Research Article
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Health insurance does matter: clinically significant variation in obesity-related diagnoses between insurance types in 83,059 morbidly obese patients

Abstract

Introduction: Clinical management of morbidly obese patients is a growing challenge. In this milieu, any new information adds to the therapeutic acumen for these complex individuals. However, the interaction of insurance status with weight-related medical illnesses is unknown.

Objective: To identify variations in the distribution of weight-related medical problems according to health insurance.

Methods: Pre-operative data on 83,059 patients from the Surgical Review Corporation's BOLD database who were about to undergo laparoscopic Roux-en-Y gastric bypass was examined in four groups: Medicaid (n=3,305), Medicare (n=8,643), Private insurance (n=60,163), and Self-Pay (n=1,493). Continuous variables were tested by analysis of variance. Distribution of obesity comorbidities was examined using a general linear model with treatment in the model and modified for a binomial distribution.

Results: Among the morbidly obese, clinically important weight-related medical problems vary significantly according to the health insurance status of the patients. Morbidly obese Medicare participants have the highest rates of comorbidities and adverse socioeconomic factors. ($p<0.001$ to<0.0001) The Medicaid group had the highest BMI and asthma rate and was second only to Medicare in almost all of the other categories. ($p<0.0001$) Private Insurance patients had fewer obesity-related comorbidities than did Medicaid and Medicare, and the lowest unemployment rate. Self-Pay individuals generally had the lowest rates of comorbidities of any of the groups.

Conclusion: These results suggest that the index of suspicion for weight-related medical problems should be heightened according to the variation in their incidence reported here when treating obese patients.

Volume 8 Issue 3 - 2018

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Received: May 14, 2018 | **Published:** May 30, 2018

Introduction

While obesity is not a classic pathogen such as influenza, it's rampant and dramatic rise worldwide over a relatively short period of time has made it a significant threat to the health of mankind as a whole. Thus, obesity has been classified as an epidemic since the late 1990s.[1] The most recent data from the World Health Organization shows 33.9% of Americans to be obese, and approximately 18.2% of people are obese worldwide.[2] Obesity has nearly tripled over the last three decades and is projected to continue rising, hence it's unfortunate but appropriate status as an epidemic.

Five of the top ten leading causes of death in the United States are obesity-related comorbidities. These include type 2 diabetes mellitus, cardiovascular disease, stroke, certain types of cancer (especially breast and endometrial cancer in women and colorectal cancer in men), and kidney disease.[3] Other common comorbidities are insulin resistance, hypertension, dyslipidemia, chronic lung disease, obstructive sleep apnea, gallbladder disease, gout, back pain, and osteoarthritis.[4] The cost of treating these life-threatening comorbidities exceeds $147 billion per year.[5] Clark and colleagues found that severely obese adults in particular (BMI>50) used 109% more healthcare funds than normal-weight adults.[6] This includes greater expenditures for durable medical equipment, emergency room visits, home health and hospice, nursing home, prescription drugs, as well as inpatient and outpatient visits. Additionally, obesity increases overall risk of disability and early retirement as a result of chronic illnesses.[7]

Clearly, the epidemic of obesity and its tremendous use of healthcare funds has become a major concern. The added problem of multiple comorbidities complicates management of these patients, making every clinical insight helpful to providers. Previously we have identified statistically and clinically significant variation in morbidly obese patients by race (adams) and by sex (Schwartz). Nevertheless, whether or not weight, BMI, demographics and the prevalence of major weight-related medical conditions varies according the type of heal insurance is unknown. Multiple articles have investigated the frequency of obesity-related comorbidities within an insurance status, i.e. Medicare or Medicaid.[8–12] However, none have compared and contrasted whether or not the distribution of comorbidities is consistent across all insurance types. If the clinical presentation of morbidly obese patients varies among types of health insurance carried, then such knowledge could provide clinically important information to physicians regarding care of these patients, and it would raise the index of suspicion for obesity-related complications. The objective of this study was to identify variations in the distribution of weight-

related medical problems according to the type of health insurance carried by morbidly obese patients.

