



# Pre-operative Bariatric Clinic Attendance Is a Predictor of Post-operative Clinic Attendance and Weight Loss Outcomes

Hamish Shilton<sup>1</sup>  · Yang Gao<sup>1</sup> · Nitesh Nerlekar<sup>2</sup> · Nicholas Evennett<sup>1</sup> · Rishi Ram<sup>1</sup> · Grant Beban<sup>1</sup>

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## Abstract

**Aim** Our primary aim was to determine whether non-attendance at pre-operative clinics were associated with non-attendance at post-operative clinics and its influence on weight loss. We also sought to examine the relationship between gender, ethnicity and post-operative clinic attendance with respect to weight loss post-bariatric surgery.

**Methods** A retrospective audit was performed for patients undertaking the bariatric surgery program at the Auckland City Hospital between 2013 and 2016.

**Results** One hundred and eighty-four patients completed our program, with a mean age of 46.1 years. Mean weight at commencement was 133.3 kg, with a BMI of 47.4. At 2 years follow-up ( $n = 143$ ), excess weight loss was 70.8% following RYGB and 68.0% following LSG ( $p = 0.5743$ ). More patients attended all pre-operative than post-operative clinics (67.4% vs 37.5%  $p = < 0.001$ ). One pre-operative clinic non-attendance was associated with less weight loss at 2 years and it increases the risk of missing at least 50% of post-operative clinics with a risk ratio of 2.73,  $p = 0.005$ . Non-attendance of at least 50% of post-operative clinics was also associated with less weight loss at 2 years (33.4 kg vs 44.3 kg,  $p = 0.040$ ). Although Maori and Pacific Islanders more frequently missed > 50% of post-operative clinics, weight loss was similar between European, Maori and Pacific Islander populations (2-year weight loss 44.2 kg vs 40.74 kg vs 44.1 kg, respectively,  $p = 0.8192$ ).

**Conclusion** Pre-operative clinic non-attendance helps predict post-operative clinic non-attendance. Missing any pre-operative clinics and at least 50% of scheduled post-operative clinics is associated with poorer weight loss outcomes.

**Keywords** Bariatric · Weight loss · Clinic attendance · Roux-en-Y gastric bypass · Sleeve gastrectomy · Ethnicity · Predictors · New Zealand · Maori · Pacific islander

## Introduction

Obesity is a global epidemic, and New Zealand has the third highest adult obesity rate in the OECD and rising. [1] The New Zealand Health Survey 2017/18 found that 32% of adults aged 15 and over were obese, up from 27% in 2006/07. Obesity was present in 47% of Maori and 65% of Pacific Islander adults. [2]

Many district health boards (DHBs) in New Zealand have a public bariatric surgery program to help those already obese.

Much effort has been focused on looking at predictive factors prior to bariatric surgery to improve the selection process and address those patients who require more support to successfully complete bariatric programs. Pre-operative weight gain, psychological factors, coping mechanisms, ethnicity, comorbidity and clinic attendance have all been investigated. [3–8]

Post-operative clinic non-attendance has been associated with poorer weight loss and a higher complication rate than regular attendees. [3, 9–14] There have not been any reports to

✉ Hamish Shilton  
hamishshilton@hotmail.com

Yang Gao  
ygao065@gmail.com

Nitesh Nerlekar  
nitesh.nerlekar@gmail.com

Nicholas Evennett  
nicholase@adhb.govt.nz

Rishi Ram  
rishir@adhb.govt.nz

Grant Beban  
GBeban@adhb.govt.nz

<sup>1</sup> Department of Surgery, Auckland City Hospital, 2 Park Rd, Grafton, Auckland 1023, New Zealand

<sup>2</sup> Monash Cardiovascular Research Centre, Monash University, Wellington Road, Clayton, Victoria 3800, Australia

correlate if pre-operative clinic non-attendance would predict post-operative clinic non-attendance.

We aim to assess whether pre-operative clinic non-attendance is a predictor for post-operative clinic non-attendance and to assess the health care outcomes for the Maori and Pacific Islander populations within our bariatric program.

