

**Pre-Operative Risk of Medical Complications Varies by Health Insurance Carrier in
Moderately Obese Women: Medicaid v Medicare v Private v Self-Pay**

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ABSTRACT

Introduction: Clinical variation by health insurance status in mixed sex bariatric surgery populations is reported, but such variation among moderately obese women is unknown. Objective: to identify pre-operative variation by health insurance in female surgical patients.

Methods: Pre-operative data from 53,292 adjustable gastric band female patients from the BOLD database was analyzed in four groups: Medicaid (n=1,403), Medicare (n=3,273), Private insurance (n=38,439), and Self-pay (n=2,917). Data included age, weight, BMI, race, and 33 obesity-related medical conditions. Statistics: ANOVA and general linear model.

Results: Medicaid/Medicare/Private/Self-Pay age (42+-12/57+-12/44+-11/43+-12), weight (125+-23/120+-22/119+-19/119+-23), and BMI (47+-8/46+-8/44+-11/43+-12) varied significantly ($p < 0.0001$), as did race %: African-American (20/12/13/5), Caucasian (60/75/74/85), Hispanic (13/5/6/5), Asian (0.14/0.12/0.21/0.24), Other (7/8/7/5) ($p < 0.0001$). Medicaid: highest asthma, hernia, abdominal panniculitis, GERD, liver disease, gout, back pain, depression, mental health diagnosis, psychologic impairment, smoking ($p < 0.0001$), and pseudotumor cerebri ($p = 0.007$). Medicare: highest risk for cardiopulmonary problems and diabetes. Medicaid: highest asthma, abdominal-hepatobiliary, and psychological/behavioral. Private: highest PCOS and alcohol, lowest depression and smoking. Self-Pay: lowest in all except PCOS.

Conclusions: Pre-operative characteristics of moderately obese women vary by insurance. Medicare's highest risk for cardiopulmonary problems and diabetes, and Medicaid's highest asthma, abdominal-hepatobiliary, and psychological/behavioral complications should be considered in managing moderately obese women subscribing to these carriers.

Keywords: Obesity; Adjustable gastric band; Female; Insurance Status; Co-morbidities

INTRODUCTION

According to the National Institute of Health (NIH), the prevalence of obesity defined as a body mass index (BMI, kg/m²) ≥ 30 , has increased significantly among adult men and women from 1980-2000; Between 2005 and 2014, the prevalence of obesity and extreme-obesity has increased significantly among women. However, their male counterparts have not seen statistically significant increases during that time frame. The 2013-2014 National Health and Nutrition Exam Survey (NHANES) of the National Center for Health Statistics (NCHS) noted that 40.4% of all adult women in the United States are classified as obese⁷. Obese women have an increased risk of diabetes, insulin resistance, dyslipidemia, certain forms of cancer, obstructive sleep apnea, coronary artery disease, and degenerative joint disease⁸. As a result of this obesity epidemic, these medically fragile individuals are now part of every medical and surgical practice, no longer limited to medical bariatricians and bariatric surgeons. Thus, in managing patients who are severely overweight, every clinical insight is important. With so many health implications, both surgical and non-surgical interventions have been sought out as a solution to the multifactorial disease process of obesity and associated obesity-related medical problems.

Previously we have reported significant variation by health insurance carrier in the pre-operative characteristics of super-obese men and women about to undergo bilio-pancreatic diversion/duodenal switch (Raisdana) and among patients who chose laparoscopic Roux-en-Y gastric bypass (Blair). In addition, we observed variation in outcomes by insurance status in combined sex populations after bilio-pancreatic diversion/duodenal switch (Gomez) and following open Roux-en-Y gastric bypass.

(Davis). However, whether or not clinical characteristics of women with moderately severe obesity also vary by health insurance type is unknown.

The objective of this study was to examine the preoperative clinical characteristics of women with obesity about to undergo adjustable gastric band by their insurance status to determine whether or not variation in demographics, in weight, and in weight-related medical illnesses among these different groups of women exist.

