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Bariatric Surgery Insurance Requirements Independently Predict Surgery Dropout

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Abstract

Background—Many insurance companies have considerable pre-bariatric surgery requirements despite a lack of evidence for improved clinical outcomes. The hypothesis of this study is that insurance-specific requirements will be associated with a decreased progression to surgery and increased delay in time to surgery.

Methods—Retrospective data collection was performed for patients undergoing bariatric surgery evaluation from 2010–2015. Patients who underwent surgery (SGY; n= 827; mean BMI 49.1) were compared to those who did not (no-SGY; n= 648; mean BMI 49.4). Univariate and multivariate analysis were performed to identify specific comorbidity and insurance specific predictors of surgical dropout and time to surgery.

Results—A total of 1475 patients using 12 major insurance payers were included. Univariate analysis demonstrated insurance requirements associated with surgical drop out included longer median diet duration (no-SGY= 6 months; SGY=3 months; p< 0.001); PCP letter of necessity (p<0.0001); laboratory testing (p=0.019); and evaluation by cardiology (p<0.001), pulmonology (p<0.0001), or psychiatry (p=0.0003). Using logistic regression to control for comorbidities, longer diet requirement (OR 0.88, p<0.0001), PCP letter (OR 0.33, p<0.0001), cardiology evaluation (OR 0.22, p=0.038), and advanced laboratory testing (OR 5.75, p=0.019) independently predicted surgery dropout. Additionally, surgical patients had an average interval between initial visit and surgery of 5.8±4.6 months with significant weight gain (2.1 kg, p<0.0001).

Conclusion—Many pre-bariatric surgery insurance requirements were associated with lack of patient progression to surgery in this study. In addition, delays in surgery were associated with

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preoperative weight gain. Although prospective and multicenter studies are needed, these findings have major policy implications suggesting insurance requirements may need to be reconsidered to improve medical care.

Keywords

Bariatric Surgery; Insurance Requirements; Access to Care; Gastric Bypass

Background

Bariatric surgery has emerged as the gold standard treatment for obesity and associated comorbidities with better long term outcomes than diet, exercise, and weight loss medication [(1)]. Hormonal mediators of appetite have been implicated as a driving force of weight gain following diet induced weight loss [(2)]. Additionally, metabolic adaption related to resting metabolic rate reduction following diet induced weight loss may contribute to high incidence of weight regain [(3, 4)]. This metabolic adaption following weight loss is not seen to the same degree in patients following gastric bypass [(5)] and strongly suggests that weight has a biological set point that is refractory to conservative treatment [(6)]. The list of conditions that are directly related to obesity is long and includes type 2 diabetes, hypertension, non-ischemic cardiomyopathy, nonalcoholic steatohepatitis, obstructive sleep apnea, obesity hypoventilation syndrome, and a variety of cancers[(7)]. In addition to the physical toll on patients, severe obesity and associated comorbidities have significantly impacted health care costs with an estimated national cost of $69 billion in 2013 alone [(8)]. Considering the significant cost of obesity, bariatric surgery has been shown to be a cost effective treatment [(9, 10) (11)]. However, the high cost of bariatric surgery ($25,000–$30,000) is prohibitive for most patients without third party payers [(12)].

Although specifics vary depending on local coverage mandates, many insurance carriers require significant preoperative measures such as supervised diets, specialist evaluations and laboratory testing before patients undergo bariatric surgery. Although intensive short term weight loss may reduce liver size and thereby complication risk, there is no clear evidence that these particular preauthorization requirements improve long term clinical outcomes [(13).] In fact, Kuwada et al. showed that a mandated medical program consisting of greater than or equal to 6 months of supervised diet resulted in surgical delay without difference in preoperative percent excess weight loss (%EWL) or weight loss at 6 and 12 months postoperatively [(14)]. Likewise, Jamal et al. demonstrated that 13 weeks of preoperative dietary counseling, compared with no preoperative dietary counseling, resulted in an approximately 50% greater surgical dropout rate and less weight loss at 12 months post-surgery [(15)]. Together, these studies raise the possibility that preoperative diet requirements are an obstacle to bariatric surgery and post-surgery weight loss. However, previous studies have only analyzed mandated diet programs' impact on surgical delay, surgical dropout, and weight loss pre- and postoperatively and limit our ability to identify other insurance requirements which predict surgical dropout. Therefore, the purpose of this study was to evaluate the associations between a variety of insurance requirements on surgical attrition as well as the impact on pre-surgical weight change in a single center. We hypothesized that,