## Methods

We conducted a retrospective database analysis of our bariatric program at the Auckland City Hospital between 1st January 2013 and 31st December 2016. Our study protocol was submitted to our local research office and deemed compliant with an audit which does not require further ethical approval within New Zealand. The database was an excel document stored on the hospital intranet and includes all participants of our bariatric program to date. Demographics including ethnicity and procedure type were stored on this database. Clinic appointments and weights were obtained from the hospital electronic records. Initial weight was the recorded weight taken at the first pre-operative appointment, prior to commencing our pre-operative program which is aimed at education and lifestyle changes. Patients had a minimum follow-up of 1 year, with the 2013–2015 cohorts completing the full 2-year follow-up of the program at the time of data collection. Excess weight loss (EWL) and total weight loss (TWL) were calculated at each time point based on the initial weight. EWL is calculated as a percentage of the weight equivalent to a body mass index (BMI) of 25.

Our bariatric program consists of at least four pre-operative clinic reviews following an information seminar. From referral, patients are invited to the information seminar, which is presented by our surgeons. Following this, patients are seen in clinic by our nurse specialist, dietician and health psychologist in individual sessions. We then hold rotating monthly group sessions with our nurse specialist, dietician and health psychologist. During this 3-month period, patients have time to use the information provided to instigate lifestyle modifications. We then discuss at a multidisciplinary team (MDT) meeting the morning of the surgeon review. With information from the MDT meeting, the surgeon makes the final decision for surgery and procedure type, and if required, further reviews with other members of the MDT as appropriate. The pre-operative program generally takes around 6 months to complete. Our unit performs Roux-en-Y gastric bypass (RYGB) as well as laparoscopic sleeve gastrectomy (LSG). One anastomosis gastric bypass (OAGB) was performed on a few patients. With some exceptions, patients must have type 2 diabetes mellitus (T2DM) or obstructive sleep apnoea (OSA) with a body mass index (BMI) over 35 to qualify for the

program. We have a general policy of discharge if patients fail to attend two pre-operative clinic appointments.

Post-operatively patients are reviewed by our team on eight occasions over 2 years. Patients are scheduled to further appointments if necessary. A clinic appointment was marked as not attended if they did not attend without notifying us prior to the appointment time.

## Statistical Analysis

Statistical analysis was performed using Graphpad Prism version 8.01, GraphPad software, La Jolla, California, USA. Significance was defined as 0.05 in two-sided probability. Data are presented as mean  $\pm$  SD and median (IQR) as appropriate. Categorical variables were analysed using chi square and Fisher's exact tests, and continuous variables were analysed using the two-sided unpaired *t* test. The McNemar test was used for case control to match pre- and post-operative clinic non-attendance. Ethnicity groups were analysed using one-way ANOVA for continuous data. The Tukey test was used for post hoc multiple comparison testing on all significant results.

## Results

### Demographics

One hundred and eighty-four patients underwent bariatric surgery between 2013 and 16. The mean age was 46.1 years, whilst 73.4% were female. Age and gender distribution were similar across the years of the program.

Mean weight at the start of the program was 133.3 kg, with a BMI of 47.4, equating to a mean weight excess of 62.7 kg.

At 1 year, 143 of 184 (77.7%) patients attended and recorded a weight. At 2 years, 76 of 114 (66.6%) patients attended and recorded a weight.

The greatest EWL was recorded at 1 year post-operatively with some non-significant weight gain in both procedure groups in the second year post-operatively (1 year 72.01% vs 2 year 69.3%  $p = 0.3283$ ). RYGB and LSG produced similar excess weight loss at 2 years (70.8% vs 68.0%,  $p = 0.5743$ ).

There was no significant difference in excess weight loss between males and females at 2 years (72.4% vs 67.9%  $p = 0.3925$ ), or between age groups. Two-year mean EWL for those < 50 years was 66.3% versus 72.8% for those over 50 years old ( $p = 0.1788$ ).

The largest ethnic group receiving bariatric surgery were Europeans  $n = 94$  (51.1%), followed by Maori  $n = 40$  (21.7%). There were 31 Pacific Islanders (16.9%).

Procedures performed during this period were 111 LSG (60.3%) and 68 RYGB (37.0%). Five patients received an OAGB (2.7%).

T2DM was the most common comorbidity, being present in 68.5% of patients. OSA was present in 38.0%. Both T2DM and OSA were present in 17.4% of patients.