Methods

The BOLD database

This study evaluated de-identified, HIPAA-compliant baseline pre-operative data from the Surgical Review Corporation's Bariatric Outcomes Longitudinal Database (BOLD) on 83,059 morbidly obese adult (>18 years) patients who were about to undergo laparoscopic Roux-en-Y gastric bypass between June 2007 and December 2010.[13] The investigation was approved by the Surgical Review Corporation Data Access Committee and the IRB of Our Lady of Lourdes Medical Center, Camden, NJ. BOLD is a national database that collected information from participants in the Surgical Review Corporation-approved Bariatric Surgery Center of Excellence (BSCOE) program. SRC BSCOE's data was collected for all bariatric patients during the preoperative (i.e. patient visits), perioperative (i.e. hospital stay), and postoperative periods.

Data collected included age, weight, BMI, sex, insurance status (Medicaid, Medicare, private insurance, or self-pay) and 33 obesity co-morbidities: hypertension (HTN), angina, congestive heart failure (CHF), deep vein thrombosis/pulmonary embolism (DVT/PE), ischemic heart disease, peripheral vascular disease (PVD), pulmonary hypertension (PHTN), obstructive sleep apnea (OSA), obesity hypoventilation syndrome, asthma, abdominal hernia, panniculitis, cholelithiasis, gastroesophageal reflux disease (GERD), liver disease, stress urinary incontinence, diabetes mellitus (DM), gout, hyperlipidemia (HPL), irregular menses, polycystic ovarian syndrome (PCOS), pseudotumor cerebri, back pain, fibromyalgia, lower extremity edema, musculoskeletal pain. In addition, preoperative mental health diagnoses including disability, depression, psychologic impairment, alcohol use, substance abuse, tobacco use and unemployment status were examined.

Statistical analysis

Continuous variables were analyzed using an ANOVA with treatment in the model. Pair-wise comparisons were performed on the least squares means of the treatments calculated from the ANOVA model to find differences in the treatment groups. Distribution of obesity comorbidities was examined by using a general linear model with treatment in the model and modified for a binomial distribution to account for the comorbidities being dichotomous variables. In order to maintain statistical power, severity indices in BOLD that divided patients within each comorbidity into sub-categories of disease severity were pooled into a single group for each comorbidity and analyzed as either having or not having the specified medical condition.[14]

Results

Demographic data is displayed in Table 1. Of the study population of 83,059 patients, 82% (60,163) had private insurance, 12% (8,643) had Medicare, 4% (3,305) had Medicaid, and 2% (1,493) were self-pay. Overall, 78% of patients were female. However, the female/male ratio was significantly higher among Medicaid subscribers (87/13) than in the Medicare (76/24), Private insurance (78/22), and Self-Pay (73/27) groups (p<0.0001). Medicare participants were older than the other groups with an average age of 54±12 (p<0.0001). Body mass index (BMI) was highest among Medicaid subscribers (50±9) and lowest in the Private insurance group (47±8) (p<0.0001). Weight was highest in Medicaid and Self-Pay and lowest in Private (p<0.01).

Table 1 Demographic characteristics of preoperative cohort

	Medicaid	Medicare	Private insurance	Self-pay	p Value
n (# of patients)	3,305	8,643	60,163	1,493	----
Age (yrs)	49 ±10	54 ±12	44 ±11	44 ±12	<0.0001
Weight (kg)	138 ±29	136 ±31	132 ±26	139 ±32	<0.01
Body Mass Index	50 ±9	49 ±9	47 ±8	49 ±9	<0.0001
Sex (F/M %)	87/13	76/24	78/22	73/27	<0.0001