within this population, insurance specific requirements would be associated with an increase in time delay to surgery and a decrease in progression to surgery.

Methods

After Institutional Review Board approval with waiver of consent, retrospective analysis ofadult patients who underwent initial bariatric surgery evaluation between January 7, 2010 and May 26, 2015 was performed. Of the 1549 patients who underwent surgical evaluation during that time period, patients undergoing surgical revision (n=71) and those with unknown insurance status (n=3) were excluded from analysis. Procedures included laparoscopic Roux-en-Y gastric bypass (LRYGB), sleeve gastrectomy (SG), and laparoscopic adjustable gastric band (LAGB) that were performed by two surgeons at a major academic medical center to minimize variance in procedures. Patients were screened for insurance status prior to initial appointments.

The primary outcome was surgery dropout based on insurance requirements defined as failure to undergo surgery at this center by December 2015. Secondary outcomes included insurance requirements associated with surgical delay, insurance payers associated with a greater rate of surgical dropout (e.g. private versus non-private insurance), and amount of weight loss prior to surgery. Insurance carriers were included for patients based on clinic database records with preoperative insurance requirements assigned by known requirements for insurance carriers as of December 2015. Insurance requirements were variable based on insurance carrier and included diet of inconsistent duration, nutrition evaluation, primary care physician (PCP) letter, cardiology evaluation, pulmonology evaluation, psychiatry evaluation, sleep study, advanced laboratory testing consisting of TSH or H. pylori serology, or electrocardiogram (EKG). Comorbidities were included based on patient problem list from the clinical data repository (CDR). Comorbidities screened for included chronic obstructive pulmonary disease (COPD), degenerative joint disease (DJD), obstructive sleep apnea (OSA), type 2 diabetes (T2D), gastroesophageal reflux disease (GERD), cardiac dysrhythmia, hypertension, and tobacco use.

Univariate analysis was performed with use of chi-squared or Fisher's exact test for categorical variables and Student's *t*-test or Mann-Whitney *U*-test for continuous variables as appropriate to identify differences in comorbidities and insurance requirements between groups. Multivariate logistic regression was used to adjust for all preoperative factors, including comorbidities and insurance status and requirements, and determine which parameters were independently predictive of failure to proceed to surgery. Linear regression was fit for all patients who proceeded to surgery to identify the factors which predict longer interval between initial evaluation and surgery. SAS version 9.4 (SAS Company, Cary NC) was used for analyses. Statistical significance was set at $p<0.05$.

Results

Group demographics are shown in Table 1. Groups were well balanced in terms of age (mean SGY=41.1 years; no-SGY=41.4, p=0.54), sex (SGY=83.1% female, no-SGY=81.3%, p=0.92), and BMI (SGY=49.1; no-SGY=49.4, p=0.576). However, the surgical group had

lower rates of COPD (1.1% vs. 3.3%, p=0.01) and tobacco use (0.9% vs. 2.5%, p=0.01) but higher rates of T2D compared with the no-SGY group (40.2% vs. 31.9%, p=0.01).

Longer diet duration (median diet duration 3 vs. 6 months) was associated with surgery dropout (SGY=3 months, no-SGY=6 months, p<0.001). In addition, PCP letter of necessity (no-SGY=26.7% vs. SGY=12.9%, p<0.0001), advanced laboratory testing (no-SGY=21.9%, vs. SGY=10.7%, p=0.019), and evaluation by subspecialist including cardiology (no-SGY= 22.3% vs. SGY=9.1%, p<0.001), pulmonology (no-SGY=24.8% vs. SGY=10.7%, p<0.0001) or psychiatry (no-SGY=86.1% vs. 78.7%, p=0.0003) were also associated with surgical attrition.

