Retrospective validation and comparison of prediction calculators for weight loss and comorbidity resolution after bariatric surgery.

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Background

- There are a variety of prediction tools available to clinicians in bariatric surgery, which can assist in patient and procedure selection and setting goals and expectations.
- The Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP®)published a calculator to predict one year weight loss outcomes, comorbidity remission and 30 day morbidity and mortality after bariatric operations.
- The Michigan Bariatric Surgery Collaborative (MBSC) also created a calculator based on data from over 25,000 patients that predicts weight loss, comorbidity resolution at one year, and 30 day morbidity and mortality (1).
- Review of other prediction tools show that predictions for weight loss are often overestimated (2).
- We retrospectively evaluated the accuracy of these 2 calculators, both based on large databases, against our clinic population.

Methods

- We compared the actual and predicted outcomes of 306 patients who underwent primary laparoscopic Roux-en-Y gastric bypass or sleeve gastrectomy between August 2013 and August 2018 at Lahey Hospital, for whom 1 year follow up data was available.
- All patient data were entered into both MBSAQIP and MBSC databases to obtain predicted 1 year total body weight loss (TBWL) and comorbidity resolution, and 30 day morbidity and mortality outcomes.
- Data were analyzed using SAS software.
  - Repeated measure ANOVA was used to compare TBWL in the overall cohort as well as in several subgroups (**Table 2**), with a p value of <0.05 defined as significant.
  - Logistic regression models were used to compare comorbidity resolution and 30 day outcomes, with a c-statistic of 0.7 or greater defined as significant.

Table 1: Demographics.

Variable (n=306)	
Age (mean, (SD))	43.5 (11.9)
Female (n (%))	241 (78.8)
Preoperative BMI (mean, (SD))	43.6 (6.4)
Hypertension (n (%))	125 (40.9)
Hyperlipidemia (n (%))	78 (25.5)
Gastroesophageal reflux (n (%))	141 (46.1)
Obstructive sleep apnea (n (%))	101 (33.0)
Diabetes mellitus (n (%))	
Non-insulin dependent	37 (12.1)
Insulin dependent	26 (8.5)
Surgery type (n (%))	
43644- Gastric bypass	124 (40.5)
43775- Sleeve gastrectomy	182 (59.5)

Table 2: Total body weight loss at 1 year, predicted vs. actual

Group	n	MBSAQIP Mean (SD)	MBSC Mean (SD)	Actual Mean (SD)	p value
All	306	30.5 (3.0)	30.6 (3.8)	25.7 (9.0)	**<0.001**
Gastric bypass	124	32.8 (2.4)	33.3 (3.5)	27.3 (9.0)	0.09
Sleeve	182	28.9 (2.2)	28.7 (2.9)	24.6 (8.8)	
BMI≥50	47	30.3 (3.0)	30.3 (3.7)	25.4 (8.8)	0.94
BMI<50	259	31.5 (2.3)	31.8 (4.2)	26.9 (10.2)	
Age<50	207	31.3 (2.5)	31.2 (3.7)	26.9 (8.9)	0.12
Age≥50	99	28.9 (3.2)	29.2 (3.8)	23.1 (8.6)	
Male	65	30.0 (2.9)	30.3 (3.4)	24.7 (9.6)	0.63
Female	241	30.6 (3.0)	30.6 (3.9)	25.9 (8.8)	
≥2 comorbs	147	29.8 (3.0)	30.3 (3.7)	23.9 (8.7)	**0.002**
0-1 comorbs	159	31.2 (2.7)	30.8 (3.9)	27.3 (9.0)	
Diabetes	63	30.0 (2.6)	30.5 (3.4)	24.4 (9.0)	0.31
No diabetes	243	30.6 (3.0)	30.6 (3.9)	26.0 (9.0)	

Table 3. Mean changes between predicted and actual TBWL and prediction tool comparison.** indicates p<0.001; * indicates p<0.05

Group	n	MBSAQIP vs. Actual Mean (SD)	MBSC vs. Actual Mean (SD)	MBSAQIP v. MBSC Mean (SD)
All patients	306	-4.8 (8.5)**	-4.9 (8.7)**	-0.07 (2.62)
0-1 comorbs	159	-3.9 (8.6)*	-3.5 (8.5)*	0.3 (2.5)
≥2 comorbs	147	-5.9 (8.3)*	-6.4 (8.7)*	-0.5 (2.7)

