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Intensive pre-operative information course (IPIC) and pre-operative weight loss results in long-term sustained weight loss following bariatric surgery: 11 years results from a tertiary referral centre

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Abstract

Introduction Outcomes of long-term (5–10-year) weight loss have not been investigated thoroughly and the role of pre-operative weight loss on long-term weight loss, among other factors, are unknown. Our regional bariatric service introduced a 12 week intensive pre-operative information course (IPIC) to optimise pre-operative weight loss and provide education prior to bariatric surgery. The present study determines the effect of pre-operative weight loss and an intense pre-operative information course (IPIC), on long-term weight outcomes and sustained weight loss post-bariatric surgery.

Methods Data were collected prospectively from a bariatric center (2008–2022). Excess weight loss (EWL) ≥ 50% and ≥ 70% were considered outcome measures. Survival analysis and logistic regression identified variables associated with overall and sustained EWL ≥ 50% and ≥ 70%.

Results Three hundred thirty-nine patients (median age, 49 years; median follow-up, 7 years [0.5–11 years]; median EWL%, 49.6%.) were evaluated, including 158 gastric sleeve and 161 gastric bypass. During follow-up 273 patients (80.5%) and 196 patients (53.1%) achieved EWL ≥ 50% and ≥ 70%, respectively. In multivariate survival analyses, pre-operative weight loss through IPIC, both < 10.5% and > 10.5% EWL, were positively associated with EWL ≥ 50% (HR 2.23, $p < 0.001$) and EWL ≥ 70% (HR 3.24, $p < 0.001$), respectively. After a median of 6.5 years after achieving EWL50% or EWL70%, 56.8% (154/271) had sustained EWL50% and 50.6% (85/168) sustained EWL70%. Higher pre-operative weight loss through IPIC increased the likelihood of sustained EWL ≥ 50% (OR, 2.36; $p = 0.013$) and EWL ≥ 70% (OR, 2.03; $p = 0.011$) at the end of follow-up.

Conclusions IPIC and higher pre-operative weight loss improve weight loss post-bariatric surgery and reduce the likelihood of weight regain during long-term follow-up.

Keywords Preoperative · Bariatric · Weight loss

Bariatric surgery plays an important role in combating obesity and offers superior weight loss results and comorbidity improvement compared to medical and lifestyle management alone [1–7]. It is a safe and effective treatment for weight loss; however, outcomes of bariatric surgery are largely based on follow-up periods of 6 to 36 months with fewer studies having longer-term follow-up. [2, 6, 8–15]

The outcomes of weight loss and whether patients achieve sustained weight loss and avoid weight re-gain at longer follow-up periods (e.g. 10 years) is unclear. As such the pre-operative variables that impact the likelihood of longer-term sustained weight loss has not been investigated thoroughly. For example the role of pre-operative weight loss as a predictive factor of weight loss has been investigated in

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shorter term follow-up studies but the evidence of its long-term benefit is inconclusive [17–26].

In the present study, our regional bariatric service introduced a 12 week intensive pre-operative information course (IPIC) to optimise pre-operative weight loss and provide education prior to surgery. We have followed patients up for up to 11 years with the aim of determining the effect of pre-operative weight loss, IPIC as well as other factors on long-term weight outcomes and sustained weight loss.

Methodology

Patients were collected prospectively from a tertiary referral center that performed bariatric surgery for multiple NHS health boards covering a population of approximately 1.4 million people. Ethical approval from the institutional review board and patient consent was not required as per our regional policy. All patients who underwent bariatric surgery from 2008 to 2022 were included.

From 2010 ($n = 259$), patients underwent a 12 week intensive pre-operative information course (IPIC), designed to educate patients and their carers about the surgical pathway, surgical risks/ complications, healthy eating, behavioural change and psychological issues. IPIC involved weekly video education on behavioural change, healthy eating, psychological issues and surgery. Patients engaging with IPIC received consultations with dietitians, psychologists and bariatric specialist nurses. Engagement with this process and at least a 5% weight loss were required prior to full assessment for surgery. Patient weight loss from initial appointment with the bariatric service to the date of surgery was recorded whilst the patient underwent IPIC. In the non-IPIC group, there was no pre-operative course and patients proceeded straight to surgery after surgical consultation.

Following surgery their weight was monitored in outpatient clinics and patients were routinely followed up at set intervals: 6 months, one-year and then annually for up to 11 years. The following data were collected prospectively throughout the study period: demographics, surgical operation details, peri-operative complication, and weight loss during follow-up. Patient comorbidities at the time of surgery was also recorded with particular attention to patients with type-2 diabetes (T2DM), hypertension, sleep apnoea and psychiatric conditions. Patients with type-2 diabetes, hypertension and psychiatric conditions were only considered as having the condition if they were taking medications for the condition. Patients were also followed up for readmissions within 90 days.

