



# Where Are My Patients? Lost and Found in Bariatric Surgery

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## Abstract

**Purpose** Follow-up is a cornerstone of the success of bariatric surgery. However, adherence to monitoring decreases over time. The reasons for non-compliance with follow-up still remain unclear.

**Materials and Methods** This is a retrospective, single-center, cohort study, including all patients undergoing bariatric surgery between 2014 and 2017. Patients lost to follow-up were called back and questioned about the reasons of non-adherence. Patients followed and lost to follow-up were compared in terms of weight loss.

**Results** Overall, 29.7% of patients were lost to follow-up. After a callback, we obtained information on 89.9% of patients. The first reason of non-attendance was considering follow-up as unnecessary (29.5%). Almost a quarter of patients (24%) discontinued follow-up due to geographic distance, while 23.3%, 18.6%, and 14.0% of patients explained the lack of follow-up due to family, professional, or health problems. Only 7.0% declared to renounce to follow-up because of poor weight loss. Percentage of excess weight loss at 3 and 5 years after surgery was respectively 73.6% and 81.2% in attendant patients, and 70.7% and 68.4% in non-adherent patients ( $p = ns$ ). Despite a greater weight loss in the group of patients regularly followed, the difference with patients lost to follow-up remained not significant in multivariate analysis.

**Conclusions** Follow-up is of crucial importance in the management of bariatric patients. Follow-up disruption is associated to individual patient choice and external constraints. In order to improve the quality of long-term care, care providers will probably need to adapt to these constraints, diversifying the offer of care.

**Keywords** Obesity surgery · Follow-up · Attrition

## Introduction

Obesity prevalence has doubled in 73 countries around the world and steadily increased in others since 1980, and health problems resulting from being overweight or obese now affect more than 2 billion people. In 2015, almost 30% of the world's population was obese. Obesity and high BMI contributed to 4 million deaths and 120 million disability-adjusted life-years globally [1]. Bariatric surgery is a well-established treatment strategy for obesity after failure of behavioral and pharmacologic weight loss therapies and associated with improved comorbidities, quality of life, and survival in severe obesity [2].

This type of surgery requires a pre- and postoperative multidisciplinary evaluation, and postoperative follow-up is considered essential in bariatric surgery programs [3, 4]. Long-term care permits to address any problems or concerns that develop over time by an experienced team. Moreover, several studies have reported that patients that attend their postoperative appointments have better results in terms of weight loss [5–8].

Despite these medical recommendations, a considerable proportion of patients do not attend routine post-surgical visits [9]. Attrition rates from follow-up vary from 3.7 to 63% [10–12]. At the date, few studies explored the reasons of attrition after bariatric surgery. Identification of the reasons for which patients fail to adhere to postoperative follow-up is important because it facilitates patient adherence to postoperative follow-up and weight management programs which are essential to reduce complications and to ensure long-term weight loss [13].

The aim of this study was to analyze the causes of postoperative visit disruption and to assess the impact on weight loss.

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## Methods

This is a retrospective, single-center cohort study including all patients operated of bariatric surgery, between 2014 and 2017 in a Center of Excellence in Obesity Care in France.

All patients operated of laparoscopic sleeve gastrectomy (LSG) and laparoscopic Roux-en-Y gastric bypass (LRYGB) between January 1, 2014, and December 31, 2017, were included. Data on follow-up were collected until April 30, 2019, in order to obtain between 1 and 5 years of follow-up for all patients. In case of multiple interventions in the same patient during the study period, only the last intervention was accounted for analysis.

Primary outcome was to assess the reasons for interrupting a regular postoperative follow-up. The definition of interruption of follow-up was the absence of any medical visit for more than 12 months, irrespective of the time lap from the date of bariatric intervention. We will refer to these patients as patients lost to follow-up. Secondary outcome was the comparison for weight loss among patients regularly followed and patients lost to follow-up. Weight loss was assessed as body mass index (BMI), percentage of excess weight loss (%EWL), and percentage of total weight loss (%TWL) and according to Reinhold's criteria [14, 15].