Multivariate logistic regression analysis was used to adjust associations between insurance requirements and surgical dropout for comorbidities as shown in Table 2. Diagnosis of T2D and private insurance status were the only demographic factors positively predictive of progression to surgery. However, COPD and tobacco use were predictive of surgical dropout. Insurance requirements that were predictive of surgical dropout included longer diet time (OR=0.880 per month required, 95% CI 0.839–0.922, p<0.0001), PCP letter of necessity (OR=0.413, 95% CI 0.302–0.565, p<0.001), cardiology evaluation (OR=0.272, 95% CI 0.075–0.982, p=0.0469), pulmonology evaluation (OR=0.290, 95% CI 0.098–0.862, p=0.026), and advanced laboratory testing (OR=0.088, 95% CI 0.022–0.350, p=0.0006). Private insurance status was also independently predictive of progression to surgery compared to Medicare or Medicaid payer status (OR=3.093, 95% CI 2.274–4.207, p= <0.001). The model had moderate discriminatory power with an area under the curve (c-statistic) of 0.711.

Surgical patients had a mean 5.8±4.5 months preoperative interval between initial visit and time of bariatric surgery. Requirements that predicted longer interval between initial evaluation and surgery were cardiology evaluation (3.7 month increase from average, p=0.01) and advanced laboratory testing (3.3 month increase, p=0.03). Interestingly, surgical patients gained weight (mean 2.1 kg) in the time between initial evaluation and surgery. Full results of the linear regression are presented in Table 3.

Discussion

The main finding from this study is that several insurance requirements may prohibit successful follow through with bariatric surgery. Many insurance carriers represented in this study mandate that patients undergo nutritional, psychological and medical laboratory testing prior to surgery without substantial evidence to support that these requirements benefit the patient. In our current study, we found that longer diet duration (median 3 vs. 6 months), PCP letter of necessity, cardiologist evaluation, pulmonologist evaluation, and advanced laboratory testing were the strongest predictors of surgical dropout. Interestingly, previous studies have also shown that diet requirements of 3 to 6 months delay or prevent progression to surgery [14, 15]. This supports the notion that shorter dietary interventions of only 2 to 4 weeks are reasonable to reduce liver size and minimize surgical complications [13].

Our study shows that input from other physicians including PCP letter of necessity, cardiology evaluation, and pulmonology evaluation are predictive of failure to progress to surgery. We propose that time delay, as seen with longer diet duration, is one explanation for these results. The linear regression analysis (Table 3) demonstrated that, in patients who underwent surgery, cardiology evaluation was associated with a 3.7 month increase in time to surgery (p= 0.01). Pulmonology evaluation was also associated with a 2.1 month increase, but this finding was not significant (p=0.14). While reasons for this increased time to surgery are not clear from our data, it is possible that specialists focused on additional testing or optimization of medical risk factors, or focused patient attention more on the risks of intra- or postoperative complications. The fact that the no-SGY patients had a significantly higher rate of COPD (3.3% in no-SGY vs. 1.1% in SGY, p=0.01) and tobacco use (2.5% in no-SGY vs. 0.9% in SGY, p=0.01) could suggest that some of these patients were excluded appropriately due to increased surgical risk. Overall, however, groups were well balanced in terms of other comorbidities although there was a higher rate of T2D in the SGY group, which may have provided more motivation to follow through with surgery.

Patients with private insurance were more likely to undergo surgery compared to those with medicare or medicaid. This may be a surrogate for socioeconomic status as patients with private insurance potentially have more financial resources and therefore the ability to pay for surgery as well as additional tests and evaluations. Medicaid requirements in this study population were extensive including cardiopulmonary clearance, laboratory testing, psychiatric evaluation, and 6 months supervised diet. Private insurance was associated with a small but non-significant shorter time to surgery (−0.55 months, p=0.17).