For each patient the excess weight loss (EWL) percentage was calculated at each follow-up period (e.g. 1 year) and excess weight loss (EWL) 50% and 70% were used as outcome measures.

Statistics analysis

All statistics were performed using R studio. The cohort characteristics were reported and outcomes (e.g. EWL ≥ 50% and EWL ≥ 70%) were reported for the overall cohort. The rates of achieving EWL ≥ 50% and EWL ≥ 70% were reported for years 1, 2, 5 and 10 of follow-up. For subsequent analyses gastric balloons were excluded from analyses.

Factors associated with EWL ≥ 50% and ≥ 70% were identified using the Log rank test in Kaplan–Meier (KM) analysis. Variables that were associated and statistically significant ($p < 0.1$) were then including in the Cox Proportional Hazards Model (CPHM). The impact of IPIC on long-term weight loss (EWL > 50% and EWL > 70% was determined using KM and then CPHM. Patients who received IPIC were split by median pre-operative EWL% and those with higher versus lower weight loss were compared.

With a focus on long-term follow-up the median EWL% during each interval of follow-up (e.g. 8-year) were calculated. The EWL achieved at each interval was recorded. For those that achieved EWL ≥ 50% and EWL ≥ 70%, a subgroup analysis, using Chi-squared was conducted to find variables that were associated with sustained EWL by the end of follow-up.

Across the entire cohort, multivariate logistic regression was conducted using all variables to determine factors associated with EWL ≥ 50% and EWL ≥ 70% at the end of follow-up.

Results

Three hundred thirty-nine patients (median age, 49 years; M:F, 84:255) were included between 2008 and 2022 (158 laparoscopic sleeve gastrectomies, 161 laparoscopic gastric bypasses and 20 gastric balloons. The median start weight and BMI of the entire cohort when first engaging with the bariatric service was 130.1 (IQR, 116.9–147.8) and 47.2 (IQR, 43.2–52.7), respectively. The median pre-operative weight and BMI were 124.4 kg and 45.5 with a median pre-operative excess weight loss of 9.3% (median weight, 5.5 kg, median total weight loss, 4.2%). 273 patients (80.5%) and 196 patients (53.1%) achieved EWL ≥ 50% and ≥ 70%, respectively, during a median follow-up of 7 years. In total 259 patients (76.4%) received IPIC and 80 patients (23.6) did not undertake IPIC. The

Table 1 Background characteristics of entire cohort and excess weight loss groups (<50%, ≥50% and ≥70%)

Variable	All patients ($n=339$)	Excess weight loss group		
		EWL < 50% ($n=68$)	EWL ≥ 50% ($n=271$)	EWL ≥ 70% ($n=168$)
Median age (IQR)	49 (26–73)	52.5 (46.5–58.0)	48 (40.8–55.0)	47.5 (40 – 55)
≥40	79 (23.3)	9 (13.6)	70 (25.6)	47 (27.8)
41–50	108 (31.9)	17 (25.8)	91 (33.3)	53 (31.4)
51–60	152 (44.8)	40 (59.7)	112 (41.0)	69 (40.8)
>60				
Male:Female	84 (24.8)	15 (22.4)	69 (25.3)	39 (23.1)
Comorbidities				
Psychiatric, (medicated)	150 (44.2)	30 (40.8)	120 (44.0)	72 (42.6)
Hypertension	96 (28.3)	30 (40.8)	99 (36.3)	60 (35.5)
Diabetes, (medicated)	129 (38.1)	25 (37.3)	71 (26.0)	35 (20.7)
Sleep apnoea	36 (10.6)	6 (9.0)	30 (11.0)	13 (7.7)
Median start weight (kg), IQR	130.1 (116.9–147.8)	135 (122.7–157.3)	129.1 (116.2–145.7	123.0 (109.9–142.0)
Median start BMI, IQR	47.2 (43.2–52.7)	50.3 (45.9–54.6)	46.5 (42.5–52.2)	45.7 (41.8–50.4)
<40	78 (23.0)	9 (13.2)	69 (25.5)	47 (28.0)
40–45	109 (32.2)	19 (27.9)	90 (33.2)	53 (31.5)
46–50	116 (34.2)	30 (44.1)	86 (31.7)	55 (32.7)
50	36 (10.6)	10 (14.7)	26 (9.6)	13 (7.7)
Pre-operative weight loss (kg)	5.4	2.9	5.9	6.3
Pre-operative EWL%	9.3	5.0	10.0	10.4
Operations				
Sleeve	158 (46.6)	29 (43.3)	129 (47.3)	87 (51.5)
Bypass	161 (47.5)	27 (40.1)	132 (48.7)	77 (45.8)
Peri-operative complication	52 (15.3)	11 (16.2)	41 (15.1)	26 (15.5)
Readmission	24 (7.1)	6 (8.8)	18 (6.6)	9 (5.4)
Median LOS, days (IQR)	2 (1–2)	2 (1–2)	2 (1–2)	2 (1–2)

background characteristics of the entire cohort and EWL groups are displayed in Table 1.