Complications within this cohort include one death and two patients requiring intensive care; one for a closed loop small bowel obstruction, the other presenting with caecal perforation. There was one oesophageal perforation secondary to placement of the bougie. Five patients had sleeve stenosis requiring intervention. One patient had anastomotic stenosis following RYGB. One patient presented with small bowel obstruction at the jejunostomy site. Three patients experienced sleeve gastrectomy leaks, one of whom was our recorded mortality 10 months post-operatively, although the direct cause of death related to a large, pre-existing ventral hernia.

### Primary Outcomes

Of 184 patients on our program, only 31.0% attended all pre- and post-operative clinics. Patients attended more pre-operative clinics than post-operative clinics, with 124 (67.4%) attending all pre-operative clinics, but only 69 (37.5%) attending all post-operative clinics.

Overall for the entire cohort, there was a weak correlation (0.41) between non-attendances at pre-operative clinics resulting in non-attendances at post-operative clinics.

Table 1 shows the demographics and outcomes dependent on the number of clinic appointments missed based on “Did not attend” (DNA). Post-operative clinic non-attendance resulted in less weight loss at 2 year follow-up for those who missed greater than three appointments ( $\geq 50\%$  of scheduled appointments) compared with those who missed no more than three appointments (mean 33.4 kg vs 44.3 kg,  $p = 0.040$ , TWL 26.0% vs 32.4%  $p = 0.0333$ ). The weight loss was lower throughout the entire follow-up period, with greater weight regain during the second year post-operatively as seen in Fig. 1. Missing three or fewer post-operative clinics did not result in any significant difference with regard to weight loss. Those who missed more than one pre-operative clinic was associated with missing greater than three post-operative clinics (RR 2.73,  $p = 0.005$ ). In addition, we found any pre-operative clinic non-attendance in itself was predictive of poorer weight loss at 2 years for TWL (32.5% vs 26.8%  $p = 0.0192$ ).

### Secondary Outcomes

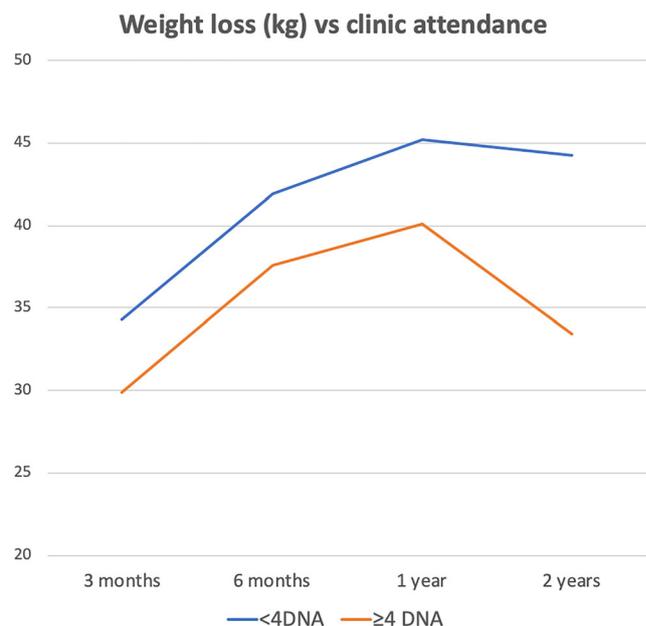
Weight loss between ethnic groups was similar; however, Pacific islanders had greater weight and BMI at 1 and 2 years post-operatively than did the European or Maori populations (Fig. 2). Weight loss outcomes by ethnicity are shown in

**Table 1** Outcomes by post-operative clinic attendances

Did not attend (DNA)	< 4 clinic DNA	$\geq 4$ clinic DNA	P value
N	139	45	
Age	46.7	44.0	0.121
Female (n, %)	101 (72.7)	34 (75.6)	0.847
Ethnicity			
Euro	76	18	0.042
Maori	25	15	
Pacific Islander	20	11	
Procedure			
LSG	86	25	0.725
RYGB	49	19	
OAGB	4	1	
Initial weight	133.8 $\pm$ 23.6	131.1 $\pm$ 22.6	0.502
Initial BMI	47.6 $\pm$ 7.4	46.6 $\pm$ 6.8	0.402
2-year follow-up (n=)	64	12	
2-year weight	90.4 $\pm$ 15.5	92.8 $\pm$ 22.1	0.648
2-year BMI	32.1 $\pm$ 5.3	32.7 $\pm$ 5.7	0.707
2-year weight loss	44.3 $\pm$ 16.7	33.4 $\pm$ 15.9	0.04
2-year EWL	70.9 $\pm$ 19.3	60.7 $\pm$ 27.2	0.120
2-year TWL	32.4 $\pm$ 8.6	26.0 $\pm$ 11.6	0.029

Table 2. Two-year EWL for NZ Europeans, Maori and Pacific Islanders were 71.0, 70.8 and 56.8% respectively ( $p = 0.125$ ).

