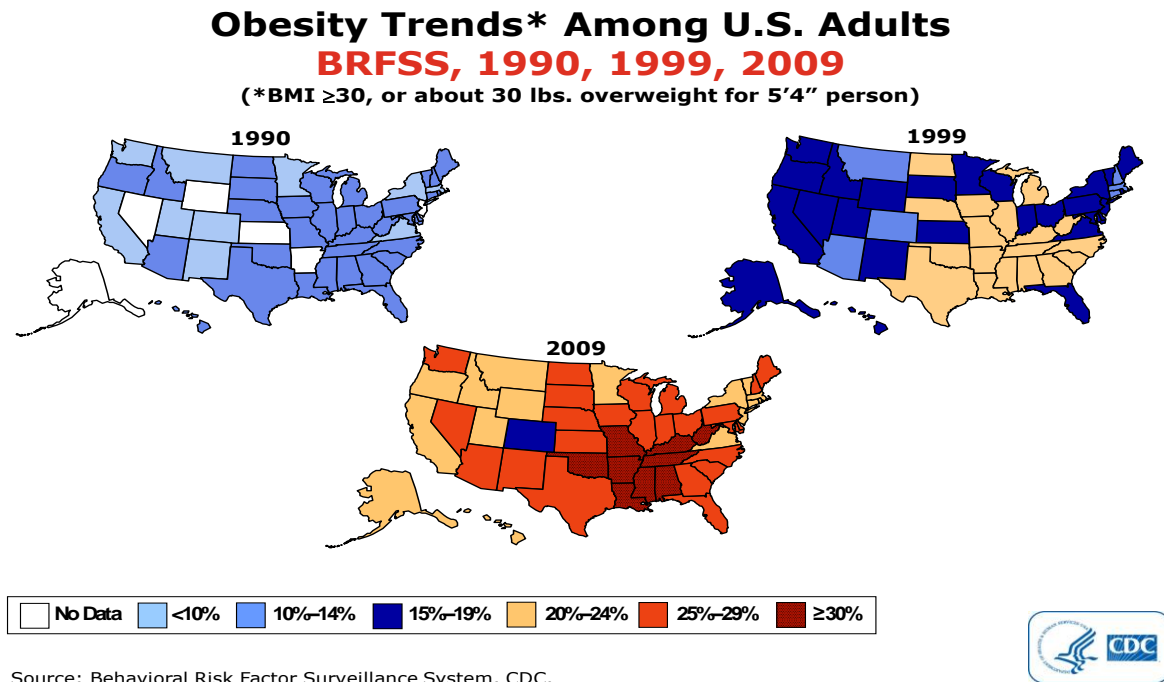
**Figure 1: Trends in Overweight and Obese Adults**



NOTE: Age-adjusted by the direct method to the year 2000 U.S. Census Bureau estimates, using the age groups 20-39, 40-59, and 60-74 years. Pregnant females were excluded. Overweight is defined as a body mass index (BMI) of 25 or greater but less than 30; obesity is a BMI greater than or equal to 30; extreme obesity is a BMI greater than or equal to 40.  
SOURCE: CDC/NCHS, National Health Examination Survey cycle I (1960-1962); National Health and Nutrition Examination Survey I (1971-1974), II (1976-1980), and III (1988-1994), 1999-2000, 2001-2002, 2003-2004, 2005-2006, and 2007-2008.

Since the 1990s, obesity rates have doubled in the United States<sup>4</sup> with more than 60 million, approximately 30 percent of, adults classified as obese<sup>1,2</sup>. This trend is not limited geographically; however, certain states and population groups are more likely to have higher prevalence rates. South Carolina ranks ninth in the nation with twenty-nine percent of the adult population (2,748,599) classified as obese<sup>1,2</sup>.

Figure 2: US Obesity Trend, 1990 - 2009



The highest rates of obesity are in the southeast<sup>2</sup> with women and African-Americans reporting higher BMI rates compared to men and other racial ethnic groups<sup>2</sup> (Appendix A). In South Carolina, high obesity rates are associated with lack of physical activity and with meals high in fat and sugar content<sup>3</sup>.

### Obesity and Poor Health Outcomes

Not surprisingly, obesity is associated with health complications and poor health outcomes<sup>4,5,6</sup>. Obesity is associated in the literature as the cause or contributing to the presence of the following medical conditions:

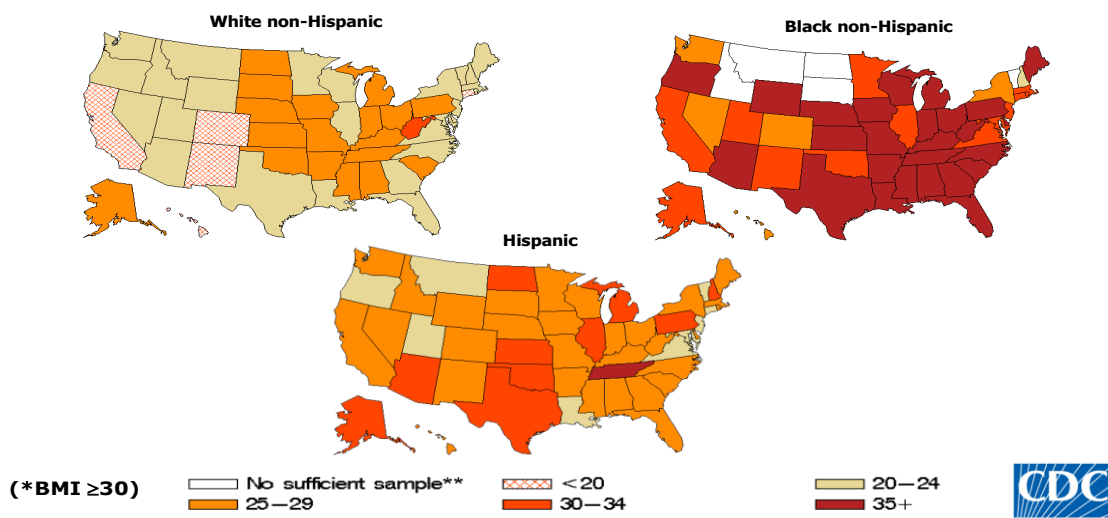
- hypertension (high blood pressure)<sup>7,8</sup>
- heart disease and stroke<sup>7,8</sup>
- respiratory disorders (asthma; bronchitis; chronic obstructive pulmonary disease)<sup>9,10</sup>
- diabetes and related complications (blindness, kidney failure, amputation)<sup>11,12</sup>

- gallbladder disease<sup>12</sup>
- cancer (endometrial, breast, and colon)<sup>13, 14</sup>
- degenerative osteoarthritis and joint stress<sup>15</sup>
- high cholesterol and triglyceride levels<sup>7, 8, 16</sup>
- sleep apnea<sup>17</sup>
- premature death<sup>18</sup>
- poor perinatal outcomes and birth defects<sup>19, 20</sup>
- work disability<sup>21</sup>

Overall, obese individuals have poorer health outcomes and higher death rates than those with normal BMI rates<sup>1-21</sup>. In South Carolina, obesity is a major risk factor among the top ten chronic conditions associated with the leading causes of death: heart disease (1st); cancer (2nd), strokes (3rd), Alzheimer's Disease (non-obesity related) (4th), respiratory disorders (5th) and diabetes (6th)<sup>22</sup>.