Our finding that advanced laboratory testing, including thyroid studies, was also associated with increased surgical dropout suggests that advanced testing should be evidence based and pursued if medically necessary, given the potential adverse effect on time delay, surgical dropout, and costs of care. Preoperative thyroid testing has likely been advised because of the association between unregulated hypothyroidism and surgical complications [(16)]. But this may not be necessary since the Clinical Practice Guidelines by the American Association of Clinical Endocrinologists (AACE), The Obesity Society (TOS), and American Society for Metabolic and Bariatric Surgery (ASMBS) recommends against routine screening for primary hypothyroidism prior to bariatric surgery (Grade D evidence) unless the patient is at risk for hypothyroidism (Grade B evidence). Similarly, consideration of routine H. pylori testing is only recommended in high-prevalence areas (Grade C evidence) [(17)]. Taken together, our findings suggest shorter dietary interventions, referrals to specialists, and medical laboratory testing should be pursued based on physician discretion but there is no clear evidence to support these as mandatory requirements.

Weight loss prior to surgery is often regarded as beneficial for intraoperative outcomes as well as postoperative length of stay, complications, and absolute weight loss. A small prospective randomized control trial by Alami et al. found that a 10% preoperative weight loss, compared with no weight loss, resulted in decreased operating room time and improved weight loss at 3 but not at 6 months [(18)]. However, our surgical patients gained weight (mean 2.1 kg) between time of initial evaluation and surgery, suggesting that surgical delay may lead to weight gain and that insurance mandated dietary requirements were ineffective in this

population. This finding is consistent with work by Harnisch et al. who found no difference on post-surgery weight loss or disease resolution of T2D and hypertension at 12 and 24 months between patients with approximate 10 pound weight gain compared with those who lost 10 pounds preoperatively [19]. Thus, preoperative weight loss was not necessarily correlated with greater BMI change postoperatively, and more work is required to determine if optimizing cardiorespiratory fitness, with or without weight loss, can promote long term weight maintenance, insulin sensitivity and cardio-metabolic health [20, 21].

Our study has several limitations that may impact interpretation. The retrospective nature of this single center study impacts our ability to draw causal relationships. The fact that this study involved a single state and surgical center limits its generalizability as there is significant variability in access to care across states, third party payer distribution, and hospital centers. Multicenter, prospective studies are needed to understand broader implications. Additionally, the definition of surgical dropout used in this study may have led to an overestimation of dropout— particularly in patients with later initial visits—as patients may have delayed surgery, remained undecided, or undergone surgery at a different center. Some patients may also have been appropriately excluded from surgery upon further assessment. Diet was not strictly controlled for, and varied significantly with some insurance carriers requiring multiple documented diet attempts and others necessitating one to six months of physician supervised diet. While we did not specifically characterize which diet method was related to surgical delay or dropout, a concern with a dietary mandate is that the associated surgical dropout may promote up to a three-fold higher mortality rate [22]. At this time, ASMBS guidelines do not routinely recommend preoperative diets or weight loss[7]. Furthermore, although confounding factors including T2D, HTN, COPD, tobacco use, and dysrhythmias were considered, heart failure was not included as a confounding factor since there were a low number of patients with heart failure diagnosis in our study sample. Additionally, as patient data was collected as far back as January 2010, there may have been changes in insurance requirements that were not taken into account in the study. Nevertheless, a strength of the present study is that it evaluated multiple insurance requirements with a large sample size in order to gain better understanding of which requirements are implicated in surgical delay and dropout.