Excess weight loss

After a median follow-up of 7 years (IQR, 4–9; range 0.5–11 years), the median EWL% of the entire cohort was 49.6%. The median EWL% at 1 year, 2 year, 5-year and 10 years of follow-up was 65.1% ($n=318$), 63.1% ($n=302$), 51.4% ($n=179$) and 43.8% ($n=35$) (Supplementary Fig. 1).

The median EWL% of the IPIC cohort was 52.7% at the end of follow-up after a median of 7 years, at which point 48.6% (126/259) and 27.4% (71/259), achieved EWL ≥ 50% and EWL ≥ 70%, respectively. The median EWL% in this subgroup at 1 year, 2-year, 5-year and 10-year of follow-up was 69.8%, 68.0%, 53.3%, and 47.8%. This compares with a median EWL% in the non-IPIC cohort of 41.3% at the end of follow-up with a median EWL% at 1 year, 2-year, 5-year and 10-year of 50.7%, 47.2% and 43.1% and 38.2% As demonstrated by Fig. 1a and b, patients who received IPIC had higher rates of achieving EWL ≥ 50% and EWL > 70% during long-term follow-up. Of those that received IPIC, the median weight loss pre-operatively was 10.5% EWL. Those that had higher pre-operative weight loss (EWL > 10.5%) had higher rates of achieving EWL ≥ 50% and EWL ≥ 70% in the long-term ($p < 0.001$).

Figure 1c and d demonstrate that there was a significant decrease in rates of EWL ≥ 50% ($p=0.002$) and EWL70% ($p=0.030$) as age increased. Likewise, as the starting BMI increased, the likelihood of achieving EWL ≥ 50% ($p < 0.001$) and EWL ≥ 70% ($p < 0.001$) over time also reduced (Fig. 1e and f**)**.

In the KM analysis assessing other variables, T2DM and psychiatric conditions were negatively associated with earlier EWL ≥ 50% ($p=0.009$ and $p=0.001$, respectively) and EWL70% ($p=0.024$ and $p=0.009$, retrospectively) and sleep apnoea was negatively associated with earlier EWL ≥ 70% ($p=0.009$) (Table 2). Gender, peri-operative complications and readmissions were not associated with earlier EWL ≥ 50% or EWL ≥ 70%.