Table 2 lists cardiopulmonary comorbidities compared by insurance group. Medicare patients had significantly more angina, CHF, dyslipidemia, HTN, ischemic heart disease, lower extremity edema, peripheral vascular disease, obesity hypoventilation, PHTN, and OSA (p<0.001-<0.0001). Medicaid patients had the highest incidence of asthma (p<0.0001), and they had second highest angina, CHF, lower extremity edema, peripheral vascular disease, obesity hypoventilation, PHTN, and OSA (p<0.001-0.0001). Private insurance had second highest dyslipidemia, HTN, and ischemic heart disease (p<0.0001). Self-pay had the lowest percentage of comorbidities in all cardiopulmonary categories except dyslipidemia and obesity hypoventilation (p<0.0001).

Table 3 displays abdominal and hepatobiliary obesity comorbidities. Again, Medicare patients had more abdominal hernia, cholelithiasis, GERD, and liver disease (p<0.0001). Medicaid patients had the highest percentage of panniculitis (p<0.0001) and second highest percentage of all other gastroenterological disease. Table 4 shows endocrine and metabolic comorbidities. Medicaid patients had the highest incidence of PCOS (p<0.0001) and pseudotumor cerebri (p<0.01). Medicare patients had the most diabetes mellitus (p<0.0001) and irregular menses (p<0.001) Table 5 demonstrates that Medicare patients had the most somatic comorbidity in all categories, and Medicaid had the second most (p<0.0001). Table 6 presents the psychological and social comorbidities associated with obesity. Alcohol use was highest in the private insurance group (p<0.0001). Depression, disable functional status, mental health diagnosis, psychological impairment, and unemployment were highest in the Medicare group (p<0.0001). Substance abuse and tobacco abuse was highest among Medicaid patients (p<0.001).

Overall, hypertension was the number one comorbidity across the Medicare (78.16%), private insurance (58.49%), and self-pay (55.26%) groups, and the second most common comorbidity in Medicaid patients (55.61%). Back pain was the most common comorbidity in Medicaid patients (57.73%), second most common in self-pay patients (43.8%), and third most common in Medicare (62.94%) and private insurance (48.62%) patients. Medicare patients had the highest incidence of associated comorbidities and socioeconomic factors in 26 of the 33 conditions evaluated (p<0.001-0.0001). The self-pay patient cohort had the lowest comorbidity rates of any of the insurance groups in 26 of the 33 categories examined (p<0.01-<0.0001). Private insurance individuals had the lowest congestive heart failure, obesity hypoventilation syndrome, tobacco use and unemployment (p<0.001-<0.0001), and second lowest rates of 21 other conditions.

Table 2 Cardiopulmonary obesity comorbidities by insurance status

Comorbidity	Medicaid	Medicare	Private insurance	Self-pay	p Value
Angina	4.60%	6.07%	2.46%	1.61%	<0.0001
Congestive heart failure	3.33%	7.47%	1.58%	1.61%	<0.0001
Dyslipidemia	36.01%	58.72%	42.36%	39.52%	<0.0001
Hypertension	55.61%	78.16%	58.49%	55.26%	<0.0001
Ischemic heart disease	3.30%	10.75%	3.72%	2.48%	<0.0001
Lower extremity edema	34.64%	41.86%	29.02%	25.32%	<0.0001
Peripheral vascular disease	1.24%	3.18%	0.98%	0.74%	<0.001
Asthma	26.81%	26.37%	17.45%	12.93%	<0.0001
Obesity hypoventilation	2.12%	5.16%	1.43%	2.14%	<0.0001
Pulmonary hypertension	4.66%	6.59%	4.44%	3.35%	<0.0001
Obstructive sleep apnea	52.13%	60.44%	46.89%	43.07%	<0.0001