MATERIALS AND METHODS

Pre-operative data on 53,292 female patients from the Surgical Review Corporation's (SRC) Bariatric Outcomes Longitudinal Database (BOLD)¹⁵ about to undergo adjustable gastric banding procedure was examined by insurance carrier. Insurance carriers were classified and analyzed in four groups: Medicaid (n=1,403), Medicare (n=3,273), Private insurance (n=38,439), and Self-pay (n=2,917)¹.

Data included age, weight, BMI, and 34 weight-related medical conditions including abdominal hernia, abdominal skin panniculus, alcohol use, angina, asthma, back pain, cholelithiasis, mental health diagnoses, congestive heart failure (CHF), depression, history of deep venous thrombosis (DVT) or pulmonary embolism (PE), fibromyalgia, gastroesophageal reflux disease (GERD), gout, hypertension (HTN), ischemic heart disease, abnormalities in lipids, liver disease, lower extremity edema, menstrual irregularities, musculoskeletal disorders, obesity hypoventilation syndrome

(OHS), obstructive sleep apnea (OSA), peripheral vascular disease (PVD), polycystic ovarian syndrome (PCOS), pseudotumor cerebri, psychological impairment, impaired functional status, pulmonary hypertension, stress urinary incontinence (SUI), substance abuse, tobacco use and unemployment.

The data were analyzed using ANOVA with baseline and treatment in the model. In order to find differences in the treatment groups, pair-wise comparisons were performed on the least squares means of the treatments calculated from the ANOVA model. Distribution of obesity related conditions was examined by a general linear model with baseline and treatment in the model and modified for binomial distribution to account for dichotomous variables¹⁶

RESULTS

Age, race, weight, and BMI are listed in Table 1. Medicare patients were the oldest with a mean age of 57.45 years. Women with Medicaid had higher overall weight and BMI measurements at 124.5 kg and 46.67 kg/m² respectively.

Cardiopulmonary comorbidity rates by insurance status groups are shown in Table 2. Asthma was most common among women with Medicaid. Angina, CHF, personal history of DVT or PE, hypertension, ischemic heart disease, OHS, OSA, pulmonary hypertension, and PVD were all more common in women with Medicare as their insurance.

Metabolic and endocrine comorbidities are displayed in Table 3. The highest rates of PCOS were seen in women with private insurance. Gout and pseudotumor

cerebri had the highest frequency in the Medicaid group. Medicare patients had the highest rates of DM, dyslipidemia, and menstrual irregularities.

Abdominal and hepatobiliary comorbidities are listed in Table 4. Incidence of abdominal wall hernia, abdominal panniculus, and GERD was highest in the Medicaid group. Whereas cholelithiasis and SUI were seen more commonly among Medicare patients.

Somatic comorbidities are seen in Table 5. Back pain was most common among women with Medicaid. All other comorbidities in this category had the highest rates in Medicare patients. This included fibromyalgia, impaired functional status, lower extremity edema, and musculoskeletal pain.

Displayed in Table 6 are psychological and behavioral comorbidities. Alcohol use was highest in women with private insurance. Depression, mental health diagnosis, psychological impairment, and tobacco use was noted to be the most prevalent among Medicaid patients. Women with Medicare were more often unemployed. Substance abuse was most common in patients with Medicaid, however, when using a p-value of <0.01 , this did not meet statistical significance.

DISCUSSION

The results of this investigation revealed clinically significant baseline variations among women with moderate morbid obesity, according to health insurance carrier, in age, weight, BMI, and 32 weight-related medical problems. Weight and BMI were highest in the Medicaid group. Medicare patients were eldest (57+-12 years). Regarding race, Medicaid patients most frequently were African-American and