Conclusion

Many pre-bariatric surgery insurance requirements both delayed and prevented the progression to bariatric surgery in this study. Insurance requirements which were the strongest predictors of bariatric surgery dropout included longer diet requirement (median 3 vs. 6 months), PCP letter of necessity, cardiologist or pulmonologist evaluation, and non-private insurance status. Delays in surgery were associated with preoperative weight gain rather than weight loss. Collectively, these findings suggest some insurance requirements may be barriers to potentially lifesaving treatment in a patient population at risk for cardiovascular disease and other complications of obesity.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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References

1. Cheng J, Gao J, Shuai X, Wang G, Tao K. The comprehensive summary of surgical versus non-surgical treatment for obesity: a systematic review and meta-analysis of randomized controlled trials. Oncotarget. 2016
2. Sumithran P, Prendergast LA, Delbridge E, Purcell K, Shulkes A, Kriketos A, et al. Long-term persistence of hormonal adaptations to weight loss. The New England journal of medicine. 2011; 365(17):1597–604. [PubMed: 22029981]
3. Fothergill E, Guo J, Howard L, Kerns JC, Knuth ND, Brychta R, et al. Persistent metabolic adaptation 6 years after "The Biggest Loser" competition. Obesity (Silver Spring, Md). 2016; 24(8): 1612–9.
4. Rosenbaum M, Leibel RL. Models of energy homeostasis in response to maintenance of reduced body weight. Obesity (Silver Spring, Md). 2016; 24(8):1620–9.
5. Knuth ND, Johannsen DL, Tamboli RA, Marks-Shulman PA, Huizenga R, Chen KY, et al. Metabolic adaptation following massive weight loss is related to the degree of energy imbalance and changes in circulating leptin. Obesity (Silver Spring, Md). 2014; 22(12):2563–9.
6. Speakman JR, Levitsky DA, Allison DB, Bray MS, de Castro JM, Clegg DJ, et al. Set points, settling points and some alternative models: theoretical options to understand how genes and environments combine to regulate body adiposity. Disease models & mechanisms. 2011; 4(6):733–45. [PubMed: 22065844]
7. Mechanick JI, Youdim A, Jones DB, Garvey WT, Hurley DL, McMahon MM, et al. Clinical practice guidelines for the perioperative nutritional, metabolic, and nonsurgical support of the bariatric surgery patient–2013 update: cosponsored by American Association of Clinical Endocrinologists, the Obesity Society, and American Society for Metabolic & Bariatric Surgery. Endocrine practice: official journal of the American College of Endocrinology and the American Association of Clinical Endocrinologists. 2013; 19(2):337–72.
8. Wang YC, Pamplin J, Long MW, Ward ZJ, Gortmaker SL, Andreyeva T. Severe Obesity In Adults Cost State Medicaid Programs Nearly $8 Billion In 2013. Health affairs (Project Hope). 2015; 34(11):1923–31. [PubMed: 26526251]
9. Picot J, Jones J, Colquitt JL, Gospodarevskaya E, Loveman E, Baxter L, et al. The clinical effectiveness and cost-effectiveness of bariatric (weight loss) surgery for obesity: a systematic review and economic evaluation. Health technology assessment (Winchester, England). 2009; 13(41):1–190. 215–357, iii–iv.
10. Hoerger TJ, Zhang P, Segel JE, Kahn HS, Barker LE, Couper S. Cost-effectiveness of bariatric surgery for severely obese adults with diabetes. Diabetes Care. 2010; 33(9):1933–9. [PubMed: 20805271]
11. Padwal R, Klarenbach S, Wiebe N, Hazel M, Birch D, Karmali S, et al. Bariatric surgery: a systematic review of the clinical and economic evidence. Journal of general internal medicine. 2011; 26(10):1183–94. [PubMed: 21538168]
12. (WIN) W-cIN. Bariatric Surgery for Severe Obesity. National Institute of Health; 2009. https://www.niddk.nih.gov/health-information/health-topics/weight-control/bariatric-surgery-severe-obesity/Pages/bariatric-surgery-for-severe-obesity.aspx[updated June 2011
13. Edholm D, Kullberg J, Haenni A, Karlsson FA, Ahlstrom A, Hedberg J, et al. Preoperative 4-week low-calorie diet reduces liver volume and intrahepatic fat, and facilitates laparoscopic gastric bypass in morbidly obese. Obesity surgery. 2011; 21(3):345–50. [PubMed: 21181291]