Data were extracted from electronic medical records collected prospectively. Information on patients lost to follow-up was obtained by a telephone callback. A surgical resident administered a telephonic questionnaire modified from Ju and colleagues [16]. During the telephonic interview, patients were questioned on their actual weight, on eventual complications, and on the reasons why the regular follow-up was discontinued. Questionnaire used in this study is reported in [supplementary data](#). The interviewer proposed several possible reasons for interrupting postoperative visits, and the patient was allowed to adhere to several answers. In total, up to three phone calls per patient were attempted at different dates. After three unanswered calls, the patient was considered unattainable.

## Statistical Analysis

Descriptive statistics were used to summarize participant characteristics. Frequencies and percentages are reported for categorical data. Mean and standard deviation are used for continuous data. All statistical tests were 2-sided and  $p < 0.05$  was considered statistically significant. Linear mixed models with a person-level random intercept were used to model continuous weight evolution between the two groups (regular follow-up and lost to follow-up) and to test associations with the continuous fixed effect of time. This method has been reported as the most appropriate for accurate analyses of weight loss [17].

Data are reported according to the recommendations for reporting of observational studies in epidemiology (STROBE) [18]. Analyses were conducted using R (a language and environment for statistical computing—R Foundation for Statistical Computing, Vienna, Austria.)

## Results

During the study period, 447 patients were operated of bariatric surgery. Baseline patients' characteristics are reported in Table 1. Most of patients had a LSG (62.4%), while LRYGB was performed in 37.6% of cases. Considering the number of bariatric surgeries per subject, the majority of patients were at their first procedure ( $n = 375$ , 83.9%), 63 patients (14.1%) were at the second bariatric procedure, and 9 patients (2.0%) were at least at their third.

Table 2 shows eligible and available patients at the regular follow-up and after the telephone callback. On the entire cohort, we had an initial rate of patients lost to follow-up of 29.7% (133/447). After contacting missing patients, we finally obtained information on 89.9% (396/447) of patients.

Reasons of follow-up interruption obtained by the telephone questionnaire are reported in Fig. 1. Considering the follow-up unnecessary was the first cause of follow-up breakdown (29.5%). Almost a quarter of patients (24%) considered that distance from hospital or mobility difficulties was a barrier to regular visits, while 23.3%, 18.6%, and 14.0% of patients explained the lack of follow-up due to family professional or health problems respectively. Only 7.0% declared to renounce to follow-up because of weight regain, and the same percentage was also found for the patients who lost confidence in the medical team.

Weight loss according to adherence to follow-up is reported in Table 3. Weight loss was greater for patients regularly followed at any time point and for any type of weight loss measure. At 3 and 5 years after surgery, the rate of patients with %EWL  $> 50\%$  was 82.3% and 92.9% in the regular follow-up group, whereas it was 70.5% and 76.5% among lost-to-follow-up patients. Nevertheless, the mixed model results show that attendance at follow-up was not statistically associated to weight loss (Table 4). The only factors significantly associated to weight loss were time and type of surgery, with gastric bypass permitting a better weight loss than sleeve gastrectomy.

## Discussion

This study reports a non-adherence rate to follow-up after bariatric surgery moving from 3.2% at 1 year to 55.7% at 5 years after surgery. The main reason reported by patients of follow-up disruption was the belief