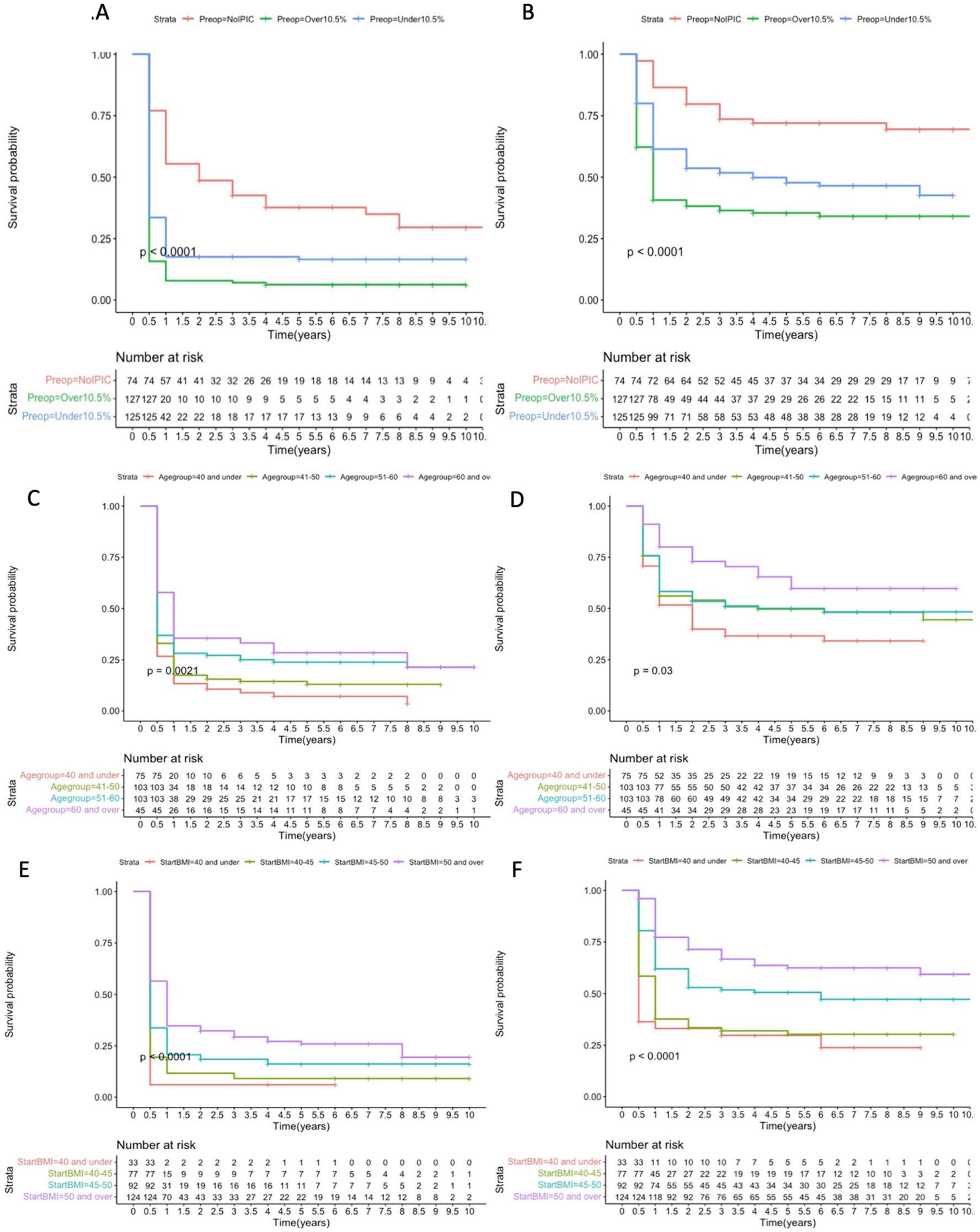

Fig. 1 Kaplan–Meier—**A** Rate of achieving EWL50% by pre-op excess weight loss, **C** in different age groups and **E** across starting BMI ranges. **B** Rate of achieving EWL70% by pre-op weight loss, **D** in different age groups and **F** across starting BMI ranges

In CPHM, the following variables were negatively associated with EWL ≥ 50%: age 51–60 (HR 0.60; $p = 0.002$), age > 60 (HR 0.39, $p < 0.001$) and starting BMI > 50 (HR 0.49, $p < 0.001$). IPIC pre-operative weight loss < 10.5% and > 10.5% of EWL were positively associated with EWL ≥ 50% and EWL ≥ 70% (HR 2.23, $p < 0.001$ and HR 3.24, $p < 0.001$, respectively (Fig. 2**)**.

When conducting CPHM to determine factors associated with EWL ≥ 70%, once again higher age (HR 0.35; $p < 0.001$), sleep apnoea (HR 0.47, $p = 0.024$),

Table 2 KM and CPHM Survival analysis: variables associated with EWL ≥ 50% and EWL ≥ 70%

Variable	KM analysis		CPHM	
	EWL ≥ 50% vs. EWL < 50%, *p*-value	EWL ≥ 70% vs. EWL < 70%, *p*-value	EWL ≥ 50%, HR, *p*-value (95% CI)	EWL ≥ 70%, HR, *p*-value (95% CI)
Age				
≥ 40	0.002	0.032	reference	reference
41–50			0.87, 0.395 (0.63–1.19)	0.68, 0.067 (0.46–1.02)
51–60			0.60, 0.002 (0.43–0.83)	0.61, 0.017 (0.40–0.91)
> 60			0.39, < 0.001 (0.24–0.63)	0.35 < 0.001 (0.19–0.66)
Male:Female	0.587	0.255	N/A	N/A
Comorbidities				
Psychiatric, medicated	0.001	0.009	0.91, 0.487 (0.69–1.20)	0.82, 0.257 (0.57–1.16)
Hypertension, medicated	0.128	0.480	N/A	N/A
Diabetes, medicated	0.009	0.024	0.84, 0.272 (0.662–1.14)	0.72, 0.115 (0.48–1.08)
Sleep apnoea	0.887	0.009	N/A	0.47, 0.024 (0.25–0.91)
Start BMI				
< 40	< 0.001	< 0.001	Reference	Reference
40–45			0.80, 0.305 (0.53–1.22)	0.71, 0.177 (0.43–1.17)
46–50			0.71, 0.108 (0.47–1.088)	0.45, 0.002 (0.27–0.74)
> 50			0.49, < 0.001 (0.32–0.75)	0.28, < 0.001 (0.16–0.47)
Pre-operative weight loss < 10.5% EWL	< 0.001	< 0.001	2.23 < 0.001 (1.52–3.29)	1.80, 0.036 (1.04–3.12)
Pre-operative weight loss > 10.5% EWL			3.24, < 0.001 (2.19–4.79)	2.77, < 0.001 (1.63–4.70)
Operations				
Sleeve	0.754	0.083	N/A	1.15, 0.395 (0.83–1.59)
Bypass				
Peri-operative complication	0.083	0.14	1.14, 0.36 (0.86–1.52)	N/A
Readmission	0.978	0.756	N/A	N/A