14. Kuwada TS, Richardson S, El Chaar M, Norton HJ, Cleek J, Tomcho J, et al. Insurance-mandated medical programs before bariatric surgery: do good things come to those who wait? Surg Obes Relat Dis. 2011; 7(4):526–30. [PubMed: 21145294]
15. Jamal MK, DeMaria EJ, Johnson JM, Carmody BJ, Wolfe LG, Kellum JM, et al. Insurance-mandated preoperative dietary counseling does not improve outcome and increases dropout rates in patients considering gastric bypass surgery for morbid obesity. Surg Obes Relat Dis. 2006; 2(2): 122–7. [PubMed: 16925335]
16. Ladenson PW, Levin AA, Ridgway EC, Daniels GH. Complications of surgery in hypothyroid patients. The American journal of medicine. 1984; 77(2):261–6. [PubMed: 6465175]
17. Mechanick JI, Youdim A, Jones DB, Garvey WT, Hurley DL, McMahon MM, et al. Clinical practice guidelines for the perioperative nutritional, metabolic, and nonsurgical support of the bariatric surgery patient–2013 update: cosponsored by American Association of Clinical Endocrinologists, The Obesity Society, and American Society for Metabolic & Bariatric Surgery. Obesity (Silver Spring, Md). 2013; 21(Suppl 1):S1–27.
18. Alami RS, Morton JM, Schuster R, Lie J, Sanchez BR, Peters A, et al. Is there a benefit to preoperative weight loss in gastric bypass patients? A prospective randomized trial. Surg Obes Relat Dis. 2007; 3(2):141–5. discussion 5–6. [PubMed: 17331803]
19. Harnisch MC, Portenier DD, Pryor AD, Prince-Petersen R, Grant JP, DeMaria EJ. Preoperative weight gain does not predict failure of weight loss or co-morbidity resolution of laparoscopic Roux-en-Y gastric bypass for morbid obesity. Surg Obes Relat Dis. 2008; 4(3):445–50. [PubMed: 18501309]
20. McCullough PA, Gallagher MJ, Dejong AT, Sandberg KR, Trivax JE, Alexander D, et al. Cardiorespiratory fitness and short-term complications after bariatric surgery. Chest. 2006; 130(2): 517–25. [PubMed: 16899853]
21. Malin SK, del Rincon JP, Huang H, Kirwan JP. Exercise-induced lowering of fetuin-A may increase hepatic insulin sensitivity. Medicine and science in sports and exercise. 2014; 46(11): 2085–90. [PubMed: 24637346]
22. Flanagan E, Ghaderi I, Overby DW, Farrell TM. Reduced Survival in Bariatric Surgery Candidates Delayed or Denied by Lack of Insurance Approval. Am Surg. 2016; 82(2):166–70. [PubMed: 26874141]