**Table 1** Baseline characteristics

<i>n</i>		Overall ( <i>n</i> = 447)	Regular follow-up ( <i>n</i> = 314)	Lost to follow-up ( <i>n</i> = 133)	<i>p</i> value
Sex	Female	363 (81.2%)	251 (80%)	112 (84.2%)	0.29
	Male	84 (18.8%)	63 (20.1%)	21 (15.8%)	
Age (year)		43.5 (12.1)	44.39 (11.2)	41.34 (12.1)	0.015
Age categories	< 25 years	32 (7.2%)	17 (5.4%)	15 (11.3%)	0.012
	25–35	90 (20.1%)	57 (18.1%)	33 (24.8%)	
	35–45	129 (28.9%)	98 (31.2%)	31 (23.3%)	
	45–55	108 (24.2%)	72 (22.9%)	36 (27.1%)	
	> 55	88 (19.7%)	70 (22.3%)	18 (13.5%)	
Height (cm)		165.5 (8.2)	165.68 (8.4)	165 (7.8)	0.384
Weight (Kg)		118.7 (19.9)	119.1 (20.8)	118 (17.4)	0.592
BMI, mean (SD)		43.3 (5.9)	43.2 (5.9)	43.4 (5.7)	0.835
Type 2 diabetes, <i>n</i> (%)		91 (20.5%)	70 (22.5%)	21 (15.9%)	0.116
Hypertension, <i>n</i> (%)		161 (36.2%)	125 (39.9%)	36 (27.3%)	0.011
OSAS, <i>n</i> (%)		179 (40.2%)	138 (43.9%)	41 (31.3%)	0.013
Dyslipidemia, <i>n</i> (%)		82 (18.5%)	66 (21.2%)	16 (12.2%)	0.026
History of LAGB, <i>n</i> (%)		0.13 (0.3)	0.12 (0.3)	0.14 (0.3)	0.602
Type of procedure	Gastric bypass	168 (37.6%)	122 (38.8%)	46 (34.6%)	0.394
	Sleeve gastrectomy	279 (62.4%)	192 (61.1%)	87 (65.4%)	
Primary procedure	Primary	375 (83.9%)	268 (85.3%)	107 (80.4%)	0.198
	Revisional	72 (16.1%)	46 (14.6%)	26 (19.5%)	

Data are reported as mean (SD) unless otherwise defined. *BMI*, body mass index; *OSAS*, obstructive sleep apnea syndrome; *LAGB*, laparoscopic adjustable gastric banding; *F/U*, follow-up

that follow-up was not necessary for them. Nevertheless, weight loss was greater in adherent patients at any time point, but without reaching a statistical significance.

The systematic review of Moroshko found that attrition rate varies from 15 to 37% at 12 months and from 28 to 53% after the second year [11]. Several factors have been suggested to explain this variability.

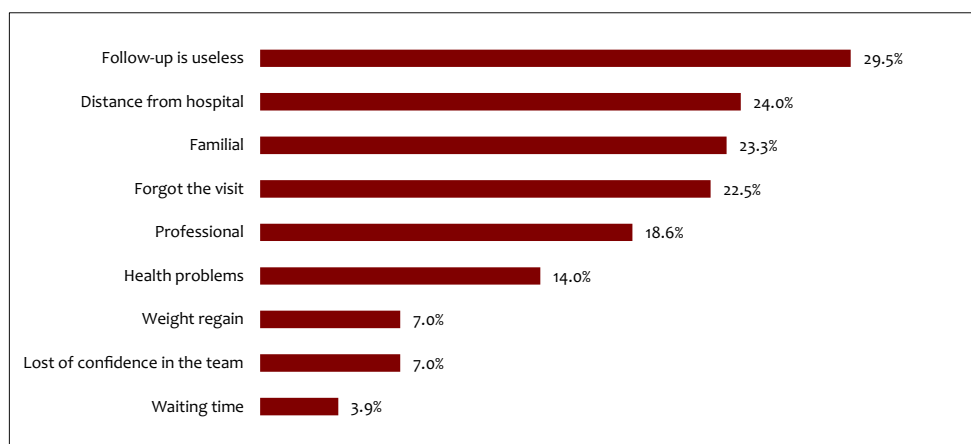
First, different definitions of regular follow-up have been used. Several authors take into account the percentage of follow-up visits [5, 19–21], and also the failure to attend follow-up scheduled visit for 12 months is described [22]. These differences are probably responsible for a part of heterogeneity in the results found in literature.