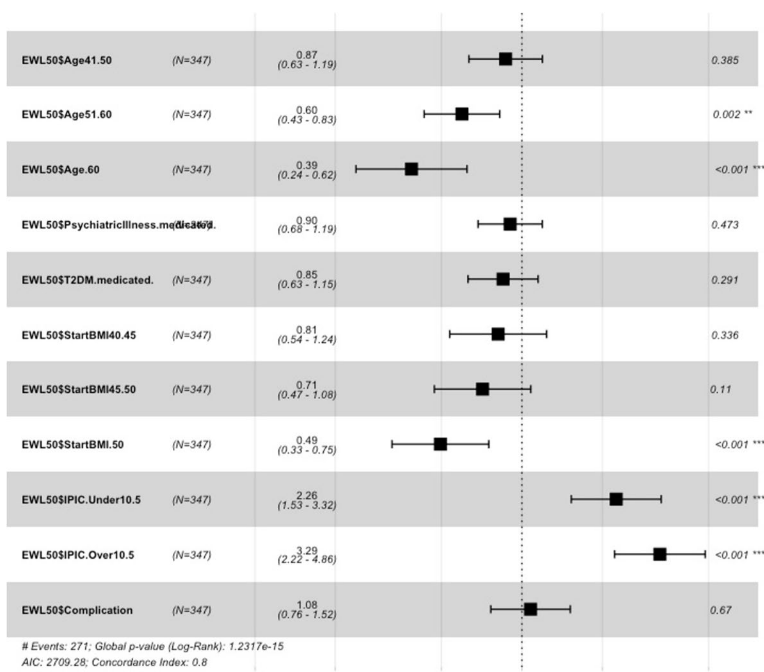

Fig. 2 Cox proportional hazard model—variables associated with EWL50%

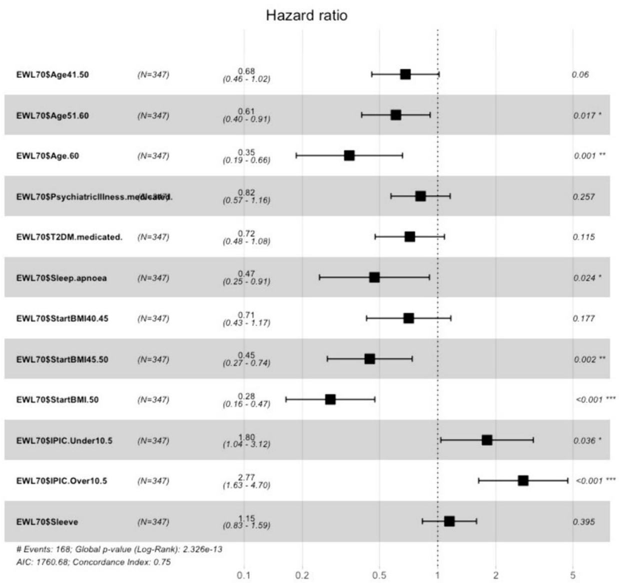

Fig. 3 Cox proportional hazard model—variables associated with EWL70%

starting BMI 46–50 (HR 0.45; $p = 0.002$) and started BMI > 50 (HR 0.28, $p < 0.001$) were negatively associated with EWL ≥ 70%. IPIC pre-operative weight loss < 10.5% and > 10.5% of EWL were positively associated with EWL ≥ 50% and EWL70% (HR 1.80, $p = 0.036$, and HR 2.77, $p < 0.001$, respectively) (Fig. 3).

Sustained excess weight loss

A separate analysis was conducted to determine whether patients managed to sustain excess weight loss. Initial analysis determined the excess weight loss achieved during each follow-up interval (e.g. 6 month follow-up interval). Figure 4 illustrates the median EWL% and distribution such as quartiles and outliers for each interval of follow-up. The first and second 6 months found significant EWL% (median, 56.6% and 7.9%, respectively), whereas the 2nd to the 7th year of follow-up found median weight gain (median EWL%: 2-year, − 1.7%; 3-year, − 6.3%; 4-year, − 4.1%; 5-year, − 2.4%; 6-year, − 3.7%; 7-year − 2.7%, respectively). The median EWL% for years 8–11 are 1.1%, − 0.2%, 6.1% and 1.7%, respectively.