Figure 3: US Prevalence of Obesity by Race and Ethnicity

### State-specific Prevalence of Obesity\* Among U.S. Adults, by Race/Ethnicity, 2006-2008



### The Cost of Obesity

Obesity is associated with increased health use and costs<sup>2, 4, 6, 23</sup>. Recent estimates of the annual nationwide medical costs of obesity are as high as \$147 billion<sup>23</sup>. On average, obese individuals have medical costs that are \$1,429 more than the costs of persons of normal-weight<sup>23</sup>. Currently, obese individuals will pay forty-two percent more in health care costs than normal-weight individuals will pay

for health care<sup>23</sup>. The annual direct medical cost to treat obesity-related illness in South Carolina is estimated to be four billion dollars with Medicare and Medicaid financing half of the medical care<sup>23,24</sup>. The reported obesity-related costs will continue to increase without a strategic effort to curb this alarming trend. Given the increased obesity rates and their impact on the well-being of South Carolinians, the next section summarizes key information on the role of bariatric surgery in addressing this trend.

## Obesity and Bariatric Surgery

Research studies have documented age, sex and ethnicity as key risk factors for weight gain<sup>1-3</sup>. A review of research studies documenting the long-term effects of obesity treatments found that weight loss from surgical and non-surgical interventions - diet and exercise and pharmacotherapy - for people suffering from obesity was associated with decreased risk of development of diabetes, and a reduction in cholesterol and blood pressure<sup>25</sup>. While counseling and pharmacotherapy can promote weight loss, bariatric surgery-induced weight loss is a key intervention associated with sustained weight loss, health care costs savings and improving clinical health outcomes<sup>26, 27, 28</sup>.

Bariatric Surgery is the last intervention for obese patients<sup>29,30,31</sup>. In 1991, the National Institute of Health approved bariatric surgery as a treatment option for patients with morbid obesity. The NIH Consensus Conference on Surgical Treatment of Morbid Obesity (1998) states that obesity surgery should be reserved only for patients who have first attempted medical therapy: "Weight loss surgery should be reserved for patients in whom efforts at medical therapy have failed and who are suffering from the complications of extreme obesity<sup>31</sup>."

Candidates for bariatric surgery must meet the following criteria established by the National Institutes of Health<sup>32</sup>:

- Have a Body Mass Index (BMI) of 40 or more (about 100 lbs or more over ideal body weight); or a BMI of 35 or more with serious medical conditions related to obesity that would improve with weight loss.
- Have attempted (and failed) previous weight loss efforts with diet, exercise, lifestyle changes, or medications.
- Be able to understand the possible risks, benefits, and side effects of the procedure.
- Understand and be committed to the lifestyle changes necessary to succeed.
- Be committed to lifestyle changes and long-term follow-up.
- Not have any medical, psychiatric, or emotional condition that would prohibit surgery.
- Be motivated and have realistic expectations of the surgery as a tool to help the patient lose weight.

Surgical weight loss occurs by reducing energy intake with the optional procedure controlling the absorption of food. Weight stability results balancing energy intake with energy outflow. While some of the changes are due to diet and weight loss alone, others are the result of anatomical changes in the gastrointestinal tract. Bariatric surgery procedures fall into two major categories<sup>33</sup>:

- 1) Restrictive surgery limits a patient's ability to ingest large quantities of food while slowing down the speed at which food empties the stomach.
- 2) Combination surgery combines restrictive and absorptive approaches. This procedure restricts food intake and bypasses segments of the small intestines.

The increased rates of bariatric surgery procedures have resulted in it becoming the second most performed abdominal operation in the United States<sup>34,35</sup>.

## **Bariatric Surgery Center of Excellence Designation**

The literature documents a growing body of research on the efficacy and safety of bariatric surgery procedures<sup>36-53</sup>. In 2005, responding to the growing rate of bariatric procedures, the American College of Surgeons and the American Society for Metabolic and Bariatric Surgery implemented programs for accrediting hospitals as centers of excellence (COE) in bariatric surgery<sup>33</sup>. Standards for COE certification vary somewhat between the programs, but they generally include minimum procedure volume standards, availability of specific protocols and resources for managing morbidly obese patients, and submission of outcomes data to a central registry<sup>54</sup>. In February 2006, the Centers for Medicare and Medicaid Services determined that bariatric surgery is covered when conducted at medical facilities that meet stringent quality and safety criteria in their bariatric surgery programs<sup>54</sup>. The facility must be recognized as a Bariatric Surgery Center of Excellence<sup>®</sup> (BSCOE) by the Centers for Medicare & Medicaid Services (CMS) as certified by the American Society for Metabolic and Bariatric Surgery or recognized by CMS as a Level One Bariatric Surgery Center as designated by the American College of Surgeons<sup>42</sup>. These combined policy actions have substantially increased the opportunities for health care coverage and regulatory oversight associated with bariatric surgery procedures.

The research on BSCOE certification status and patient outcomes is inconclusive. Initial studies using the Bariatric Surgery Longitudinal Research studies document a general association between hospital procedure volume and lower complication rates – around 10 percent – with the most common complaint being nausea/vomiting and lower mortality rates<sup>55</sup>. A recent study found that patients who undergo bariatric surgery at hospitals designated as centers of excellence do not appear to have lower mortality rates or lower rates of complications than those whose procedures are performed at other hospitals<sup>55, 56</sup>. Conversely, Medicare patients tend to do better when their procedures are performed at high-volume centers or when they receive laparoscopic bariatric surgery at facilities certified by the ACS or ASMBS designation as a bariatric surgery center of excellence<sup>42</sup>. In the first federally funded, multicenter clinical studies to evaluate the overall risks, benefits and long-term impact of bariatric surgery, researchers have found the overall risk of death and other adverse outcomes is low and varies considerably from patient to patient<sup>57, 58, 59</sup>.

Building on this initial body of evidence and in response to the SC General Assembly's S.1379 Concurrent Resolution, this study will examine bariatric surgery performed at facilities certified by the American Society for Bariatric Surgery (ASBS) as certified Bariatric Surgery Centers of Excellence (BSCOE) compared to facilities not certified by the American Society for Bariatric Surgery (Non-BSCOE). It will be the first study in South Carolina to examine bariatric surgery patient outcomes as a function of inpatient and emergency department visits, complications and mortality rates, and costs. The University of South Carolina Institute for Families in Society conducted this study under a contract with the South Carolina Department of Health and Human Services.