Table 3 Abdominal and hepatobiliary obesity comorbidities by insurance status

Comorbidity	Medicaid	Medicare	Private insurance	Self-pay	p Value
Panniculitis	12.19%	10.96%	7.40%	7.30%	<0.0001
Abdominal hernia	6.63%	7.73%	4.83%	4.15%	<0.0001
Cholelithiasis	25.36%	30.63%	21%	16.68%	<0.0001
Gastroesophageal reflux disease	51.29%	57.17%	49.04%	41.13%	<0.0001
Liver disease	7.59%	8.45%	7.26%	5.09%	<0.001

Table 4 Endocrine and metabolic obesity comorbidities by insurance status

Comorbidity	Medicaid	Medicare	Private insurance	Self-pay	p Value
Diabetes mellitus	38.06%	57.31%	36.69%	34.70%	<0.0001
Irregular menses	27.08%	31.07%	23.85%	16.68%	<0.001
Polycystic ovarian syndrome	6.02%	2.80%	5.97%	5.56%	<0.0001
Pseudotumor cerebri	3.03%	2.01%	2.25%	1.69%	<0.01

Table 5 Somatic obesity comorbidities by insurance status

Comorbidity	Medicaid	Medicare	Private insurance	Self-pay	p Value
Back pain	57.73%	62.94%	48.62%	43.80%	<0.0001
Fibromyalgia	4.96%	8.90%	2.83%	1.61%	<0.0001
Gout	4.51%	7.35%	3.41%	2.41%	<0.0001
Musculoskeletal pain	48.68%	59.18%	45.31%	42.60%	<0.0001
Stress urinary incontinence	27.41%	30.79%	23.87%	24.25%	<0.0001

Citation: Tyrrell J, Blair KM, Slotman GJ. Health insurance does matter: clinically significant variation in obesity-related diagnoses between insurance types in 83,059 morbidly obese patients. *Adv Obes Weight Manag Control.* 2018;8(3):178–183. DOI: 10.15406/aowmc.2018.08.00238

Table 6 Psychological and behavioral obesity co-morbidities by insurance status

Comorbidity	Medicaid	Medicare	Private insurance	Self-pay	p Value
Alcohol use	22.21%	19.70%	34.04%	29.87%	<0.0001
Depression	45.66%	50.47%	34.19%	34.19%	<0.0001
Disabled functional status	5.57%	12.66%	2.13%	1.94%	<0.0001
Mental health diagnosis	19.09%	20.70%	9.82%	9.24%	<0.0001
Psychologic impairment	27.84%	31.17%	15.81%	14.27%	<0.0001
Substance abuse	1.03%	0.69%	0.39%	0.47%	<0.01
Tobacco use	9.08%	7.14%	6.22%	6.50%	<0.001
Unemployed	46.38%	78.01%	10.99%	14.47%	<0.0001

Discussion

This study has identified statistically and clinically significant variation in weight, BMI, demographics, socioeconomic factors, and the incidence of weight-related medical conditions according to the type of health insurance carried by morbidly obese patients. Medicare patients were the oldest. The incidence of obesity comorbidities and adverse socioeconomic factors was highest among Medicare patients in 79% of the conditions evaluated in this study. Medicaid patients presented with the highest incidence of PCOS, pseudotumor cerebri, asthma, and substance/tobacco abuse, and had the second highest in fifteen other obesity maladies. Private insurance patients drank more, smoked less, and were more employed than the other groups. In addition, they had the second highest hypertension, PCOS, and pseudotumor cerebri, lowest congestive heart failure, and second lowest rates of 21 other conditions. Self-pay patients manifested the lowest weight-related medical problem frequencies of the four insurance groups in 79% of the comorbidities. Our review of the literature indicates that these differences in weight, demographics, and distribution of obesity comorbidities among morbidly obese patients according to their health insurance status have not been reported previously, and are important findings of this study.