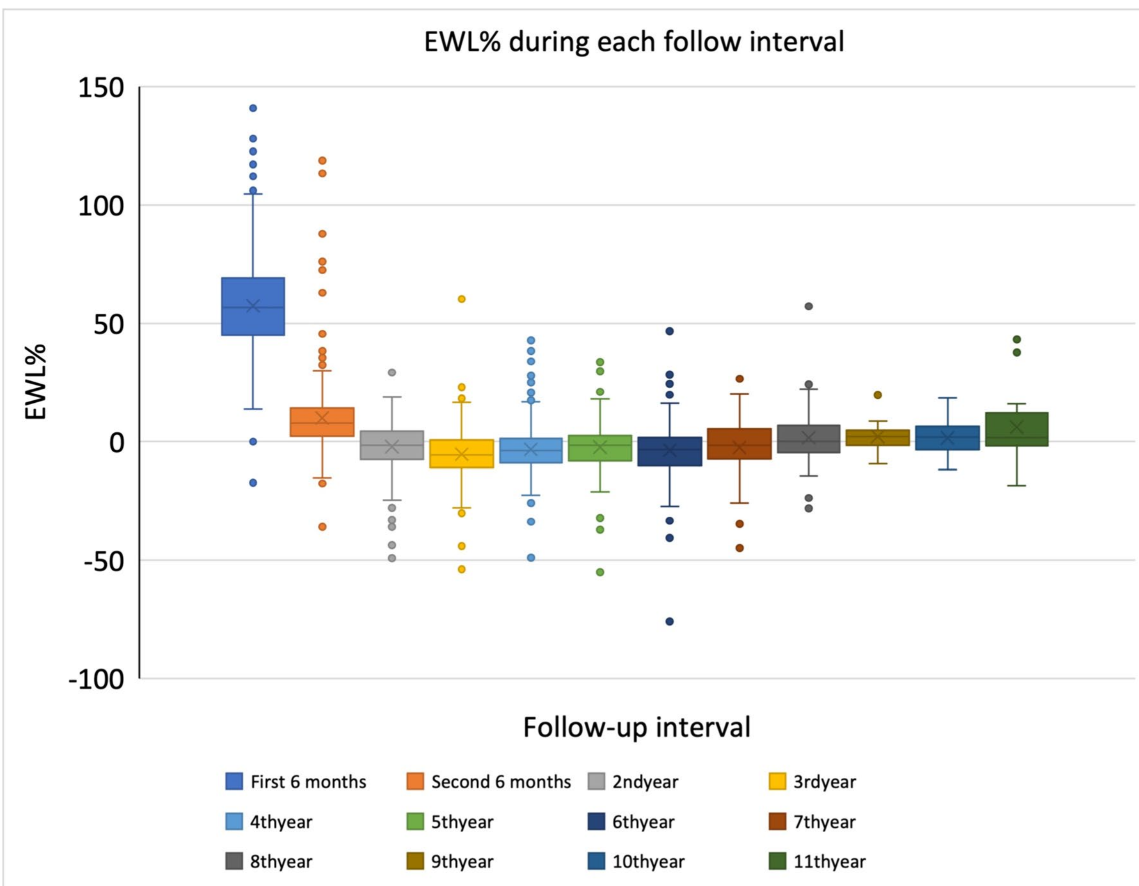

Fig. 4 EWL% during each follow-up interval

Table 3 Variables associated with sustained EWL at the end of follow-up in those that achieved EWL > 50% and EWL70%

Variable	EWL > 50% ($n=271$)		EWL > 70% ($n=168$)	
	Sustained EWL ($n=154$)	Not sustained EWL ($n=117$)	Sustained ($n=85$)	Not sustained EWL ($n=83$)
Age				
≥ 40	40 (26.0)	29 (24.8)	23 (27.1)	24 (28.9)
41–50	47 (30.5)	43 (36.8)	27 (31.8)	26 (31.3)
51–60	50 (32.5)	36 (30.8)	25 (29.4)	30 (36.1)
> 60	17 (11.0)	9 (7.7)	10 (11.8)	3 (3.6)
Male:Female	39 (25.3)	29 (24.8)	18 (21.2)	20 (24.1)
Comorbidities				
Psychiatric, medicated	56 (36.4)	41 (35.0)	27 (31.8)	29 (34.9)
Hypertension, medicated	54 (35.1)	32 (27.4)	25 (29.4)	29 (34.9)
Diabetes, medicated	39 (25.3)	23 (19.7)	14 (16.5)**	20 (24.1)**
Sleep apnoea	12 (7.8)	16 (13.7)	4 (4.7)	6 (7.2)
Start BMI				
< 40	18 (11.7)	12 (10.3)	14 (16.5)	9 (10.8)
40–45	50 (32.5)	23 (19.7)	26 (30.6)	27 (32.5)
46–50	36 (23.4)	39 (33.3)	21 (24.7)	26 (31.3)
> 50	47 (30.5)	42 (35.9)	22 (25.9)	21 (25.3)
IPIC				
No IPIC	27 (17.5) **	53 (45.3) **	13 (15.3)	8 (9.6)
Under 10.5%	55 (35.7) **	74 (63.2) **	26 (30.6)	39 (45.9)
Over 10.5%	71 (46.1)**	59 (50.4) **	45 (52.9)	37 (43.5)
Operations				
Sleeve	61 (39.6)***	66 (56.4)***	34 (40.0)**	52 (62.7)**
Bypass	87 (56.5)***	46 (39.3)***	50 (58.8)**	27 (32.5)**
Peri-operative complication	27 (17.5)	14 (12.0)	13 (15.3)	13 (15.7)
Readmission	11 (7.1)	7 (6.0)	4 (4.7)	5 (6.0)