Table 1

Baseline Characteristics

Parameter	Surgery (n=827) *No. of patients (%)*	No Surgery (n=648) *No. of patients (%)*	p-value
BMI (kg/m^2)	49.1	49.4	0.68
Age (mean in years)	41.1	41.4	0.54
Female sex	689 (83.1%)	527 (81.3%)	0.92
Caucasian race	701 (84.7%)	555 (85.5%)	0.71
Chronic Obstructive Pulmonary Disease	9 (1.1%)	19 (2.9%)	**0.01**
Degenerative Joint Disease	191 (23.1%)	143 (22.1%)	0.64
Obstructive Sleep Apnea	355 (42.9%)	265 (40.9%)	0.43
Diabetes Mellitus	332 (40.2%)	207 (31.9%)	**0.001**
Cardiac Dysrhythmia	5 (0.6%)	7 (1.1%)	0.31
Gastroesophageal Reflux Disease	317 (38.3%)	256 (39.5%)	0.65
Hypertension	529 (63.9%)	395 (60.9%)	0.24
Tobacco Use	7 (0.85%)	16 (2.5%)	**0.01**
Private insurance status	404 (48.8%)	203 (31.3%)	<**0.0001**
Non-private insurance status	423 (51.1%)	445 (68.7%)	<**0.0001**
Insurance requirements:			
Median diet time (in months)	3	6	<**0.0001**
Mean diet time (in months ± SD)	3.4 ± 3.1	4.3 ± 2.7	<**0.0001**
Nutrition evaluation	18 (2.2%)	10 (1.5%)	0.37
Primary care physician letter	106 (12.9%)	172 (26.7%)	<**0.0001**
Cardiology evaluation	75 (9.1%)	144 (22.3)	<**0.0001**
Pulmonology evaluation	85 (10.4%)	160 (24.8%)	<**0.0001**
Psychiatry evaluation	645 (78.7%)	555 (86%)	**0.0003**
6 months of psychiatry evaluation	18 (2.2%)	22 (3.4%)	0.16
Sleep study	12 (1.45%)	7 (1.1%)	0.53
Advanced laboratory testing	88 (10.7%)	141 (21.9%)	<**0.0001**
EKG	14 (1.7%)	17 (2.6%)	0.22

BMI= body mass index (kg/m^2)

Table 2

Logistic Regression for factors predictive of time to surgery

Parameter	Odds Ratio	95% Confidence Interval		p-value
BMI (kg/m^2)	1.004	0.991	1.017	0.58
Chronic Obstructive Pulmonary Disease	0.354	0.149	0.839	**0.02**
Degenerative Joint Disease	1.100	0.839	1.443	0.49
Obstructive Sleep Apnea	1.117	0.876	1.425	0.37
Type 2 Diabetes	1.366	1.073	1.739	**0.01**
Cardiac Dysrhythmia	0.636	0.184	2.199	0.47
Gastroesophageal Reflux Disease	0.981	0.775	1.240	0.87
Hypertension	1.088	0.851	1.390	0.50
Tobacco Use	0.267	0.101	0.705	**0.01**
Private Insurance	3.093	2.274	4.207	**<.0001***
Diet Time (per month required)	0.880	0.839	0.922	**<.0001***
Multiple Diet Attempts	1.133	0.830	1.547	0.43
Nutrition Evaluation	1.064	0.263	4.297	0.93
Primary Care Physician Letter	0.413	0.302	0.565	**<.0001***
Cardiology Evaluation	0.272	0.075	0.982	**0.046***
Pulmonology Evaluation	0.290	0.098	0.862	**0.03***
6 Month Psychiatry Evaluation	0.671	0.315	1.426	0.30
Psychiatry Evaluation	0.918	0.662	1.275	0.61
Sleep Study	0.772	0.149	4.000	0.76
Advanced Laboratory Testing	0.088	0.022	0.350	**0.001***
EKG	0.519	0.123	2.180	0.37

BMI= body mass index (kg/m^2); EKG= electrocardiogram; advanced laboratory testing included TSH or H. pylori serology testing; private insurance included non-Medicaid or non-Medicare insurance carriers

Table 3

Linear Regression for factors predictive of time to surgery

Parameter	Estimate (difference in time to surgery in months)	Standard Error (+/−)	p-value
Private Insurance	−0.56	0.40	0.17
Diet Time (increase per month diet required)	0.09	0.06	0.17
PCP Letter	−0.69	0.49	0.16
Cardiology Evaluation	3.69	1.19	**0.01***
Pulmonology Evaluation	2.13	1.45	0.14
Advanced Laboratory Testing	3.30	1.54	**0.03***

PCP= Primary care physician; Intercept (mean time to surgery in months) was found to be 5.8 months (SD ± 4.5). Cardiology evaluation was associated with an additional 3.69 months time to surgery, and advanced laboratory testing (TSH, H. pylori serologies) was associated with an additional 3.3 months to surgery.