## STUDY APPROACH

### Project Timeline

To meet the January 2011 report submission deadline, the following schedule of activities shaped the study approach:

- Appoint Advisory Committee – September 2009
- Advisory Committee Meets Quarterly – Starting October 2009
- Data Protocol and Approach Approved – October 2009
- Case Sample Data Collection Instruments Approved – December 2009
- Case Sample Data Collection and Analysis – January 2010 – December 2010
- ORS Multiyear Data Linkages and Analysis – January 2010 – December 2010
- Preliminary Draft Findings and Recommendation to Advisory Committee – October 2010
- Draft Report – December 2010
- Final Report to SC General Assembly – January 2011

### Study Sample

The study draws on data from the SC Budget and Control Board, Office of Research Statistics (ORS) inpatient hospital files to obtain two samples: (1) patients who had undergone bariatric surgery (bariatric surgery group), and (2) a matched cohort of severely obese patients who had not undergone bariatric surgery (obese group). ORS receives claims data from hospitals and outpatient facilities for all patients across public and private sources of insurance. The bariatric surgery and obese patients were matched by age, race, gender, zip code of geographical residence, and the presence of claims with a diagnosis of severe or morbid obesity.

The bariatric surgery sample population consists of all patients undergoing bariatric surgery between July 1, 2000 and June 30, 2006 that includes 5,576 from all hospitals and outpatient facilities in South Carolina. The obese sample consisted of a matched cohort group of 93,082 patients comprising the comparison group of eligible severely obese patients who had not selected to undergo surgery. A summary file of claims two years before and after the initial bariatric surgery procedure or for the

comparison group the first diagnosis of obesity is drawn for each study participant and referred to as the index event.

## Study Participant Inclusion Criteria

Study participation inclusion criteria consisted of paid facility claims, age group, obesity diagnosis, and the presence of bariatric surgery procedures. Patients with a history of bariatric surgery performed outside of facilities in South Carolina were excluded from this study. To be included in the study population, a patient must meet the following criteria (a-c):

- a) Facility setting claims: Inpatient; Emergency Department, and Outpatient
- b) Age at diagnosis: 14 to 64 years
- c) Obesity Diagnosis: claims with an ICD-9 Diagnosis code of 278.0X or 259.9 or an inpatient hospital stay with a DRG of 288. Bariatric surgery procedures are identified by the ICD-9 codes in Table 1.

**Table 1: Bariatric Surgery Procedure Codes**

	ICD-9 Code
<b>Gastric bypass</b>	
High gastric bypass	44.31
Gastroenterostomy other (1998-2005)	44.39
Gastroenterostomy - laparoscopic (2004-2005)	44.38
<b>Gastroplasty</b>	
Gastroplasty - not otherwise specified (1998- 2005)	44.69
Gastroplasty - laparoscopic (2004-2005) [including vertical banded gastroplasty and those combined with gastroenterostomy]	44.68
<b>Adjustable Band</b>	
Laparoscopic Adjustable Band (2004-2005) [prior to 2004 coded as 44.69]	44.95
Laparoscopic Band revision (2004-2005) [prior to 2004 coded as 44.69]	44.96
Laparoscopic band removal (2004-2005) [prior to 2004 coded as 44.99]	44.97
<b>Malabsorptive</b>	
Sleeve gastrectomy	43.89
Partial gastrectomy with jejunal anastomosis	43.70
Gastrectomy, distal	43.60
Gastrectomy, proximal	43.50
Small bowel to small bowel anastomosis	45.50
Small bowel segment isolation	45.51
Partial resection jejunum	45.62
Intestine to intestine anastomosis, not specified	45.90
Intestinal isolation, not specified	45.91
<b>Other</b>	
Gastric operation, not specified elsewhere	44.99

## Data File

A multi-year dataset was constructed to examine outcomes by facility bariatric certification status versus non-bariatric status. Outcome measures consisted of the following variables: a) population-based case bariatric surgery and obesity rates; b) bariatric major postoperative complications rates; c) average hospital stays; d) hospital charges; and e) mortality rates. Collected data was based on index events (or anchor date) - bariatric surgery date for the bariatric surgery group and the date of first diagnosis of severe obesity (without bariatric surgery) for the obese group covering index events between fiscal years 2000 to 2006. Four years of claims data were drawn for each patient. For the bariatric surgery group, the data spanned two years of preoperative and two years of postoperative claims data and for the obese comparison population, two years before and after first diagnosis of severe obesity. As an example, a patient with a bariatric surgery procedure or first diagnosis of severe obesity in 2006 will have a multi-year dataset with claims for all health care services between 2004 to 2006 (pre) and 2006 to 2008 (post).

The presence of co-morbidities and complications was determined from the patient data file. At the advice of the Study Advisory Committee, post-surgery complications were evaluated within 180 days of surgery for the following conditions:

- Aspiration (ICD-9 codes 507 and 9973);
- Pulmonary insufficiency (ICD-9 codes 5184, 5185 and 5188);
- Cardiac complications (ICD-9 code 9971);
- Pneumonia (ICD-9 codes 480 to 487);
- Acute renal failure (ICD-9 code 584);
- Septicemia (ICD-9 code 038);
- Postoperative infection (ICD-9 code 9985);
- Cardiac arrest (ICD-9 code 4275);
- Acute myocardial infarction (ICD-9 code 410);
- Reintubation (ICD-9 code 9604), and
- Reoperation for bleeding (ICD-9 codes 3941, 3949, and 3998)

The mortality rate is calculated as the number of deaths indicated in patient histories within two-years of the index event. The reader is cautioned not to assume the cause of the patient death is related to the bariatric surgery. This study did not match an indication of death with a death certificate; therefore, cause of death is unknown.



## Data Analysis

Paid claims are organized in three groups for analysis. The bariatric surgery group is organized into two groups based on their facility certification status, i.e., BSCOE or Non-BSCOE Designation (Attachment A), and the third group is obese. Statistical analysis included chi-square tests to compare BSCOE and non-BSCOE results. Student *t* tests (paired) were used for bariatric and obese patients not eligible for surgery. At the suggestion of the Advisory Committee, individuals were excluded from the study sample with claims indicating surgeries with emergency admission and a diagnosis indicating Gastrointestinal neoplasm (ICD-9 150.XX-159.XX), Inflammatory Bowel Disease (ICD-9 555.0-556.9), and Noninfectious Colitis (ICD-9 558.9). Additionally, repairs were excluded in calculating bariatric surgery complication rates.

## STUDY FINDINGS

### Patient Characteristics

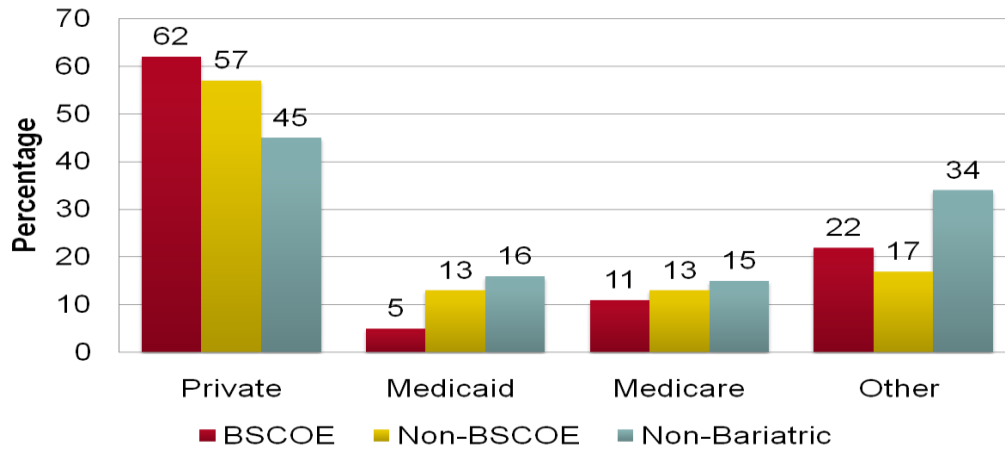
A total of 98,658 patients were included in the study with 5,576 in the bariatric surgery cohort and 93,082 patients in the obesity group (Table 2). The bariatric surgery groups are matched by gender and race across certification status. They differed on geographical location of the bariatric surgery facility indicating a difference in volume by region, particularly in the Midlands and Pee Dee regions. The comparison group of non-bariatric surgery severely obese patients was matched by gender, race, and the county of residence of the patient classified by geographic region to patients with bariatric procedures.