Both the Medicare and Medicaid cohorts were older than the private insurance and self-pay groups. This may be explained by the fact that patients only qualify for Medicare at the age of 62 or by having a special condition (i.e. end stage renal disease, amyotrophic lateral sclerosis, etc.). It is possible that these patients may delay gastric bypass surgery until they have sufficient coverage to help defer the costs of the procedure. This delay puts them at risk for the development of further comorbidities and/or worsening of comorbidities they already possess.[15] It should also be noted that there were fewer Medicaid patients in our study compared with Medicare. This may be related to the factors mentioned by Alexander et al. in 2008, including decreased payment to physicians and hospitals for the care of Medicaid patients, prejudice against economically deprived individuals, and lower rates of approval for bariatric procedures by Medicaid.[8]

Considering that most patients eligible for Medicare are 62 and older, it is not surprising that the Medicare group was the oldest. However, the finding that obese Medicare patients have the most comorbidities is more interesting. This was true across multiple comorbidities in the endocrine, cardiovascular, gastrointestinal, pulmonary, and musculoskeletal systems, as well as psychological/social factors. Previous studies have reported that obese Medicaid patients had a greater prevalence of serious comorbid conditions preoperatively compared with Medicare?[8] Our study contradicts these results, demonstrating instead that Medicare patients carry the greatest burden of comorbidities, even though their weight and BMI ~~was~~ were not the highest. The link between Medicare being the oldest group and having the most comorbidities may lie in "obesity-years". Similar to pack-years for estimating smoking risks,[16] obesity-years would be the number of years a patient has been obese. In 2011, Abdullah et al. discovered that increased duration of obesity is associated with increased risk for mortality.[17] Even obesity for a short period of time increases risk of mortality, and for every additional 2 years of obesity, mortality increased by a staggering 6-7%. They suggested taking the duration of obesity into consideration when treating obese patients. Our study supports this finding in that our oldest population also carried the greatest obesity comorbidities. In this investigation? Medicare patients had the highest percentages of diabetes mellitus, irregular menses, all cardiovascular diseases studied, abdominal hernia, cholelithiasis, GERD, liver disease, obesity hypoventilation, pulmonary HTN, OSA, all musculoskeletal diseases studied, stress urinary incontinence, depression, disabled functional status, mental health diagnosis, and psychologic impairment. The longer duration of obese years in these patients may be the culprit for high comorbidity rates, and the concept of obesity-years may help us identify patients at risk for such diseases. In the present study, Medicare patients had significantly higher rates of cardiovascular disease in particular. Therefore, the index of suspicion for heart disease among our obese Medicare patients should be higher than other insurance types. The Medicare group also had the highest percentage of patients with diabetes. Blecker et al.,[18] found comorbid diabetes to significantly increase the rates of hospitalization and healthcare spending in patients who also had heart disease. Both of these obesity-related comorbidities should be treated aggressively in Medicare patients.[19]

The Medicaid group had the highest rates of PCOS and second highest rates of irregular menses. Thus, practitioners could use this information to screen more of their obese female Medicaid patients for these conditions and possibly provide earlier intervention to prevent them. Additionally, obese Medicaid patients had the highest rates of tobacco use. Practitioners who treat Medicaid patients could consider implementing more aggressive smoking cessation counseling for these patients. CMS statistics reveal that 51% of Medicaid patients are under 21, and 90.5% are under the age of 65. Medicaid patients are 40% non-Hispanic white, 22% black, and 24% Hispanic; 48% are

disabled. A study from 2012 discovered 41% of Medicaid patients to have low-income status (<$39,000).[20] They also observed Medicaid patients to be younger and from larger metropolitan areas compared to private insurance, whose patients were more suburban. This information may help to recognize patients at risk for comorbidity and serious hospitalizations. Several of the most common reasons for hospitalization among Medicaid patients found by Lopez-Gonzalez et al. overlap with our comorbidity results for obese patients. These include complications from diabetes mellitus, pulmonary disease and asthma, and mood disorders/psychotic disorders. With the recent expansion of Medicaid over the last several years, patients may have more options and coverage regarding bariatric surgery.[21] Thus, we should aim to identify Medicaid patients at risk for these specific obesity-related comorbidities (diabetes, lung disease, and psychiatric disorders) for earlier intervention, either via bariatric surgery or other therapies.