There was a significant difference in clinic attendance achieved by ethnicity, with a greater percentage of both Maori (37.5%) and Pacific Islanders (35.5%) missing at least 50% of post-operative clinics compared with Europeans (19.1%) ( $p = 0.042$ ).



**Fig. 1** Weight loss (kg) by clinic non-attendance

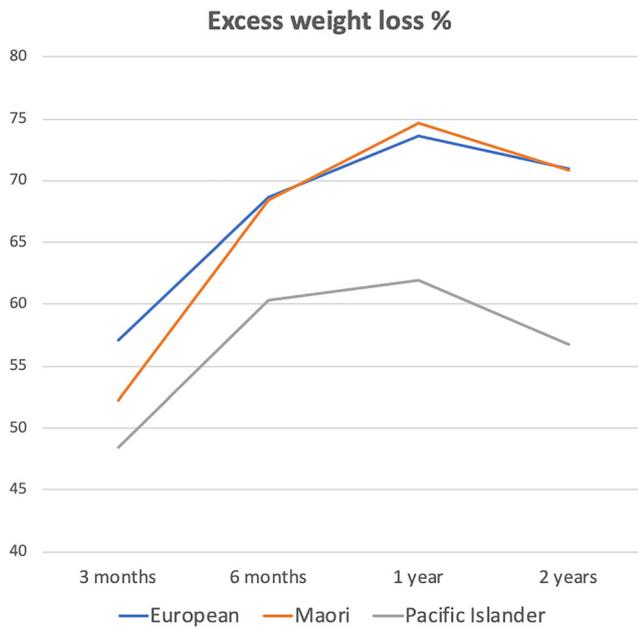


Fig. 2 Excess weight loss % by ethnicity

**Discussion**

The absolute weight loss results in our study are comparable with major randomised controlled trials (RCTs) reporting on weight loss for LSG and RYGB. Our study did not have any significant difference between procedure types on weight loss, which is similar to the SM-BOSS trial. [15] However, in contrast, other RCTs have found a significantly greater weight loss with RYGB. [16, 17]

Our paper identifies that post-operative clinic attendance is poorer than pre-operative clinic attendance. This is consistent

with the previous study. [8] We sought to identify if there was a correlation between pre-operative clinic attendances as a predictive factor for post-operative clinic attendance, and indeed found this to be true. Patients missing clinic appointments pre-operatively can be identified and further counselled about the risks of the procedure and the need to adhere to post-operative clinic review.

Non-attendance at post-operative clinic reviews has an adverse outcome on weight loss following many forms of bariatric surgery including gastric band, sleeve gastrectomy and gastric bypass. [3, 9–13] Our paper has also shown a significant decrease in weight loss once patients have missed at least four post-operative clinics, which correlates to 50% of their scheduled appointments. Regular clinic attendance also leads to better adherence to routine safety advice such as taking supplementary multivitamins. [18]

Non-attendance at post-operative clinics also results in poorer control of obesity-related comorbidities and development of post-operative complications. [14] This is the more important outcome following bariatric surgery rather than weight loss in itself, as it is the long-term improvement in comorbidities that is really the end goal of bariatric surgery.

There are many barriers to patient non-attendance at clinic, such as travelling distance to the clinic review. [19–21] In our study, distance from clinic review was short, as our catchment area was entirely within the city of Auckland. Uninsured patients tend to have more limited access to care and suffer from obesity and its metabolic complications more than their privately insured counterparts. [22] A public bariatric service such as ours improves access to patients who cannot afford private health insurance. Despite removal of these identified barriers, post-operative non-attendance remained an issue within our cohort.