Table 4: Comorbidity resolution. *=MBSAQIP c-statistic; **=MBSC c-statistic

Group	n	MBSAQIP Predicted at 1 year Mean (SD)	MBSC Predicted at 1 year Mean (SD)	Actual WITHOUT comorbidity at 1 year N (%)
HTN	125	57.2 (12.5)	62.7 (12.2)	73 (58.4) *=0.71 **=0.72
HL	78	60.2 (10.8)	61.6 (12.9)	38 (48.7) *=0.64 **=0.62
OSA	101	58.7 (6.9)	64.3 (11.7)	76 (75.3) *=0.50 **=0.52
GERD	141	59.6 (6.8)	N/A	89 (63.1) *=0.55
DM	63	71.6 (19.6)	77.5 (10.6)	42 (67.7) *=0.84 **=0.80

Table 5: 30 day outcomes. *=MBSAQIP c-statistic; **=MBSC c-statistic

Group	MBSAQIP Predicted at 30 days Mean (SD)	MBSC Predicted at 30 days Mean (SD)	Actual WITH outcome at 30 days N (%)
All morbidity	5.7 (2.9)	5.7 (2.7)	19 (6.2) *=0.58 **=0.58
Death	1.1 (0.1)	0.1 (0.1)	0 (0.0)
Serious	2.6 (1.6)	1.9 (1.0)	5 (1.6)
SSI	0.8 (0.6)	n/a	0 (0.0)
Leak	0.3 (0.1)	n/a	2 (0.7)
Bleed	1.1(0.8)	n/a	1 (0.3)
Readmission	3.1 (1.5)	n/a	19 (6.2)
Reoperation	1.2 (0.7)	n/a	4 (1.3)
Intervention	1.2 (0.8)	n/a	7 (2.3)

Results

- The study population demographics were 78.8% female, 40.5% underwent laparoscopic gastric bypass, and mean preoperative body mass index (BMI) was 43.6.1 ± 6.4 (**Table 1**).
- At one year follow up, mean total body weight loss (TBWL) was 25.7 ± 9.0% (**Table 2**).
  - The MBSAQIP calculator overpredicted total body weight loss by a mean of 4.8 ± 8.5%, with low goodness-of-fit (**Table 3**).
  - The MBSC calculator overpredicted total body weight loss by a mean of 4.9 ± 8.7%, with low goodness-of-fit (**Table 3**).
  - The differences in the prediction between the calculators was not statistically significant (**Table 3**).
  - Patients with 2 or greater comorbidities had a greater difference between predicted and actual weight loss compared to patients with 0-1 comorbidity (**Table 3**).
- For one year comorbidity resolution, only diabetes and hypertension achieved a c-statistic of greater than 0.7 for either MBSAQIP or MBSC (**Table 4**).
- Actual 30 day morbidity was 6.2%, compared to 5.7 ± 2.9% predicted by MBSAQIP (c-statistic=0.58) and 5.7 ± 2.7% predicted by MBSC (c-statistic=0.58) (**Table 4**).
- There were insufficient numbers to assess the validity of the predictions for the additional 30 day outcomes.

Conclusions

- Both the MBSAQIP and MBSC calculators poorly predicted the weight loss achieved by our patients, as there was great variability among actual patient outcomes.
- The predictions for morbidity and for resolution of hyperlipidemia, obstructive sleep apnea, and gastroesophageal reflux disease showed poor discrimination.
- The predictions for hypertension and diabetes resolution showed reasonable discrimination.
- These tools should be used with caution when counseling patients.

Sources

1. Finks JF et al. Predicting risk for serious complications with bariatric surgery: results from the Michigan Bariatric Surgery Collaborative. Ann Surg. 2011 Oct;254(4):633-40.
2. Sharples AJ et al. Systematic review and retrospective validation of prediction models for weight loss after bariatric surgery. Surg Obes Relat Dis. 2017 Nov;13(11):1914-1920.

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