Secondly, it has to be considered that a bias is likely linked to the power and the design of different studies. For instance, the SOS study, which is a prospective cross-sectional registry study, reported a lost-to-follow-up rate of 6% at 2 years, with a progressive evolution of 16% at 10 years and 34% at 15 years [23], which is lower than those in retrospective cohort studies [11].

Two studies from France have already reported on follow-up rate. Bordaberry et al. in 2017 described a breakdown rate of 27.5% at 9 years. In their study, factors like age, type of surgery, time lapse from surgery, unemployment, and some comorbidities such as dyslipidemia seemed to have an impact on follow-up adhesion [24]. The second study by Vignot et al. found an attrition rate of 15% at 1 year, followed by a fall to

**Table 2** Attrition at follow-up before and after telephone callback

Years after surgery	Eligible patients	Regular follow-up	Lost to regular follow-up	Lost to follow-up after callback
1	447	446 (96.8)	1 (3.2)	1 (0.2)
2	416	407 (92.6)	9 (7.4)	2 (0.5)
3	294	254 (63.6)	40 (36.4)	11 (3.7)
4	184	140 (61.4)	44 (38.6)	22 (12)
5	70	31 (44.3)	39 (55.7)	15 (21.4)

**Fig. 1** Reasons for interrupting regular follow-up

25% at 2 years and 44% at 5 years [25]. Similarly, a study based on a French national health insurance database concluded that at 5 years after surgery, the quality of follow-up can be rated as satisfactory by only 14% of patients [26].

In the analysis of the reasons of non-attendance, the most common response was that patients consider follow-up as unnecessary. This explanation has been provided only by 3% of the patients in the study of Vidal [13], and it looks surprising because the preoperative assessment of bariatric candidates in France lasts between 6 and 12 months and during this period, multidisciplinary teams stress the importance of long-term care.

The second most relevant problem for non-attendance in our study was distance from the hospital as it was mentioned by 24% of patients. This issue has already been reported previously in different studies [27–29] and deserves particular attention because it cannot be easily modified. Hence, we think that the type of follow-up should adapt to this type of situation is through the deployment of remote consultation or smartphone applications, as already reported [30, 31].

Concerning family and work-related issues, our results are less marked than those published by Vidal significantly, although on a smaller cohort of patients [13]. Similar findings were recently reported by Goldenshluger significantly who identifies logistic such as occupation-related reasons as a major cause of follow-up interruption [10].

Finally, several publications from the USA suggest that obesity patients interrupt medical care because of denial of coverage by their health insurance companies [32, 33]. In France, as in most European countries, medical care obesity costs are fully in charge of the National Health System; hence, the economic barrier is less commonly advocated.

Despite the non-negligible attrition rate, calling non-adherent patients permitted to collect data on almost 90% of patients, which is higher than previously reported in a study by Ju et al. [16]. Hence, we could estimate weight loss on the majority of our patients.

Weight loss in the group of patients regularly followed was higher but the difference with patients lost to follow-up was not significant. A retrospective analysis published by Gould significantly showed a significant difference in the %EWL of a RYGB patient group observed at 3–4 years in favor of the most followed subjects [34]. Similarly, Spaniolas et al. found that adherence to postoperative follow-up was independently associated with improved 12-month weight loss after bariatric surgery [35]. Even if most of studies are consistent with these findings, controversial results have been already published. For instance, Goldenshluger et al. reported no association between adherence to follow-up and weight loss during a 3-year study period [10]. Differences between studies in the content of the follow-up visits, in the definition of adherence, in