Hispanic. Caucasian patients were highest in Medicare and Asians in Self-Pay. Medicaid patients had the highest rates of asthma, abdominal and hepatobiliary problems (hernia, abdominal panniculitis, GERD, liver disease), gout, back pain, psychological conditions (depression, mental health diagnosis, psychologic impairment), tobacco use, and pseudotumor cerebri (n=11), and were the lowest in none. Medicare patients had the highest rates of cardiovascular obesity co-morbidities (angina, CHF, hypertension, ischemic heart disease, DVT/PE, PVD, pulmonary hypertension), pulmonary conditions (obesity hypoventilation and obstructive sleep apnea), diabetes, dyslipidemia, menstrual irregularity, cholelithiasis, stress incontinence, somatic complaints (fibromyalgia, impaired functional status, leg edema, musculoskeletal pain), and unemployment (n=19), and were lowest in none. Private women had the highest rates of PCOS and alcohol use and were lowest in depression and smoking. Self-Pay experienced the lowest incidence of every obesity co-morbidity except PCOS. Only substance use did not vary by insurance carrier. The advance clinical knowledge presented in these results can facilitate anticipatory management of obese women undergoing major surgery. Our review of the literature indicates that these statistically and clinically significant variations by health insurance status in women with moderate morbid obesity have not been reported previously and are important findings of this study.

Women with Medicaid had higher preoperative weights and BMI's. Despite this they only had the highest rates of 12 of the 32 studied comorbidities (asthma, gout, pseudotumor cerebri, abdominal wall hernia, abdominal panniculus, GERD, liver disease, back pain, depression, mental health diagnosis, psychological impairment, and

tobacco use). It seems reasonable that a higher weight would correspond to more patients with abdominal panniculitis and abdominal wall hernias in this group of women. While the rate of substance abuse was largest in this group, it did not reach statistical significance.

Among cardiopulmonary conditions studied, all but asthma were most prevalent among women with Medicare. The most astounding variation was noted in Medicare women among whom the rate of CHF was up to 10.4 times and at least 1.7 times higher than the women in the other insurance groups (4.98% vs 0.48-2.85%). Ischemic heart disease affected 9.07% of women with Medicare, and incidences greatly increased compared with the other groups carrying that diagnosis only 1.61-4.35% of the time. The rate of hypertension was also very high in the Medicare group at 72.59% compared to rates of 40.56-55.38 in the other insurance groups.

Metabolic and endocrine abnormalities were more diverse in distribution among insurance groups. Regarding gynecologic issues, PCOS was most common in women with private insurance and menstrual irregularities afflicted. Medicare patients most frequently had problems with menstrual irregularities. Age could be a contributing factor in this instance, as perimenopause is associated with anovulation and menstrual irregularities,¹⁷ whereas PCOS is more likely to be diagnosed with more frequent evaluations for infertility in a younger, insured population of women¹⁸. Gout and pseudotumor cerebri were seen most often in women with Medicaid with rates of 7.13% and 2.42% compared to 0.82-5.04% and 1.1-1.62% in the other groups respectively. Diabetes was 1.3 times and dyslipidemia were 1.4 times more common in women with

Medicare compared to the rates in the next highest insurance group which could be contributed to increased age in the Medicare group.

Cholelithiasis was noted in 29.76% and SUI was carried by 33.21% of women with Medicare, rates significantly highest versus other insurances. Medicaid women with moderate obesity experienced the highest rates of abdominal wall hernia (6.41%), abdominal panniculus (7.75%), GERD (51.67%), and liver disease (5.27%). Medicaid also the was group with the highest weight and BMI. Surprisingly, alcohol use was the lowest among women with Medicaid at 17.53% while they still had the highest rates of liver disease.

All somatic complaints, other than back pain were most frequent in women with Medicare. Back pain was seen in 58.95% of Medicaid patients which ranged from 39.56-55.91% in the other groups. Fibromyalgia was 1.5-4.2 times more commonly seen in patients with Medicare. Musculoskeletal pain was noted in 53.74% of women with Medicare vs. 33.49-45.12% of women with other insurance statuses. Impaired functional status was most common in women with Medicare with ranges from a low of 1.3 times higher than the Medicaid to 10.6 times higher than the self-pay women. Lower extremity edema was the final medical issue studied in this category, showing prevalence rates of 35.59% in the women with Medicare, which had a rate 1.2-1.8 times that of the other insurance groups.

