



# Impact of Patient Attrition from Bariatric Surgery Practice on Clinical Outcomes

Julia A. Jurgensen<sup>1</sup>  · Wendy Reidt<sup>2</sup> · Todd Kellogg<sup>2</sup> · Manpreet Mundi<sup>1</sup> · Meera Shah<sup>1</sup> · Maria L. Collazo Clavell<sup>1</sup>

Published online: 1 November 2018

© Springer Science+Business Media, LLC, part of Springer Nature 2018

## Abstract

**Background** Obesity has become a global epidemic. Bariatric surgery remains the most successful modality for producing sustained weight loss. Attrition rates after bariatric surgery are currently reported between 3 and 63% depending on the type of bariatric operation and the length of follow-up provided by the bariatric surgery team. It is currently unknown if patient attrition from bariatric surgery programs impact clinical outcomes. The availability of the Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP) and the Mayo Clinic Midwest unified electronic medical record (EMR) provide a unique opportunity to explore this topic.

**Methods** Raw data was downloaded from MBSAQIP database for all laparoscopic Roux-en-Y gastric bypass (LRYGB) cases between May 1, 2008 and January 8, 2015 ( $N = 1242$ ). Baseline weight and preexisting comorbidities (type 2 diabetes, hypertension, and hyperlipidemia) were recorded using the MBSAQIP database and the EMR. Current weight and comorbidity data (type 2 diabetes, hypertension, and hyperlipidemia) were subsequently collected at the time closest to the patient's surgical anniversary dates during the following assessment periods: years 1, 2, and 3 after surgery. Mean percentage total weight loss (TWL) was calculated at each time frame for each patient. Data was summarized using descriptive statistics, including counts and percentages for categorical variables by either year or year and location.

**Results** The number of patients seen by the bariatric surgery practice (BSP) compared to those seen by other providers within our practice (attrition to bariatric surgery practice (ABSP)) was highest in year 1 and reduced each subsequent year (year 1: BSP  $N = 740$ , ABSP  $N = 166$ , year 2: BSP  $N = 425$ , ABSP  $N = 309$ , and year 3: BSP  $N = 235$ , ABSP  $N = 325$ ). The mean TWL in the BSP and ABSP groups at year 1 was 31.84% versus 30.19%, at year 2 was 31.34% versus 29.67%, and at year 3 was 29.01% versus 27.71% respectively. Differences were statistically significant between groups at years 1 and 2 ( $p < 0.05$ ). A statistically significant difference was not found in year 3 despite a trend towards higher TWL in the BSP group. Among all patients, statistically significant differences ( $p < 0.0001$ ) were observed between baseline and years 1, 2, and 3 for type 2 diabetes, hypertension, and hyperlipidemia.

**Conclusions** Our study confirms the problem of patient attrition to follow up at our BSP. It is also the first to suggest a difference in weight loss outcomes among patients seen in BSP compared to those seen by other providers (ABSP) at 1 and 2 years after Roux-en-Y gastric bypass (LRYGB). The potential implications of this observation on long-term weight maintenance after LRYGB and the impact on metabolic comorbidities remain unknown but warrant further investigation. It also warrants the development of strategies to improve patient retention in BSP and/or engagement of medical providers to achieve that end.

**Keywords** Bariatric surgery · Laparoscopic Roux-en-Y gastric bypass · Attrition · Lost to follow-up

✉ Julia A. Jurgensen  
jurgensen.julia@mayo.edu

Wendy Reidt  
Reidt.Wendy@mayo.edu

Todd Kellogg  
Kellogg.Todd@mayo.edu

Manpreet Mundi  
Mundi.Manpreet@mayo.edu

Meera Shah  
Shah.Meera@mayo.edu

Maria L. Collazo Clavell  
Collazoclavell.Maria@mayo.edu

<sup>1</sup> Division of Endocrinology, Diabetes, Nutrition, and Metabolism, Mayo Clinic, 200 First St. SW, Rochester, MN 55905, USA

<sup>2</sup> Division of Surgery, Mayo Clinic, Rochester, MN, USA

## Purpose

Patient attrition from bariatric surgery programs is common and limits reporting on long-term clinical outcomes. We aim to report the prevalence of patient attrition and differences in weight loss between patients seen in our bariatric surgery program (BSP) compared to those seen by other providers within our practice (attrition to bariatric surgery practice (ABSP)).