Table 2 Outcomes by ethnicity

	European	Maori	Pacific Islander	P value
N=	94	40	31	
Initial weight	133.2 ± 23.4	134.9 ± 19.6	141.9 ± 26.4	0.198
Initial BMI	47.9 ± 6.8	47.9 ± 6.8	47.9 ± 6.8	0.056
N=	76	26	25	
1-year weight	87.0 ± 14.8	86.8 ± 12.3	99.1 ± 17.9	0.002 <sup>a</sup>
1-year BMI	31.0 ± 4.4	31.1 ± 4.4	35.6 ± 5.5	0.001 <sup>a</sup>
1-year weight loss	45.7 ± 16.8	45.3 ± 14.4	46.0 ± 17.9	0.990
1-year EWL	73.6 ± 17.9	74.7 ± 15.8	62.0 ± 17.1	0.010 <sup>a</sup>
1-year TWL	33.8 ± 9.1	33.8 ± 7.6	31.2 ± 8.0	0.408
N=	44	13	10	
2-year weight	88.4 ± 14.6	89.7 ± 13.9	108.2 ± 19.8	0.002 <sup>a</sup>
2-year BMI	31.4 ± 4.8	31.2 ± 3.3	37.0 ± 6.2	0.005 <sup>a</sup>
2-year weight loss	44.2 ± 17.7	40.7 ± 12.3	44.1 ± 23.3	0.819
2-year EWL	71.0 ± 21.8	70.8 ± 14.4	56.8 ± 16.6	0.125
2-year TWL	32.6 ± 10.2	31.1 ± 7.0	28.0 ± 9.2	0.389

<sup>a</sup> Tukey test. Pacific Islander group significant compared with European and Maori groups

Equity of access between various ethnic groups within a publicly funded bariatric program is paramount. In our program, we found differences in clinic appointment attendance between those of the European ethnicity and the Maori and Pacific Islander populations. This is in line with previously reported data looking at attrition rates after acceptance onto our program, where, in particular, Maori and Pacific Island males had the lowest rates of progression through to surgery. [23] This has prompted changes to our program, most notably eliminating the requirement for pre-operative weight loss in most patients, the results of which will be reported in future publications.

Despite the difference in clinic attendance between ethnic groups, we did not find a significant difference in weight loss between these ethnic groups. Adults living in the most deprived areas were 1.6 times more likely to be obese as adults living in the least deprived areas in New Zealand. [1] Two recent publications highlight the challenges in achieving equity regarding surgery for the New Zealand Maori and Pacific Islander populations, with Maori and Pacific Islanders less likely to receive bariatric surgery per 1000 morbidly obese population. [24, 25] In other studies, disparities in weight loss have been seen between those of varying racial background in the USA, with Caucasian ethnicity having a higher tendency to attend clinic follow-up and a lower incidence of nutritional deficiency. [26–28]

There has only been one published paper reporting the outcomes following bariatric surgery in relation to the local Maori and Pacific Islander populations in New Zealand. [29] This review conducted by Lam et al. followed-up long term outcomes in diabetes resolution and weight loss following RYGB between 2001 and 2007. Their cohort had 17.5% Maori/Pacific Islander patients and found no significant difference in weight loss or diabetes remission rates compared with their European population. It is reassuring to see that Maori and Pacific Islander participation in bariatric programs is increasing over time in New Zealand, and again, that weight loss is similar between these groups in our study.

## Limitations

The general policy of our program was to discharge patients with two pre-operative clinic non-attendance from our program. As there were few exceptions, this has resulted in <10% of patients with two or more non-attended pre-operative clinic appointments who still proceeded to surgery and provided data for analysis of post-operative clinic attendance. This limits the ability to detect a stronger correlation between pre-operative and post-operative clinic non-attendance. Our data was not large enough to meaningfully analyse complication rate with clinic attendance.

## Conclusion

Pre-operative bariatric clinic non-attendance is correlated with post-operative clinic non-attendance and significantly worse weight loss at 2 years. Post-operative clinic non-attendance resulted in less weight loss when 50% of scheduled clinic appointments were missed. Weight loss outcomes were similar between all ethnicities despite clinic attendance being poorer in the Maori and Pacific Islander populations compared with the Europeans.

## Compliance with Ethical Standards

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

**Ethical Statement** The research protocol and ethical review paperwork were reviewed by the Auckland District Health Board research committee. It was declared to abide by the definition of an audit and by New Zealand law, did not require further ethical board approval.

**Human/Animal Rights Statement** There were no procedures performed on humans or animals for the purpose of this audit.

**Informed Consent** No identifiable personal data was collected for this research.

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