Alcohol was used more often (32.63% vs. 17.53-~~32.09%~~ PUT MEDICARE IN HERE) in the private insurance group, followed closely by Self-Pay (32.09%). ~~It is interesting that alcohol use and liver disease are inversely related in the statistics which may be explained by abnormalities in reporting.~~ Interestingly, while alcohol use was

much higher among Private and Self-Pay patients, liver disease afflicted more Medicare and Medicaid individuals. ~~There is also a~~ One factor for the alcohol/liver disease disparity for Medicaid could be the well-established link between BMI and liver disease¹⁹. Higher liver disease in Medicare versus Private and Self-Pay may relate to increased Medicare age, from which one might speculate that Medicare patients carried obesity for more years than the others, subjecting the liver longer to the adverse effects of excess weight. Substance abuse did not vary by health insurance.

Mental health sequelae burdened women with Medicaid most frequently, with rates of 46.9%, 20.67%, and 27.51% of depression, other mental health diagnosis, and psychological impairment respectively. ~~The mechanisms under this finding are not clear from the data.~~ Tobacco use was also 1.4 to 1.5 times more common among Medicaid women than the other insurance groups. Not surprisingly, unemployment was most common in the Medicare group with a rate of 71.46% compared with 9.05%, 9.73%, and 47.26% among the self-pay, private insurance, and Medicaid groups respectively.

While we know that people with obesity carry a higher risk of a wide array of disorders affecting a multitude of organ systems⁸, age most certainly plays a role in the development of many of these same illnesses. This could be a confounding factor in why women with Medicare had the highest rates of 19 of the 34 characteristics studied, despite not having the highest weights or BMIs. Furthermore, there may be a link between how long a person is exposed to obesity and the incidence of obesity related comorbidities.

There were several limitations to the present investigation. This is a retrospective analysis of prospectively collected data, and, as such, carries many typical confounders.

In addition, the patients in this study represent a self-selected population of women with moderately severe morbid obesity who chose adjustable gastric band, and thus the results might not be applicable to all women with obesity. Finally, diagnosis of co-morbidities was based on a clinical BOLD definitions¹⁵ or was self-reported by patients, rather than derived from a pathological diagnosis, such as biopsy for liver disease, as an example.

CONCLUSION

There is significant discordance in the pre-operative clinical characteristics of women with moderate obesity when stratified by insurance status. Asthma, abdominal-hepatobiliary conditions, and psychological/behavioral issues predominate among Medicaid females. Medicare insured obese women suffer most from cardiopulmonary illnesses, diabetes/dyslipidemia, cholelithiasis, and somatic disabilities. For surgeons, it is important to recognize that Medicare patients with obesity are the highest risk insurance group for cardiopulmonary problems and diabetes. This can raise the index of suspicion for these problems, granting the opportunity to address these comorbidities prior to surgical intervention to optimize outcomes. Similarly, advance knowledge of Medicaid related obesity comorbidities can facilitate presumptive management. Insurance type does not determine obesity co-morbidities. Rather, this study revealed variation among women who are drawn to subscribe with each of the coverages examined.

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Table 1: Age, weight, BMI, and Race by insurance carrier for women undergoing adjustable gastric banding procedures

	Medicaid	Medicare	Private Insurance	Self-pay	p-value
Age	42.49	57.45	44.33	43.02	<0.0001
Weight (kg)	124.5	120.2	119.3	118.6	<0.0001
BMI	46.67	45.59	44.43	43.6	<0.0001
AfrAmer	19.74%	12.13%	12.69%	4.53%	<0.0001
Caucasian	60.09%	75.07%	73.5%	85.26%	<0.0001
Other	6.77%	8.19%	7.38%	4.59%	<0.0001
Asian	0.14%	0.12%	0.21%	0.24%	<0.0001
Hispanic	13.26%	4.49%	5.38%	6.22%	<0.0001
BMI = Body Mass Index, AfrAmer = African American					