## Background

Obesity has become a global epidemic; it is estimated that 1.7 billion people worldwide are overweight or obese with two thirds of these individuals living in the USA [4, 14]. Bariatric surgery is considered the best treatment for obesity in comparison to other medical or behavioral treatments [11–13, 15]. A patient is a candidate for bariatric surgery if his or her body mass index (BMI) is  $\geq 40$  kg/m<sup>2</sup> or  $\geq 35$  kg/m<sup>2</sup> with at least one comorbidity condition, such as obstructive sleep apnea, type 2 diabetes, hypertension, hyperlipidemia, or obesity hypoventilation syndrome.

Laparoscopic Roux-en-Y gastric bypass (LRYGB) has been considered the gold standard for bariatric surgery procedures for some time [14]. The total weight loss (TWL) reported after LRYGB is approximately 30% of preoperative weight within 1 year [4]. Reported health benefits include remission of type 2 diabetes in 86% (79–92% CI), hypertension in 74% (67–81%), and hyperlipidemia in 68% (58–77%) among cohorts in observational studies [3]. Health benefits are durable, with higher percentage of individuals achieving glycated hemoglobin levels of  $< 7\%$  with or without medications 5 years after RYGB when compared to lifestyle interventions alone [11].

Although lack of attendance to follow-up medical and behavior health appointments has been associated with increased weight loss after bariatric surgery [5, 8], many bariatric programs report attrition rates between 3 and 63% depending on the type of bariatric operation and the length of follow-up provided by the bariatric surgery team [7, 10]. Consequently, many patients are not receiving the full benefit of aftercare from their bariatric surgery team potentially contributing to less weight loss and more adverse effects [6, 9]. Little is known about factors contributing to this observation and whether weight loss and resolution or improvement of comorbidities after bariatric surgery varies in patients who follow up with their bariatric surgery practice compared to those who are lost to follow-up [10].

The Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP) database and the Mayo Clinic unified electronic medical record (EMR) provide a unique opportunity to further explore patient attrition from our

bariatric surgery program. MBSAQIP is an accreditation body for inpatient and outpatient bariatric surgery centers in the USA and Canada that have undergone an independent, voluntary, and rigorous peer evaluation in accordance with nationally recognized bariatric surgical standards. Mayo Clinic Rochester uses a unified electronic medical record with access to inpatient and outpatient clinical notes, vital signs, medications, and laboratory testing obtained by any clinical area within the Mayo Clinic health system. This allows for data collection on bariatric surgery patients seen by any provider within the Mayo Clinic health system.

## Methods

### Bariatric Surgery at Mayo Clinic

The bariatric surgery program at Mayo Clinic Rochester is accredited by MBSAQIP. Current surgical procedures offered include LRYGB, laparoscopic gastric sleeve, and biliopancreatic diversion with duodenal switch. The LRYGB is the most commonly performed operation at our institution. It involves the formation of a disconnected 20–30-cm gastric pouch with gastrojejunal anastomosis and formation of a 100–150 cm Roux limb. During the study period, a total of five surgeons participated.

### Population

This is a retrospective study of prospectively gathered data in the follow-up of adult (18 years of age and older) patients who underwent LRYGB for the treatment of medically complicated obesity at Mayo Clinic in Rochester, MN, between May 1, 2008 and January 8, 2015. Raw data was downloaded from MBSAQIP database on October 12, 2016 for all LRYGB cases. The assessment periods for years 1, 2, and 3 were defined as follows: year 1 was from 274 to 547 days after LRYGB, year 2 was from 548 to 912 days after LRYGB, and year 3 was from 913 to 1277 days after LRYGB. These study subjects were then assigned to either BSP cohort if seen in the bariatric surgery practice or ABSP cohort if seen by other providers within the health system. Patients who were not seen in the Mayo Clinic system were considered lost to follow-up (ABSP). The comorbidity data was assessed for the BSP and ABSP groups together rather than comparing the groups.

### Definition of Attrition

Patient attrition was defined as patients not seen for his/her planned appointment as dictated by established protocol in the bariatric surgery program. Reasons for patient attrition were

varied. To minimize attrition, patients are contacted by the bariatric surgery practice on two separate occasions with two different types of efforts (telephone call and letter) prior to being considered lost to follow-up [2].