**Table 2: Demographic Profile**

Characteristic	BSCOE	Non-BSCOE	Non-Bariatric
Study Population	N = 2,635	N = 2,941	N = 93,082
Gender			
Female	2,108 (80%)	2,302 (78%)	63,742 (69%)
Male	527 (20%)	649 (22%)	29,340 (31%)
Race			
White	2,122 (81%)	2,341 (80%)	55,569 (60%)
Black	479 (18%)	561 (19%)	35,782 (39%)
Other	35 (1%)	39 (1%)	1,694 (1%)
Region (Zip Codes)			
Upstate	780 (30%)	787 (28%)	25,929 (29%)
Midlands	1,045 (41%)	425 (15%)	22,451 (25%)
Pee Dee	165 (6%)	775 (28%)	19,990 (22%)
Low Country	589 (23%)	795 (29%)	22,231 (25%)
Not Available	56	151	

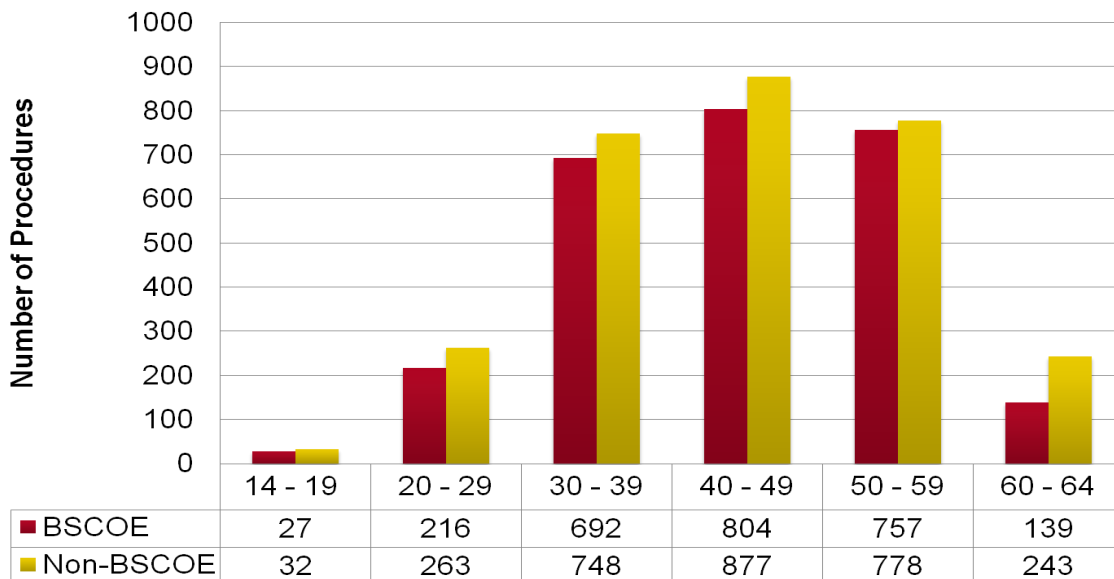
Patients undergoing procedures in BSCOE were more likely to have private and other federal insurance programs (Figure 3). Military, Federal and the SC State Employee Insurance Plan comprised other sources of insurance. Severely obese individuals were more likely to have public insurance (Medicaid and Medicare) and other federal sources of insurance than those who underwent bariatric surgery procedures.

**Figure 3: Source of Insurance**



As a group, the average age of the study population undergoing bariatric surgery and obese ranged between 40 and 49 years. Across all age groups, the volume of procedures was greater for facilities not certified as a BSCOE and for patients between the ages of 40 and 49 (Figure 4).

**Figure 4: Age Group and Number of Bariatric Surgery Procedures**



The rate of bariatric surgery procedures substantially increased for each of the study anchor years, i.e., 2000 to 2006. Procedures performed at BSCOEE have grown substantially from 65 in FY 2000 to 694 in FY2006. This substantial growth coincides with the implementation of certification status and the CMS policy position on Bariatric Surgery Centers of Excellence. In contrast, procedures at non-BSCOEE facilities did not increase at the same rate ranging from 155 in FY2000 to 497 in FY 2006 (Figure 4). An inverse relationship exists between the number of procedures and BSCOEE certification status indicating a decline in the number of procedures in non-BSCOEE facilities with an increase in procedures at BSCOEE facilities.

**Figure 5: Percent of Patients with Comorbid Conditions**

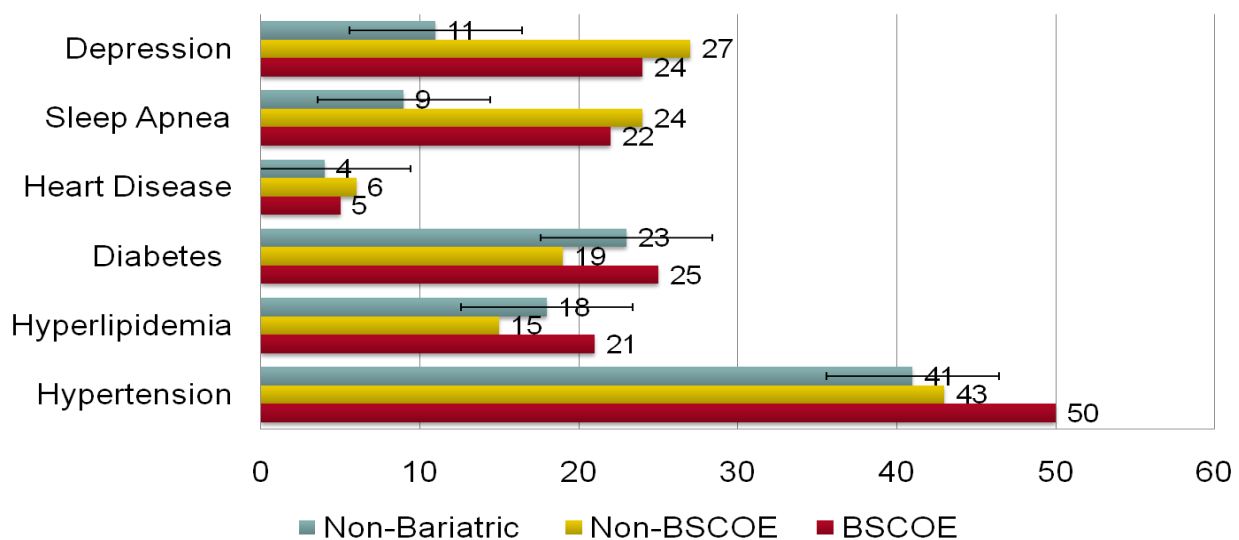


Figure 5 highlights the percent of patients with comorbid conditions most closely associated with obesity and poor health outcomes. On average, patients undergoing bariatric procedures in BSCOEE have a higher percentage of comorbid conditions than patients in non-BSCOEE facilities or those classified as severely obese who elect not to undergo bariatric surgery. As illustrated by error bars in Figure 5, severely obese patients had statistically significant lower rates of depression and sleep apnea compared to those who underwent bariatric surgery. Across all groups, hypertension and diabetes were the most common comorbid conditions.