*$p<0.05$, **$p<0.01$ and ***$p<0.001$ as determined by Kaplan Meier

At the end of follow-up, after a median of 6.5 years after achieving EWL50%, 56.8% (154/271) sustained EWL50% by the end of follow-up. Patients with sustained EWL50% had statistically higher rates of gastric bypass versus gastric sleeve compared to those with unsustained EWL50% (60.4% vs. 39.6% and 43.6% vs. 56.4%, respectively) (Table 3). Patients who had high pre-operative weight loss through IPIC were more likely to have sustained EWL ≥ 50% at the end of follow-up compared to those with unsustained EWL ≥ 50%.

Of the 168 patients that achieved EWL70%, 50.6% sustained EWL70% by the end of their follow-up after a median follow-up of 5.5 years from EWL > 70%. Both sleeve gastrectomy (62.7% vs. 40.0%) and T2DM (medicated) (24.1% vs. 16.5%) were associated with unsustained EWL70% by the end of follow-up (Table 3).

Multivariate logistic regression was conducted to determine factors associated with sustained EWL ≥ 50% and EWL ≥ 70% at the end of follow in the overall cohort. The only variable associated with sustained EWL ≥ 50% were high pre-operative weight loss (> 10.5% EWL) through IPIC (OR, 2.36; $p=0.013$), whereas sleeve gastrectomy was negatively associated with sustained EWL ≥ 70% (OR 0.45, $p=0.001$).

Similarly, the only variable associated with sustained EWL ≥ 70% were high pre-operative weight loss (> 10.5% EWL, median) through IPIC (OR, 2.03; $p=0.011$), whereas sleeve gastrectomy was negatively associated with sustained EWL ≥ 70% (OR 0.46, $p=0.006$).

Discussion

This study has shown that the median EWL% was significantly higher in those receiving IPIC than those who did not, and EWL% was even higher in those with higher pre-operative weight loss as a result of IPIC. These patients were more likely to achieve EWL outcomes (EWL ≥ 50% and ≥ 70%) and sustained EWL at the end of follow-up.

Whilst many factors were associated with worse outcomes (e.g. higher starting BMI, higher age, T2DM), sleeve gastrectomy was also associated with more unsustained EWL50% and EWL70%, in comparison to gastric bypass.

There are only a few studies in the literature that have long-term follow-up, the most significant of which is the Swedish Obesity Subjects (SOS) trial [6, 8–15]. The SOS trial was a prospective controlled trial with multiple sub-studies, one of which was a prospective matched surgical intervention study with 2010 patients receiving surgical intervention (gastric banding, vertical banded gastroplasty, or gastric bypass) and 2037 patients in the control group, with patient follow-up for up to 20 years. The SOS trial, along with studies show that bariatric surgery led to statistically significant weight loss (measured as %EWL and %TWL) at follow-up periods of 5, 7, 10, 15, 20. Nevertheless, in both shorter follow-up and longer studies, there is significant heterogeneity in the weight loss outcomes of bariatric surgery [4, 9]. Currently in the literature, the main factors that are discussed to account for this heterogeneity are the surgical method (e.g. gastric sleeve versus bypass) and the starting BMI [4]. Other factors have been discussed in the SOS trial such as starting insulin levels and diagnosis of diabetes [6]. Due to the lack of studies investigating long-term follow-up, the factors associated with sustained weight loss versus weight regain are unknown. As we have demonstrated here, whilst 80% of patients achieved EWL $\geq$ 50% during follow-up, 43.2% of patients suffered weight regain or had unsustained EWL $\geq$ 50% after a median of 6.5 years from achieving EWL $\geq$ 50. It appears that weight regain rates over longer term follow-up appear to be a significant issue and associated factors should be recognised.