## Assessment

At the time of data download, baseline weight (collected from the EMR immediately before or on the day of surgery) was recorded. Subsequent weights were obtained from the integrated EMR using any weight recorded within the assessment period for years 1, 2, or 3 that was closest to the patient's anniversary date.

Comorbidity data for type 2 diabetes, hypertension, and hyperlipidemia were collected according to the MBSAQIP variable definitions from clinical notes and reports within our EMR. Criteria for type 2 diabetes were based on the following: the patient has diabetes if the patient is on at least one glucose-lowering agent daily. The patient was classified as not having type 2 diabetes if they had no diagnosis of diabetes or managed diabetes with diet therapy only. Criteria for diagnosis of hypertension was based on the following: documentation in the patient's medical record of the diagnosis, the condition must be serious enough to require medications within 30 days of their LRYGB, and the patient must have been on the medication for at least 2 weeks prior to surgery. Criteria for diagnosis of hyperlipidemia were based on the following: patient must be either taking daily medications to treat hyperlipidemia or has a history of hyperlipidemia and received medications prior to weight loss or dietary changes.

Comorbidity data (type 2 diabetes, hypertension, and hyperlipidemia) were subsequently collected at the time closest to the patient's surgical anniversary dates during the following assessment periods: years 1, 2, and 3 after surgery. If documentation was found in the EMR regarding the comorbidities during the assessment period for year 1, 2, or 3, then it was documented as present or absent. If documentation was not available within the assessment time frame for each of the comorbidities, the variable was marked as "not documented."

## Statistical Analysis

Data were summarized using descriptive statistics, including counts and percentages (Fig. 1). Mean percentage of TWL was calculated at each time frame for each patient. Data was summarized using descriptive statistics, including counts and percentages for categorical variables by either year or year and location. Means with standard deviations were used as appropriate. All tests are two-sided with a  $p < 0.05$  being statistically significant. Analyses were performed using the statistical program JMP (version 10, SAS Institute Inc., Cary, NC).

## Results

### Patient Characteristics

The initial patient sample included 1242 patients who had undergone LRYGB. Based on previously defined criteria, 1041 subjects were eligible for 1-year follow-up, 921 subjects eligible for 2-year follow-up, and 749 eligible for 3-year follow-up. The sample size decreases each assessment year due to a reduced number of patients who had surgery at least 2 years or 3 years prior to the time of the raw data download, as well as patient deaths ( $n = 3$  in both years 2 and 3). Table 1 shows the patient baseline characteristics and weight loss percentages following LRYGB at year 1, year 2, and year 3 after surgery. There were patients who were lost to follow-up starting at year 1 (see Table 2).

### Patient Attrition

The number of patients seen by the BSP compared to those seen by ABSP was highest in year 1 and reduced each subsequent year. This was accompanied by an increase in patients seen by medical providers outside of the bariatric surgery practice (year 1: BSP  $N = 740$ , ABSP  $N = 166$ ; year 2: BSP  $N = 425$ , ABSP  $N = 309$ ; and year 3: BSP  $N = 235$ , ABSP  $N = 325$ ).

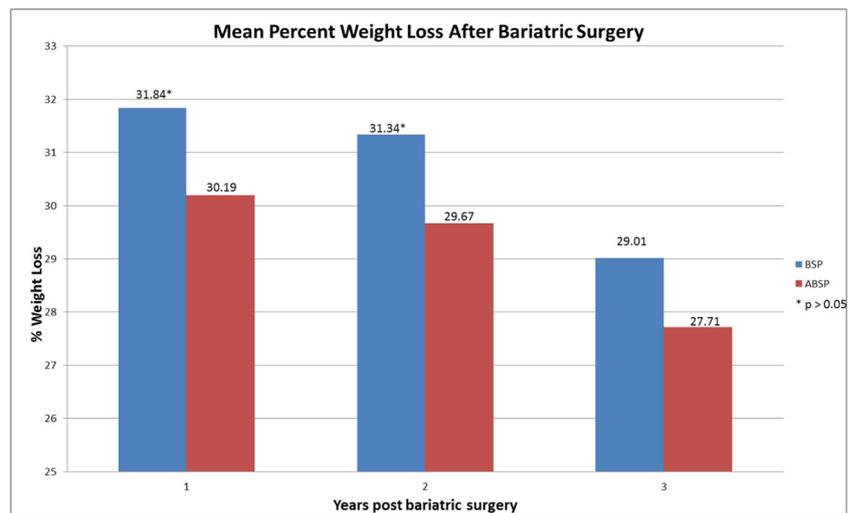
### Weight Loss

The mean percentage of total weight loss was evaluated for the BSP and ABSP groups at years 1, 2, and 3. The mean TWL in the BSP and ABSP groups at year 1 was 31.84% versus 30.19%, at year 2 was 31.34% versus 29.67%, and at year 3 was 29.01% versus 27.71% respectively. Differences were statistically significant between groups at years 1 and 2 ( $p < 0.05$ ). A statistically significant difference was not found in year 3 despite a trend towards higher TWL in the BSP group.