There was no statistical difference in the percent of bariatric surgery patients with comorbid diagnosis of depression, sleep apnea, and heart disease by type of facility. Statistically patients with the highest reported rates of hypertension were more likely to undergo bariatric surgery procedures at a BSCOEE facility.

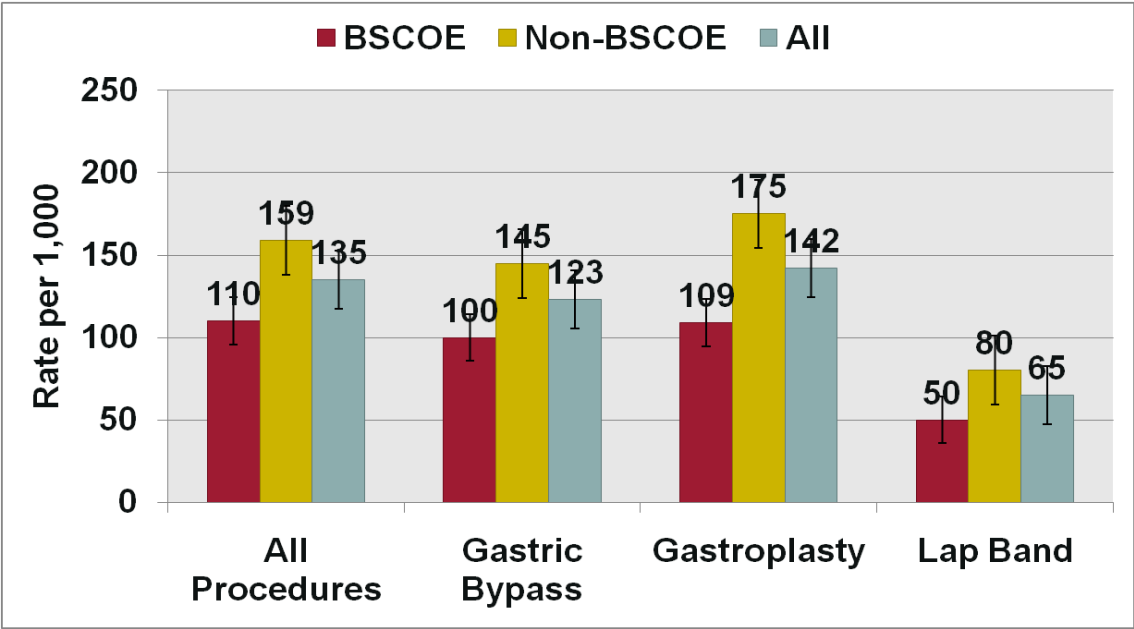
# Bariatric Surgery Outcomes

Outcomes explored in this study associated with bariatric surgery were complication rates within 180 days of the procedure, mortality rates within two years of the procedure or anchor year, and charges. The next section of this report explores each of these outcomes.

## Complication Rates

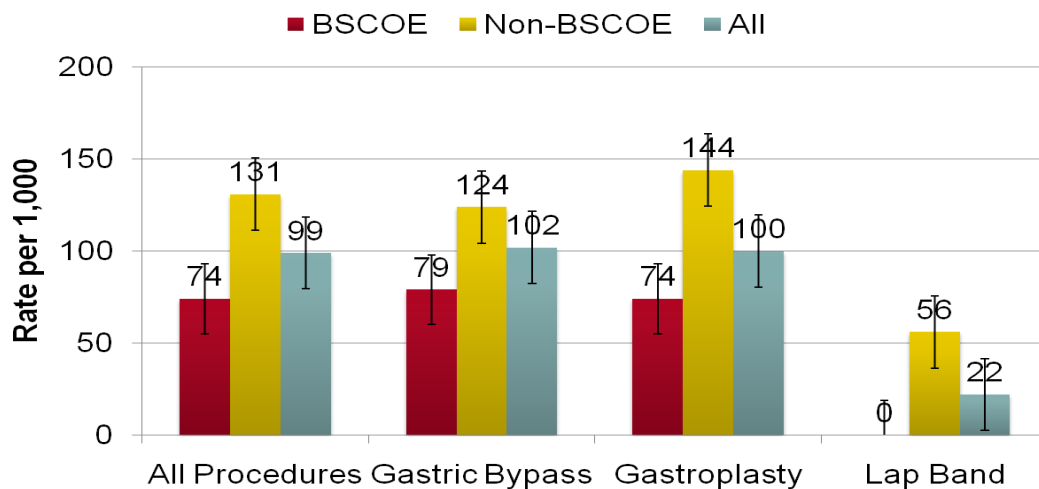
A seven-year average complication rate without repairs was calculated for gastric bypass, gastroplasty, lap band, and all bariatric surgery procedures for each facility by certification status to account for the variability within each anchor year. Standard errors that were applied to each procedure indicate a statistically significant difference exists between facilities with the BSCOE and non-COE facilities for gastroplasty procedures. The seven-year average 180-day complication rate for gastroplasty procedures was statistically higher for patients undergoing procedures at facilities not accredited as a Bariatric Surgery Center of Excellence (BSCOE) compared to facilities with the designation (Figure 6). For gastric bypass and lap band procedures, there were no statistically significant differences in the 180-day seven-year average complication rate between procedures based on the certification status of the facility, i.e., BSCOE and non-BSCOE facility.

Figure 6: Bariatric Surgery 180 –Day Complication Rate 7-Year Average (without repairs)



As seen in Figure 7, the 180-day complication rate for the matched BSCOE and non-BSCOE patients differs substantially for bariatric surgery procedures performed at BSCOE and non-BSCOE facilities. When controlling for patient characteristics, the 180-day matched cohort complication rates are higher for patients undergoing bariatric procedures at non-BSCOE facilities. Patient volume and year of COE designation was not controlled for in this analysis.