**Table 3** Weight loss according to adherence to follow-up

Years after surgery	Regular follow-up			Lost to follow-up		
	BMI (kg/m <sup>2</sup> )	%EWL	%TWL	BMI	%EWL	%TWL
Baseline	43.2 (5.9)	-	-	43.4 (5.7)	-	-
1	30.3 (5.6)	73.5 (25.2)	29.7 (9.3)	31.4 (6.2)	68.4 (27.7)	27.6 (10.2)
2	29.8 (5.7)	76.3 (26.4)	30.6 (9.9)	30.8 (6)	70.7 (25.9)	29 (10.4)
3	30.3 (5.9)	73.6 (25.7)	29.3 (9.9)	31.4 (6.4)	67.0 (29)	27.3 (11.1)
4	29.8 (4.4)	73.3 (24.2)	29.1 (10)	31.8 (5.6)	66.3 (25.6)	27.5 (9.6)
5	27.9 (3.2)	81.2 (22.9)	30.4 (9.9)	30.9 (5.5)	68.4 (28.2)	27.4 (10.5)

BMI, body mass index; %EWL, percentage of excess weight loss; %TWL, percentage of total weight loss

**Table 4** Mixed model results for prediction of weight loss over time

Covariate		Estimate (95% CI)	<i>p</i> value
Sex	Female	Reference	-
	Male	0.079 (0.072–0.087)	0.9105
Age		0.007 (0.006–0.007)	0.8002
T2D		0.743 (0.735–0.75)	0.2896
HT		0.212 (0.205–0.219)	0.7419
Dyslipidemia		- 0.272 (- 0.28 to - 0.264)	0.7143
OSAS		0.844 (0.838–0.85)	0.1477
History of banding		1.297 (1.289–1.305)	0.0954
Surgical procedure	Gastric bypass	Reference	< 0.001
	Sleeve gastrectomy	2.648 (2.642–2.654)	
Time	Baseline	Reference	
	Year 1	- 12.689 (- 12.691 to - 12.688)	< 0.001
	Year 2	- 13.096 (- 13.098 to - 13.093)	< 0.001
	Year 3	- 12.138 (- 12.14 to - 12.135)	< 0.001
	Year 4	- 11.679 (- 11.682 to - 11.676)	< 0.001
	Year 5	- 11.551 (- 11.557 to - 11.545)	< 0.001
Attendance	Regular at F/U	Reference	0.1524
	Lost at F/U	- 0.801 (- 0.807 to - 0.796)	

T2D, type 2 diabetes; HT, hypertension; OSAS, obstructive sleep apnea syndrome; F/U, follow-up

participants' perceptions of the value of such appointments may explain the discrepancies observed regarding weight loss.

Finally, the topic of the poor weight loss and long-term attendance is complicated and still remains a research field to explore. The core of question is the understanding of the causal direction between weight loss and adherence to follow-up. Is poor weight loss the cause for follow-up breakdown or attrition is responsible for weight loss? This question is often discussed in studies on patients' attendance after bariatric surgery, but the clear explication and relation between poor weight loss and attrition still remains unclear [36]. More studies are necessary on this theme to better understand this complicate mechanism.

This study has several limitations. First, the study is single center and retrospective which represent a possible bias concerning data collection. Second, data of non-adherent patients were obtained through telephone interviews. In this way, patients' responses could be biased by a social desirability bias that consists of an accentuation of positive responses by the feeling of valorization linked to being the subject of interest. This bias is difficult to control and has been limited by the use of closed-ended questions and trying to remain as neutral as possible during telephone interviews [24].

## Conclusions

Regular follow-up is of fundamental importance in the management of bariatric patients. Analysis of the reasons suggests

that follow-up disruption is not primarily linked to the quality of the care offered by bariatric centers, but rather to individual patient choice and external constraints. In order to improve the quality of long-term care in our patients, we will probably need to adapt to these constraints, diversifying the offer of care.

**Supplementary Information** The online version contains supplementary material available at <https://doi.org/10.1007/s11695-020-05186-9>.

## Compliance with Ethical Standards

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

**Ethical Approval Statement** For this type of study, formal consent is not required.

**Informed Consent Statement** Patients contacted by telephone and submitted to questionnaire were informed of the study protocol and their consent was acquired.

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