One systematic review provided evidence that gastrojejunal stoma diameter following gastric bypass, psychiatric conditions such as anxiety and depression, low activity levels post-operatively, and time after surgery may predispose patients to weight regain, however, the results were varied from trial to trial [26–32]. Clapp et al. found that at > 7 years follow-up, the weight regain rate was significant (27.8%) for sleeve gastrectomy [14]. Whilst the present study did not find any association with psychiatric conditions and either sustained or unsustained EWL%, we did find that sleeve gastrectomy was negatively associated with sustained EWL% compared to bypass ($\geq$ 50%EWL, OR 0.45, $p = 0.001$; $\geq$ 70%EWL, 0.46, $p = 0.006$).

The link between pre-operative weight loss and post-operative weight loss outcomes also remains unclear [17, 19–25]. Weight loss requirements before bariatric surgeries reportedly causes delays to accessing surgery and remains controversial [20, 22, 23]. Interestingly, higher pre-operative EWL as a result of IPIC was the main determinant of sustained EWL% in this study. This may be associated with a patient's motivation to sustain dietary and lifestyle changes and activity levels post-operatively and may provide evidence that such education courses could give patients benefit through instilling sustainable behavioural change. Whilst incorporating IPIC into the routine assessment pathway improved outcomes even in patients with lower pre-operative weight loss, it appears that patients with higher pre-operative weight loss achieve more sustained weight loss. This provides evidence towards the importance of appropriate patient selection in order to optimise post-operative long-term outcomes.

There is no conclusive evidence indicating the effect of starting BMI on the effects of bariatric surgery. This question is often complicated by the inclusion on non-obese patients in studies (BMI > 25, but < 30) [2]. In the SOS trial, high baseline BMI was predictive of poor treatment outcomes and is consistent with our findings. In our centre referral for bariatric surgery was offered when a patient has a BMI > 40 kg/m2 or a BMI between 35 and 39.9 kg/m^2 with a significant weight-related health condition. We find that as a patient's starting BMI approaches 45–50 kg/m^2, the likelihood of achieving a satisfactory excess weight loss reduces significantly [6]. Of course, we demonstrate a number of additional variables associated with poor outcomes which must also be acknowledged during consultation prior to surgery (e.g. T2DM, higher age and sleep apnoea).

The current literature is unclear which surgical techniques have the best weight loss outcomes. A meta-analysis of RCTs directly comparing sleeve gastrectomy and roux-on-y gastric bypass described similar weight loss outcomes and similar rates of complications [4]. The SLEEVEPASS trial showed that gastric bypass had better excess weight loss rates than sleeve gastrectomy at 5-, 7-, and 10-year follow-ups, however, they were unable to state that gastric bypass was superior as it did not meet their predefined statistical criteria [8]. Although gastric bypass may have a better weight loss profile, mortality is slightly higher for bypass versus sleeve (0.09% vs. 0.05%) [16]. Biliopancreatic diversion (with or without duodenal switch) seems to be more effective than gastric banding, sleeve gastrectomy and roux-on-y gastric bypass at reducing BMI but its side effect and mortality profile mean it is less popular [2, 4, 16]. Conversely, Gloy et al.'s systematic review and meta-analysis of bariatric surgery RCTs from 2013 showed no statistical difference in weight loss between adjustable gastric banding and gastric bypass as well as adjustable gastric banding and a combination of sleeve, bypass and biliopancreatic diversion [3]. It is important to note that the follow-up periods for the RCTS included in these systematic reviews were often limited to between 1 and 3 years and in studies with longer-term follow-up, gastric bypass is associated with higher long-term EWL than gastric sleeve [8, 10]. The present results support gastric bypass in achieving longer-term sustained weight loss. Neither gastric sleeve nor bypass were associated with achieving excess weight loss during follow-up which explains the inconclusive results among studies with shorter term follow-up.

There are limitations to the current study. It is a retrospective study and therefore there is a risk of selection bias. Nevertheless, this has been partially controlled for through multivariable analyses and subgroup analyses. Our data are from a single centre and may not be an adequate reflection of other centres. Despite this, our data provides evidence of improved weight loss in those engaging with IPIC and achieving pre-operative weight loss. While we are not aware of other studies that have investigated the effect, short or long-term, of pre-operative information courses in bariatric surgery, it is a strong recommendation by the enhanced recovery after surgery society in bariatric surgery. The mechanism of this relationship between pre-operative weight loss and weight loss outcomes is worthy of further research.

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Declarations

Disclosures James Lucocq, Vikram Thakur, Georgios Geropoulos, Daniel Stansfield, Laura Irvine, Mhairi Duxbury, Andrew C de Beaux, Bruce Tulloh, Beverley Wallace, Brian Joyce, Lisa Harrow, Gillian Drummond, Peter J Lamb and Andrew G Robertson have no conflicts of interest or financial ties to disclose.

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