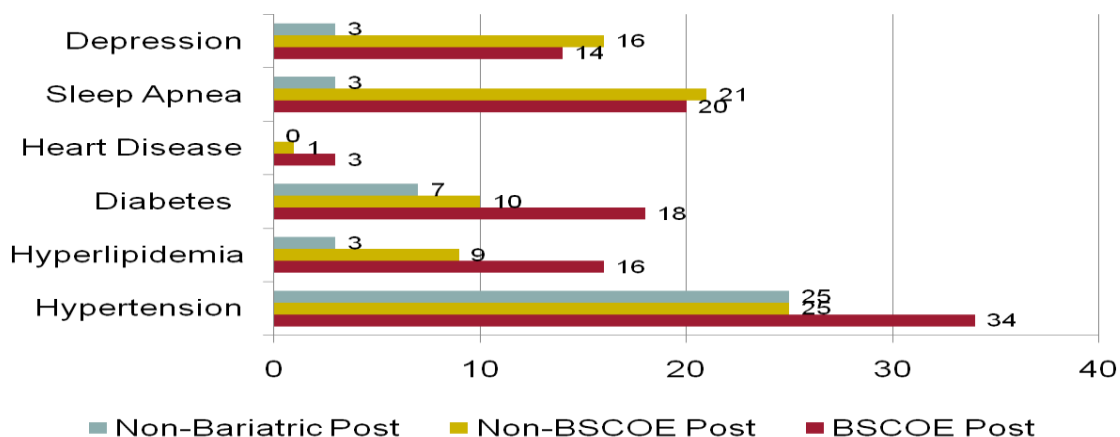
**Figure 7: Bariatric Surgery Matched 180-Day Complication Rate 7-Year Average (without repairs)**



### Comorbid Conditions

Is bariatric surgery associated with a lower percentage of patients identified with comorbid conditions associated with obesity related diseases? To examine this question, the analytical file of the matched cohort of patients was examined for the percent of patients with claims associated with comorbid conditions between 2005 and 2008. Figure 8 indicates that the percent of patients with claims associated with obesity related comorbid conditions declined substantially for patients who underwent bariatric surgery compared to severely obese patients who did not undergo bariatric surgery.

**Figure 8: Matched Cohort Change in Percent of Comorbid Conditions Three Years Post- Index Event**



## Mortality Rates

Mortality rates are identified using the designation of death on the insurance record of the study population. The cause of death is not listed preventing an association with undergoing a bariatric surgery procedure or comorbid conditions identified with obesity. Acknowledging this limitation, the data indicates that patients who underwent bariatric surgery in non-BSCOE facilities had a statistically higher mortality rate (18 per 1,000 patients) within two-years of the anchor year than those with procedures at a BSCOE facility. A possible explanation is the higher rates of comorbid obese-related conditions identified among non-BSCOE patients. When the BSCOE facility designation is not considered, severely obese patients who did not undergo a bariatric procedure had higher two-year mortality rates – 15 per 1,000 patients compared to 14 per 1,000 for those with a bariatric procedure (Table 3). This difference is not statistically significant indicating comparable two-year mortality rates for bariatric and non-bariatric obese patients.

**Table 3: Two-Year Mortality Rates for Matched Cohort Patients**

Type	No. of Patients	Deaths W/in 2 Years of the Anchor Year	Rate per 1,000 Patients
Total Bariatric	2,262	32	14
BSCOE	1,190	12	10
Non-BSCOE	1,072	20	18
Non-Bariatric	1,196	18	15

## Health Care Service Use and Paid Charges

In the two-years after the index event (e.g., bariatric surgery or severe obesity diagnosis), the increase in visit rate per 1,000 patients is not statistically significant for the three outcome measures, i.e., emergency department (ED), inpatient hospital stays (IP), and outpatient visits (OP) (Table 4).

**Table 4: Paid Charges by Service and Type of Bariatric Surgery Facility**

SURGERY	SETTING	PERIOD	PATIENTS	DISCHARGES	VISIT RATE	TOTAL CHARGES	AVG. CHARGES	TOTAL DAYS	AVG DAYS
BSCOE	ER	POST	1117	3136	2.8	\$5,627,100	\$1,794	3928	1.4
BSCOE	ER	PRE	1080	2840	2.6	\$3,479,200	\$1,225	2561	1.0
BSCOE	IP	POST	1110	2287	2.1	\$66,427,200	\$29,046	12791	5.6
BSCOE	IP	PRE	732	1538	2.1	\$32,219,300	\$20,949	8023	5.2
BSCOE	OP	POST	1325	2759	2.1	\$14,579,300	\$5,284	3374	1.8
BSCOE	OP	PRE	1477	2848	1.9	\$12,004,500	\$4,215	3337	1.6
Non-BSCOE	ER	POST	1408	4820	3.4	\$6,346,000	\$1,317	4699	1.1
Non-BSCOE	ER	PRE	1391	4221	3.0	\$3,890,500	\$922	4088	1.0
Non-BSCOE	IP	POST	1403	3481	2.5	\$93,831,000	\$26,955	21998	6.3
Non-BSCOE	IP	PRE	1041	2322	2.2	\$47,394,700	\$20,411	13006	5.6
Non-BSCOE	OP	POST	1400	2981	2.1	\$13,451,400	\$4,512	3029	1.3
Non-BSCOE	OP	PRE	1606	3345	2.1	\$9,965,500	\$2,979	3215	1.2

During the same period, the average number of inpatient hospital stays and paid charges increased for all groups (Table 5).

**Table 5: Paid Charges by Service and Bariatric Surgery Status**

SURGERY	SETTING	PERIOD	PATIENTS	DISCHARGES	VISIT RATE	TOTAL CHARGES	AVG. CHARGES	TOTAL DAYS	AVG DAYS
Bariatric Surgery	ER	POST	2525	7956	3.2	\$11,973,100	\$1,505	8627	1.2
Bariatric Surgery	ER	PRE	2471	7061	2.9	\$7,369,700	\$1,044	6649	1.0
Bariatric Surgery	IP	POST	2513	5768	2.3	\$160,258,200	\$27,784	34789	6.0
Bariatric Surgery	IP	PRE	1773	3860	2.2	\$79,614,000	\$20,625	21029	5.4
Bariatric Surgery	OP	POST	2725	5740	2.1	\$28,030,700	\$4,883	6403	1.5
Bariatric Surgery	OP	PRE	3083	6193	2.0	\$21,970,000	\$3,548	6552	1.4
No Surgery	ER	POST	49460	185524	3.8	\$211,888,200	\$1,142	223264	1.3
No Surgery	ER	PRE	50644	170467	3.4	\$143,518,500	\$842	164170	1.0
No Surgery	IP	POST	37550	86325	2.3	\$1,952,862,600	\$22,622	477169	5.5
No Surgery	IP	PRE	27069	53124	2.0	\$856,409,400	\$16,121	255410	4.8
No Surgery	OP	POST	33243	66159	2.0	\$281,481,800	\$4,255	101430	2.0
No Surgery	OP	PRE	28336	50915	1.8	\$173,624,300	\$3,410	62205	1.5

These findings would suggest the need to examine these outcomes beyond two-years of the index event to determine adequately the cost effectiveness of bariatric surgery. The index event is not included in the analysis (Tables 4-5). Overall, the analysis indicates the following:

- Outpatient visit rates averaged two per patient pre-bariatric surgery, while average charges for BSCOEs were higher at \$4,200 compared to \$3,000 for non-BSCOEs. Post bariatric surgery outpatient visit rates averaged two per patient for both BSCOE and non-BSCOE facilities. Average charges were higher for BSCOEs for post-bariatric surgery at \$5,200 compared to \$4,500 for non-BSCOE facilities.
- Inpatient pre-bariatric surgery visit rate averaged 2.1 per patient with average charges of \$20,000 for BSCOE and non-BSCOE facilities. Post-bariatric inpatient hospital visit rates averaged 2.5 per patient for both BSCOE and non-BSCOE facilities. Average post-bariatric inpatient hospital charges were higher for BSCOEs at \$29,000 compared to \$27,000 for non-BSCOE patients.
- Emergency Department pre-bariatric surgery visit rates were slightly higher for non-BSCOEs at 3.0 compared to 2.6 for BSCOE facilities. Average charges for emergency department non-BSCOEs are slightly lower at \$922 compared to \$1,225 for BSCOE facilities. Post-bariatric

emergency department visits rate are slightly higher for non-BSCOEs at 3.5 compared to 2.8 for BSCOE facilities. Average charges for emergency department visits for non-BSCOE patients are slightly lower at \$1,317 compared to \$1,794 for patients in BSCOE facilities.