Private insurance patients tend to live in more suburban areas and 70% were age 18-64. Smith et al. found 65.5% were white, 9% were black, and 11% were Hispanic.[22] Our results observed patients with private insurance to have the highest percentage of alcohol use, which would be useful in screening and treating patients for alcoholism. The top five most common comorbidities in the private insurance group were HTN, GERD, back pain, OSA, and musculoskeletal pain. Again, our results overlapped with most common reasons for hospitalization among private payers, including osteoarthritis/back pain and cardiovascular disease.[20] Thus, targeting treatment of OA and CVD in suburban, middle-aged private insurance patients may help prevent worsening comorbid disease and hospitalizations.

For self-pay patients, Smith et al. found 62% to be white, 11% were black, and 14% were Hispanic.[22] While our study observed the female/male ratio to favor females in all four insurance groups, other research has shown that self-paying individuals are more commonly male.[20–23] The self-pay group had the lowest rates of comorbidities across all organ systems studied. Emani et al.,[24] discovered that self-pay and private insurance patients had lower mortality rates for heart transplant compared to Medicare and Medicaid. One hypothesis for this finding is that the self-pay patients better access to care and less confines by insurance, leading to better outcomes in their healthcare.

There are limitations to our study. First, our study is retrospective. Our primary database, BOLD, studies a self-selected patient population who chose laparoscopic Roux-en-Y gastric bypass for the treatment of their obesity and therefore might not be representative of all morbidly obese patients. Our data is limited to what was reported by each BSCOE surgeon and what is available for analysis within BOLD. For example, BOLD defined liver disease by clinical criteria only, not liver biopsy. Patients who are not surgical candidates would also be excluded from this analysis. Nevertheless, the new knowledge presented here offers further insight into challenges faced by providers taking care of these complex patients.[25,26]

In summary, this investigation identified statistically and clinically significant information in the clinical characteristics of morbidly obese patients according to health insurance status. Medicare patients had the highest prevalence of obesity-related comorbidities, in particular cardiopulmonary and gastroenterological disease. Medicaid patients had the highest rates of asthma, panniculitis, PCOS, and substance/tobacco abuse. Alcohol use was increased in the self-pay and private insurance cohorts. Additionally, private insurance patients had high rates of hypertension, dyslipidemia, and ischemic heart disease. The most common comorbidities seen across the four groups were back pain, depression, DM, GERD, HPL, HTN, lower extremity edema, musculoskeletal pain and OSA, ranging in prevalence from approximately 30-70% of the cohort. However, patients with Medicare, followed by Medicaid exhibited statistically significant higher prevalence of such conditions. We therefore recommend that the index of suspicion for weight-related medical problems should be heightened according to the variation in their incidence reported here when treating obese patients.

Study highlights

What is current knowledge:

a. Obesity is an epidemic.

b. There are many obesity-related diseases that cause significant increases in the morbidity and mortality of this patient population.

c. Access to care varies depending upon what type of insurance patients possess.

What is new here:

a. Weight-related medical problems vary according to patient's healthcare insurance status.

b. The index of suspicion for weight-related medical problems should be heightened according to the variation in their incidence reported here when treating obese patients.

Acknowledgments

Institutional support from Inspira Health Network Department of Graduate Medical Education.

Specific author contributions

a. Gus Slotman, MD: Planning and conducting study, collecting and interpreting data, editing the manuscript, overall supervision of the project. Gus Slotman, MD approves the final draft submitted.

b. Kendall Blair, DO: Analyzing and interpreting data, drafting the manuscript. Kendall Blair, DO approves the final draft submitted.

c. Jessica Tyrrell: Drafting and completing the manuscript. Jessica Tyrrell approves the final draft submitted.

Conflicts of interest

Guarantor of the Article: Gus Slotman.

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