Table 2: Cardio-Pulmonary Comorbidities by Insurance Carrier for Women Undergoing Adjustable Gastric Banding Procedures

	Medicaid	Medicare	Private Insurance	Self-pay	p-value
Angina	3.21	4	1.67	1.51	<0.0001
Asthma	25.94	22.43	15.74	12.65	<0.0001
CHF	2.85	4.98	0.82	0.48	<0.0001
History of DVT/PE	3.71	4.64	2.11	1.47	<0.0001
HTN	55.38	72.59	51.01	40.56	<0.0001
Ischemic HD	4.35	9.07	2.41	1.61	<0.0001
OHS	1.92	3.73	1.28	0.86	<0.0001
OSA	43.55	44.61	33.98	25.06	<0.0001
PHTN	3.92	4.64	3.53	2.02	<0.0001
PVD	1.92	2.29	0.68	0.24	<0.0001

CHF = Congestive Heart Failure; DVT = Deep Venous Thrombosis; PE = Pulmonary Embolism; HTN = Hypertension; HD = Heart Disease; LE = Lower Extremity; OSA = Obstructive Sleep Apnea; OHS = Obesity Hypoventilation Syndrome; PHTN = Pulmonary Hypertension; PVD = Peripheral Vascular Disease

Table 3: Metabolic and Endocrine Comorbidities by Insurance Carrier for Women Undergoing Adjustable Gastric Banding Procedure

	Medicaid	Medicare	Private Insurance	Self-pay	p-value
DM	33.86	45.28	24.85	19.4	<0.0001
Dyslipidemia	38.28	53.35	36.29	32.05	<0.0001
Gout	7.13	5.04	1.93	0.82	<0.0001
Menstrual Irregularities	27.94	34.83	25.75	20.12	<0.0001
PCOS	4.85	1.92	6.26	6.21	<0.0001
Pseudotumor Cerebri	2.42	1.62	1.46	1.1	0.007

DM = Diabetes Mellitus; PCOS = Polycystic Ovarian Syndrome

Table 4: Abdominal and Hepatobiliary Comorbidities by Insurance Carrier for Women Undergoing Adjustable Gastric Banding Procedures

	Medicaid	Medicare	Private Insurance	Self-pay	p-value
Abdominal Hernia	6.41	6.32	3.9	3.19	<0.0001
Abdominal Panniculus	9.41	5.99	4.69	3.77	<0.0001
Cholelithiasis	26.09	29.76	19.33	15.63	<0.0001
GERD	51.67	50.6	43.85	39.9	<0.0001
Liver Disease	5.27	4.98	4.24	2.43	<0.0001
Stress Urinary Incontinence	30.93	33.21	25.27	23.86	<0.0001

GERD = Gastroesophageal Reflux Disease

Table 5: Somatic Comorbidities by Insurance Carrier for Women Undergoing Adjustable Gastric Banding Procedures

	Medicaid	Medicare	Private Insurance	Self-pay	p-value
Back Pain	58.95	55.91	45.46	39.56	<0.0001
Fibromyalgia	6.34	9.47	2.86	2.23	<0.0001
Impaired Functional Status	6.06	7.97	1.32	0.75	<0.0001
Lower Extremity Edema	30.36	35.59	22.69	18.85	<0.0001
Musculoskeletal Pain	45.12	53.74	38.76	33.49	<0.0001

Table 6: Psychological and Behavioral Comorbidities by Insurance Carrier for Women Undergoing Adjustable Gastric Banding Procedures

	Medicaid	Medicare	Private Insurance	Self-pay	p-value
Alcohol Use	17.53	19.37	32.63	32.09	<0.0001
Depression	46.9	43.63	33.3	34.38	<0.0001
Mental Health Diagnosis	20.67	16.07	9.36	8.6	<0.0001
Psychological Impairment	27.51	23.04	14.18	13.58	<0.0001
Substance Abuse	0.5	0.4	0.31	0.38	0.5237
Tobacco Use	8.91	6.02	5.93	6.17	<0.0001
Unemployment	47.26	71.46	9.73	9.05	<0.0001