Do outcomes and paid charges of patients differ for bariatric and non-bariatric patients? Excluding the index event pre and post charges for OP, IP, and ED visits, the analysis found inpatient hospital stays to be significantly higher for patients undergoing bariatric procedures (Table 5).

- Outpatient visit rates were similar at around two for bariatric and non-bariatric surgery patients. Pre-status average charges were similar around \$3,500 for both groups. While the number of post-status outpatient visits remains the same, average charges were slightly higher for bariatric surgery patients at \$4,900 compared to non-bariatric surgery patients at \$4,250.
- Inpatient pre-status visit rates were slightly higher for bariatric surgery patients at 2.2 compared to 2.0 for non-surgery patients. Average charges were slightly higher for surgery patients at \$20,600 compared to \$16,100 for non-bariatric surgery patients. Post-status visit inpatient rates for both groups were the same at 2.3 visits per patient. Average inpatient post-status charges were higher for patients with bariatric surgeries at \$27,800 compared to \$22,600 for patients without surgery.
- Emergency Department pre - visit rates for non-bariatric patients were higher at 3.4 compared to 2.9 for bariatric patients. Average charges were slightly higher for surgery patients at \$1,040 compared to \$840 for non-surgical patients. Post-visit rates were higher for non-bariatric surgery patients at 3.8 compared to 3.2 for bariatric surgery patients. Average emergency department charges were slightly higher for bariatric surgery patients at \$1,500 compared to \$1,140 for non-bariatric surgery patients.

In summary, inpatient hospital stays charges and visits were significantly higher for bariatric surgery patients. As previously noted, this study examined post-charges within two years of the index or anchor year limiting potential cost gains associated with reduced outpatient, inpatient, and emergency department visits resulting from improved health outcomes.



Do paid insurance charges differ based on bariatric surgery facility status? As noted, patients undergoing bariatric surgery at non-BSCOE facilities were more likely to have higher rates of comorbid obesity-related conditions with Medicaid or Medicare as their primary source of insurance. Table 6 indicates an association between source of insurance and paid charges, excluding the bariatric surgery procedure. The findings indicate higher paid charges for patients with Medicare insurance. Conversely, the lowest paid charges were for patients with Medicaid as their source of insurance. This pattern of difference between paid charges and source of insurance remains true for bariatric surgery procedures (Table 6). Several factors associated with Medicare and Medicaid insured patients influence paid charges. Medicare and Medicaid insured patients have higher inpatient hospital days, comorbidities, emergency room visits, and mortality compared to privately insured and other sources of insurance. In order to adequately address differences in patient populations, future studies must adequately control for these factors.

**Table 6: Paid Charges Comparison by Source of Insurance**

SETTING	PAY SOURCE	BARIATRIC SURGERY				NO BARIATRIC SURGERY			
		TOTAL	CHARGES	AVG CHGS	STD CHGS	TOTAL	CHARGES	AVG CHGS	STD CHGS
TOTAL	TOTAL	36344	\$285,879,000	\$7,866	\$33,835	706334	\$4,990,074,300	\$7,065	\$18,293
TOTAL	INSURANCE	16518	\$134,355,100	\$8,134	\$22,187	237070	\$1,969,654,200	\$8,308	\$18,665
TOTAL	MEDICAID	5999	\$44,025,100	\$7,339	\$66,289	164560	\$873,004,900	\$5,305	\$16,831
TOTAL	MEDICARE	7339	\$64,746,000	\$8,822	\$26,239	140657	\$1,189,026,900	\$8,453	\$21,885
TOTAL	OTHER	6488	\$42,752,800	\$6,590	\$17,758	164047	\$958,388,300	\$5,842	\$15,298
ER	TOTAL	15055	\$19,413,200	\$1,289	\$1,576	369614	\$379,445,300	\$1,027	\$1,777
ER	INSURANCE	5505	\$7,905,100	\$1,436	\$1,609	98602	\$113,325,400	\$1,149	\$1,542
ER	MEDICAID	3429	\$3,796,200	\$1,107	\$1,515	104187	\$92,655,900	\$889	\$1,183
ER	MEDICARE	3204	\$3,872,800	\$1,209	\$1,645	65927	\$69,527,500	\$1,055	\$1,419
ER	OTHER	2917	\$3,839,100	\$1,316	\$1,478	100898	\$103,936,500	\$1,030	\$2,538
IP	TOTAL	9382	\$216,826,300	\$23,111	\$63,640	201317	\$4,018,094,200	\$19,959	\$30,126
IP	INSURANCE	4364	\$97,528,000	\$22,348	\$39,079	74835	\$1,557,775,200	\$20,816	\$28,924
IP	MEDICAID	1393	\$35,636,400	\$25,582	\$135,403	41192	\$703,936,300	\$17,089	\$30,310
IP	MEDICARE	2120	\$53,066,600	\$25,031	\$44,468	46832	\$1,010,875,300	\$21,585	\$34,024
IP	OTHER	1505	\$30,595,300	\$20,329	\$32,496	38458	\$745,507,400	\$19,385	\$26,748
OP	TOTAL	11907	\$49,639,500	\$4,169	\$6,984	135403	\$592,534,800	\$4,376	\$5,802
OP	INSURANCE	6649	\$28,922,000	\$4,350	\$5,875	63633	\$298,553,600	\$4,692	\$5,820
OP	MEDICAID	1177	\$4,592,500	\$3,902	\$13,582	19181	\$76,412,700	\$3,984	\$6,636
OP	MEDICARE	2015	\$7,806,600	\$3,874	\$5,522	27898	\$108,624,100	\$3,894	\$5,210
OP	OTHER	2066	\$8,318,400	\$4,026	\$5,920	24691	\$108,944,400	\$4,412	\$5,640

## CONCLUSION

Overall, this study supports the growing body of evidence documenting bariatric surgery as a promising practice in the treatment of severe obesity<sup>36-60</sup>. It is a preliminary study requiring further examination to adequately document the efficacy and cost effectiveness of these surgical procedures across differing segments of the population. As the initial retrospective study on bariatric surgery in South Carolina, it documents several key findings. First, the rapid growth of bariatric surgery in South Carolina among BSCOE facilities in South Carolina provides a viable option to meet the needs of severely obese patients. Second, documenting 180-day complication and mortality rates provides a baseline from which future long-term studies can document outcome changes. Although some differences were identified, our study suggests the need for further analysis to document the difference in outcomes associated with bariatric procedures undertaken at Bariatric Surgery Centers of Excellence compared to other facilities.