### Comorbidity Improvements

Among all patients (BSP; ABSP), statistically significant differences ( $p < 0.0001$ ) were observed between baseline and years 1, 2, and 3 for type 2 diabetes, hypertension, and hyperlipidemia (Table 3). Among the BSP and ABSP cohorts, there was no difference in the prevalence of comorbidities at baseline. For example, the prevalence of diabetes at baseline in the BSP versus ABSP was as follows: year 1, 27.7% versus 30.3%; year 2, 26.42% versus 27.83%; and year 3, 24.79% versus 28%.

**Fig. 1** Mean percent weight loss after bariatric surgery. \* $P < 0.05$  statistically significant



## Discussion

Our study confirms that a significant number of patients are lost to follow-up from the bariatric surgery practice. Our attrition rate 1 year after bariatric surgery is approximately 29% and increases to 46% at year 2 and 69% at year 3. This is an observation well documented in the medical literature and represents a limitation to many studies reporting on clinical outcomes [1]. However, many patients not seen in our bariatric surgery practice were seen by other medical providers within our healthcare system. This and the availability of electronic data in MBSAQIP and Mayo Electronic Medical Record offered the unique opportunity to assess any differences in clinical outcomes among patients seen in the bariatric surgery practice versus those seen by other providers.

The weight loss observed at 1 year after LRYGB in our study is consistent with other reports in the literature. Compher et al. [4] reported a 30% TWL in the first year which is comparable to our results. However, patients seen in the bariatric surgery practice experienced statistically significant greater weight loss than those seen by other medical providers. Our mean TWL in the BSP and ABSP groups at year 1 was 31.84% versus 30.19% respectively. This difference is still

observed at year 2 after surgery. Patients who returned to the bariatric surgery practice were able to maintain a weight loss close to the reported 30% TWL at 2 and 3 years compared to patients seen by other providers.

The implications of these findings, although seem trivial, can be significant. It suggests that the multidisciplinary approach to the follow-up of the bariatric surgery patient offers benefits in achieving greater weight loss after LRYGB. The support and expertise of bariatric medical providers, dietitians, psychologists, and surgeons during what can be a challenging transition for patients is associated with better results.

Whether this observation holds true in the long term is unknown. At year 3 after bariatric surgery, our sample size was small and there is no longer a statistical difference

**Table 1** Baseline patient characteristic

Characteristic (N = 1242)	
Age, mean years $\pm$ SD (range)	48.36 $\pm$ 12.2
Gender	
Male, n (%)	261 (21)
Female, n (%)	981 (79)
Weight, mean kg $\pm$ SD	
Preoperative	125.14 $\pm$ 24.67
BMI, mean kg/m <sup>2</sup> $\pm$ SD	
Preoperative	44.78 $\pm$ 7.68

**Table 2** Follow-up data

	Where the patient was seen	Number	TWL (kg)
Year 1	BSP	740	31.84 + 8.54
	ABSP	166	30.19 + 9.78
	Death	0	
	No assessment	135	
Year 2 <sup>a</sup>	BSP	425	31.34 + 9.5
	ABSP	309	29.67 + 11.4
	Death	3	
	No assessment	184	
Year 3 <sup>a</sup>	BSP	235	29.01 + 11.67
	ABSP	325	27.71 + 10.5
	Death	3	
	No assessment	186	

ABSP: patients seen by other providers within our medical institution. BSP: patients seen by the bariatric surgery practice

<sup>a</sup> The sample size decreases each assessment year due to reduced number of patients who had surgery at least 2 years or 3 years prior to the time of the raw data download, as well as patient deaths ( $n = 3$  in year 2 and an additional 3 in year 3)

**Table 3** Comorbidity results

	Number	Yes	No	Statistical significance in reduction of prevalence of disease
Baseline				
Diabetes	1242	351 (28.3%)	892 (71.7%)	NA
Hypertension		636 (51.1%)	607 (48.9%)	
Hyperlipidemia		507 (40.7%)	736 (59.3%)	
Year 1				
Diabetes	905	81 (8.9%)	824 (91.1%)	$P < 0.0001$
Hypertension	911	279 (30.6%)	632 (69.4%)	$P < 0.0001$
Hyperlipidemia	913	205 (22.5%)	708 (77.5%)	$P < 0.0001$
Year 2				
Diabetes	712	75 (10.5%)	637 (89.5%)	$P < 0.0001$
Hypertension	718	219 (30.5%)	499 (69.5%)	$P < 0.0001$
Hyperlipidemia	721	151 (20.9%)	570 (79.1%)	$P < 0.0001$
Year 3				
Diabetes	551	60 (10.9%)	488 (89.1%)	$P < 0.0001$
Hypertension	545	174 (31.9%)	371 (68.1%)	$P < 0.0001$
Hyperlipidemia	552	119 (21.5%)	428 (78.5%)	$P < 0.0001$

between the cohorts despite a trend towards greater weight loss in the BSP cohort compared to the ABSP cohort. The transition between years 2 and 3 after bariatric surgery is an important one since many studies report the onset of gradual weight gain after this time point [1]. Factors contributing to this gradual weight gain are multifactorial and not well defined, although decreased intensity of follow-up from bariatric surgery practices has been implicated as a potential factor [1]. If this is confirmed, strategies to either enhance patient retention to follow-up in bariatric surgery practices and/or engaging nonbariatric medical providers to enhance retention are warranted.

When assessing for medical comorbidities, we lacked the sample sizes to report differences in outcomes between BSP and ABSP cohorts. Hence, we report changes in medical comorbidities in the BSP and ABSP cohorts as a whole. However, the prevalence of comorbidities (particularly diabetes) at baseline did not seem to impact patient attrition. There was no significant difference among the BSP and ABSP in the prevalence of diabetes at baseline. Our patient population experienced similar reductions in metabolic comorbidities that have been previously reported. Reported rates for type 2 diabetes dropped from 28.3% down to 8.9% at year 1, 10.5% at year 2, and 10.9% at year 3. These results are similar to those reported by Chang et al.'s with remission rate of 86% (79–92% CI) [3]. Hypertension reported rates dropped from 51.5% at baseline to 30.6% at year 1, 30.5% at year 2, and 31.9% at year 3. This less dramatic impact on hypertension has been observed by others. Schauer et al. [11] reported no significant difference between the RYGB group and the intensive

lifestyle group in regard to hypertension rates. However, the number of medications to treat the RYGB patient's hypertension was lower than the intensive lifestyle group [11]. Our patient population saw a decrease in hyperlipidemia rates from 40.7% at baseline to 22.5% at year 1, 20.9% at year 2, and 21.5% at year 3. Our rate of hyperlipidemia resolution is higher than reported in the literature [4]. One reason for this difference is that Chang et al. [3] noted that not all studies that were reviewed for their systematic review assessed resolution of hyperlipidemia. Our study results are similar to those of Schauer et al. [13] who found that triglyceride levels and HDL levels were significantly improved in the RYGB patients 5 years after surgery compared to those in the intensive lifestyle intervention group.

Our study has a similar premise to that reported by Adams et al., using electronic data to report clinical outcomes in patients who have undergone LRYGB whether seen in their obesity clinic or by other providers. However, our studies differ in the cohorts identified. They compared weight and metabolic outcomes at 12 years among three cohorts: patients who underwent RYGB (surgery group), patients evaluated for but did not undergo RYGB (nonsurgery group 1), and population-based cohort who did not seek RYGB (nonsurgery group 2). Although they report follow-up rates exceeding 90%, among the RYGB cohort, 65% of the subjects were seen at their obesity clinic. Data on remaining subjects was collected through medical records and/or telephone interviews. Only 1% of subjects were completely lost to follow-up. Weight loss outcomes are similar to those previously reported, including maximal weight loss observed at 2 years but a gradual weight

gain observed after year 2. Despite this, the average TWL from baseline reported at 12 years was excellent at 35% [1].