### Study Limitations

A major strength of this study is the design and use of a large claims database from all sources of insurance, allowing for better generalizability of bariatric surgery outcomes to severely obese patients in South Carolina. This study has several limitations that affect the study findings. The claims database does not allow the confirmation of information in the medical record, such as body mass index and other clinical factors needed to confirm the diagnosis of either obesity or comorbid conditions necessary to establish a matched cohort population. While the retrospective study design seems to be the best way to answer the study questions, picking a comparison group may introduce other confounders that may skew the results. The baseline health status of patients seeking bariatric surgery, as compared with that of control subjects, is also unknown. As an example, we have found no significant baseline differences in the presence of comorbid conditions between bariatric surgery patients and non-bariatric obese patients suggesting that the characteristics of subjects in the study groups in this study were probably similar at baseline. However, post-index event results may indicate that severely obese persons who did not seek bariatric surgery were less likely to make healthy lifestyle choices, resulting in a rate of death higher (15 per 1,000) than that for persons who underwent surgery (14 per 1,000). Likewise, the higher numbers of Medicare and Medicaid patients undergoing surgery at non-BSCOE facilities with higher mortality rates may be a function of increased risk associated with comorbid conditions. The reduced mortality rates may be significant despite the various weaknesses of the study. This study cannot conclude that there is a significant relationship between lower complication rates and facilities with a BSCOE designation. We counted as COEs any facility that had received that designation between 2005 and 2006 - the end of the study period. However, we assessed the outcomes of patients according to whether their hospitals were BSCOEs at the time of their procedures. The difference in

rates of serious complications between BSCOE and non-BSCOE facilities (74 versus 131 per 1,000 patients) for the matched sample does not mean patients have better outcomes at BSCOE facilities. A limitation of the claims database provided by the SC Budget and Control Board is the lack of identifiable information for each facility that would allow the research team to match the facility to COE designation with patient volume. Aside from minimum caseloads, most requirements for BSCOE accreditation, including the availability of specific protocols and resources for managing morbidly obese patients, are met at differing levels by facilities providing bariatric surgery. Data on caseloads is essential information required to differentiate between differing facilities and their effect on surgical complication rates.

Finally, given the highly competitive marketplace for bariatric surgery, BSCOE certification may provide a distinct advantage in the types of patients served by the facility, e.g. Medicare and Medicaid patients. Future studies must find mechanisms to receive identifiable data for each facility while protecting their identity by grouping them into categories to assist sensitivity analysis.

In conclusion, the study findings provide baseline data supporting the efficacy of bariatric surgery as a viable option for severely obese patients. It suggests the need for long-term data collection linked to medical records and follow-up with patients regarding quality of life, patient satisfaction, and health care resource use.

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## Appendix A

### South Carolina Overweight and Obese (BMI) by Gender and Race, 2009

Gender:		Neither overweight nor obese (bmi le 24.9)	OVERWEIGHT (bmi 25.0 - 29.9)	OBESE (bmi 30.0 - 99.8)
<b>Male</b>	% CI n	<b>29.2</b> (26.5-32.0) 960	<b>41.4</b> (38.7-44.1) 1611	<b>29.4</b> (26.9-31.9) 1100
<b>Female</b>	% CI n	<b>39.0</b> (36.8-41.2) 2073	<b>30.3</b> (28.4-32.3) 1801	<b>30.7</b> (28.6-32.8) 1831

% = Percentage, CI = Confidence Interval, n = Cell Size Percentages are weighted to population characteristics

Race:		Neither overweight nor obese (bmi le 24.9)	OVERWEIGHT (bmi 25.0 - 29.9)	OBESE (bmi 30.0 - 99.8)
<b>White</b>	% CI n	<b>35.2</b> (33.2-37.2) 2231	<b>37.5</b> (35.5-39.5) 2332	<b>27.3</b> (25.4-29.2) 1596
<b>Black</b>	% CI n	<b>30.0</b> (26.0-34.0) 555	<b>31.3</b> (27.9-34.8) 853	<b>38.7</b> (35.0-42.4) 1118

Source: The Behavioral Risk Factor Surveillance System (BRFSS)2009, Centers for Disease Control, Atlanta, GA.



## Appendix B

### South Carolina Bariatric Surgery Centers of Excellence® (BSCOE®)

FACILITY	PRACTICE
<b>Charleston, SC</b>	
<b>Medical University of SC</b> 25 Courtenay Drive Charleston, SC 29425	<b>MUSC - University Medical Associates</b> 25 Courtenay Drive MSC 290 Charleston, SC 29425
<b>Columbia, SC</b>	
<b>Palmetto Health Baptist</b>	<b>Palmetto Health Baptist Weight Management Clinic</b> 1850 Laurel Street Suite 1 A Columbia, SC 29201
<b>Greenville, SC</b>	
<b>Hillcrest Hospital</b> 729 S.E. Main Street Simpsonville, SC 29680	<b>UMG - Bariatric and General Surgery</b> 2104 Woodruff Road Greenville, SC 29607
<b>Spartanburg, SC</b>	
<b>Spartanburg Regional Healthcare System</b> 101 East Wood St Spartanburg, SC 29303	<b>Surgical Associates of Spartanburg, PA</b> Regional Surgical Weight Loss Service 100 East Wood St Spartanburg, SC 29303
<b>West Columbia, SC</b>	
<b>Lexington Medical Center</b> 2720 Sunset Boulevard West Columbia, SC 29169	

## Appendix C

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### South Carolina Medical Weight Loss Obesity Clinics

#### Anderson

**Anderson Bariatric Physicians PA**  
2106 North Main Street,  
Anderson, SC 29621

#### Hardeeville

**Metabolic Medical Center of Bluffton**  
300 New River Parkway  
Hardeeville, SC 29927

#### Columbia

**Metabolic Medical Center of Columbia**  
1611 Devonshire Drive, Suite 100  
Columbia, SC 29204

#### Mt. Pleasant

**Metabolic Medical Center of Mt. Pleasant**  
570 Long Point Road, Suite 100  
Mt. Pleasant, SC 29464

#### Doctors Weight Loss Center

5000 Thurmond Mall  
# 207  
Columbia, SC

#### Myrtle Beach

**Medical Weight Loss Clinic**  
7701 N Kings Hwy,  
Myrtle Beach, SC

#### Easley

**Easley Surgical Associates**  
201 Richard Street,  
Easley, SC 29640

#### Surfside Beach

**Medical Weight Loss Clinic**  
1601 Highway 17  
Surfside Beach

#### Fort Mill

**Bariatric Clinic PA**  
377 Carowinds Boulevard,  
Fort Mill, SC 29708

#### West Ashley

**Metabolic Medical Center of West Ashley**  
1941 Savage Road, Suite 100F  
West Ashley, SC 29407

#### Greenwood

**Carolina Medical Weight Management PA**  
1027 Edgefield Street,  
Greenwood, SC 29646

#### West Columbia SC

**Carolinas Bariatric Medical Centers LLC**  
2311 Sunset Boulevard  
West Columbia, SC 29169



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