In this study, we have reported statistically significant weight loss among patients seen in our bariatric surgery practice compared to those seen by other providers at 1 and 2 years after LRYGB. Although the weight difference is small, it is unknown if this early observation has implications to weight loss outcomes long term and whether enhancing subspecialty follow-up will enhance long-term results. In addition, while the year 3 data was not statistically significant, there is however clinical significance in the difference in weight loss between the BSP and ABSP groups. We have to acknowledge an important limitation of our study being the patients who were not assessed during the designated timeframes and the potential impact of their clinical data on observed results. Nevertheless, this preliminary study raises important questions that merit additional investigation as to the potential benefit of continued follow-up with the bariatric surgery team after surgery.

## Conclusion

Our study confirms the problem of patient attrition to follow-up at our bariatric surgery practice (BSP). It is also the first to suggest a difference in weight loss outcomes among patients seen in BSP compared to those seen by other providers (ABSP) at 1 and 2 years after LRYGB. The potential implications of this observation on long-term weight maintenance after LRYGB and the impact on metabolic comorbidities remain unknown but warrant further investigation. This study warrants the development of strategies to improve patient retention in BSP and/or engagement of medical providers to achieve that end.

## Compliance with Ethical Standards

This study was approved by the Institutional Review Board at Mayo Clinic.

**Conflict of Interest** The authors declare that they have no conflict of interest.

## References

- Adams T, Davidson L, Litwin S, et al. Weight and metabolic outcomes 12 years after gastric bypass. *N Engl J Med*. 2017;377(12):1143–55.
- American College of Surgeons (2016). MBSAQIP Standards Manual 2.0: resources for optimal care of the metabolic and bariatric surgery patient 2016. Retrieved from <https://www.facs.org/~media/files/quality%20programs/bariatric/mbsaqip%20standardsmanual.ashx>. Accessed 24 Sept 2018.
- Chang S, Stoll C, Song J, et al. Bariatric surgery: an updated systematic review and meta-analysis, 2003–2012. *JAMA Surg*. 2014;149(3):275–87.
- Compber C, Hanlon A, Kang Y, et al. Attendance at clinical visits predicts weight loss after gastric bypass surgery. *Obes Surg*. 2012;22:927–34.
- DeNino W, Osler T, Evans E, et al. Travel distance as factor in follow-up visit compliance in post-laparoscopic adjustable gastric banding population. *Surg Obes Relat Dis*. 2010;6:597–600.
- Gould J, Beverstein G, Reinhardt S, et al. Impact of routine and long-term follow-up on weight loss after laparoscopic gastric bypass. *Surg Obes Relat Dis*. 2007;3:627–30.
- Lara M, Baker M, Larson C, et al. Travel distance, age, and sex as factors in follow-up visit compliance in the post-gastric bypass population. *Surg Obes Relat Dis*. 2005;1:17–21.
- McVay M, Friedman K, Applegate K, et al. Patient predictors of follow-up care attendance in Roux-en-Y gastric bypass patients. *Surg Obes Relat Dis*. 2013;9:956–62.
- Miller B, Murphy K, O'Brien P, et al. Development of a measure of barriers to laparoscopic adjustment gastric banding (LAGB) after-care attendance. *Obes Surg*. 2016;26:776–84.
- Moroshko I, Brennan L, O'Brien P. Predictors of attrition in bariatric aftercare: a systemic review of the literature. *Obes Surg*. 2012;22:1640–7.
- Pontiroli A, Fossati A, Vedani P, et al. Post-surgery adherence to scheduled visits and compliance, more than personality disorders, predict outcomes of bariatric restrictive surgery in morbidly obese patients. *Obes Surg*. 2007;17:1492–7.
- Schauer P, Bhatt D, Kirwan J, et al. Bariatric surgery versus intensive medical therapy for diabetes – 5-year outcomes. *N Engl J Med*. 2017;376(7):641–51.
- Sivagnanam P, Rhodes M. The importance of follow-up and distance from Centre in weight loss after laparoscopic adjustable gastric banding. *Surgery Endoscopic*. 2010;24:2432–8.
- Vidal P, Ramon J, Goday A, et al. Lack of adherence to follow-up visits after bariatric surgery: reasons and outcome. *Obes Surg*. 2014;24:179–83.
- Wheeler E, Prettyman A, Lenhard M, et al. Adherence to outpatient program postoperative appointments after bariatric surgery. *Surg Obes Relat Dis*. 2008;4:515–20.