ORIGINAL ARTICLE

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Metabolic bariatric surgery generates substantial, sustained weight loss and health improvement in a real-world setting

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Key words
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Abstract

Background: To determine if the positive outcomes from clinical trials regarding the safety and efficacy of metabolic bariatric surgery are reproducible at a national level.
Methods: A longitudinal registry-based observation study with data collected from all persons undergoing metabolic bariatric surgery in Australia from 28 February 2012–31 December 2021 including data from 122,567 index patients who underwent 134,625 completed bariatric procedures.
Main Outcomes and Measures: Defined adverse outcomes at 90-days (unplanned readmission, intensive care admission and re-operation; death), annual change in weight (percent total body weight loss (TBWL)), diabetes treatment and need for re-operation.
Results: 79.0% of participants were female. Mean age on the day of surgery was 44.0 years (SD 11.8; range 12.9-87.9 years) and mean BMI 41.7 kg/m2 (SD 7.6). At 5-years participants who underwent one anastomosis gastric bypass had TBWL 34.88% (SD 8.67%), roux-en-Y gastric bypass 30.73 % (SD 9.47%); sleeve gastrectomy 26.5% (SD 10.5%) and adjustable gastric bands 17.6% (SD 12.1%). At 90-days 3.6% of procedures recorded a defined adverse event. 13,904 (13.6%) primary participants reported being treated for diabetes at baseline. No medication for diabetes was required by 71.6% (follow-up 58%) at 1-year and 61% (follow-up 22%) at 5-years.
13 904 (13.6%) primary participants reported being treated for diabetes at baseline. No medication for diabetes was required by 71.6% (follow-up 58%) at 1-year and 61% (follow-up 22%) at 5-years.
Conclusions: Metabolic bariatric surgery is safe and induces substantial weight loss with reduced need for diabetes medications in the real-world.
ClinicalTrials.gov ID: NCT03441451.

Introduction

Multiple Randomized Controlled Trials (RCT), cohort studies and case-series confirm metabolic bariatric surgery provides long-term durable weight loss, a reduction in obesity-related diseases and improved longevity.[1,2] As a result there has been a rapid escalation over the past 20 years in the number of bariatric surgical procedures performed.[3]

Rapid uptake of new procedures increases the risk of patient harm as enthusiasm for new procedures may precede appropriate training.[4,5] It is also possible that positive results from expert centres will not be replicated at the community level. It is therefore recommended that patients who undergo new procedures are enrolled in a registry.[6,7]

A registry uses observational study methods to systematically collect uniform data which is used to evaluate specified outcomes for a defined population.[8] When used to evaluate new procedures, registries collect information on a predefined agreed set of quality indicators. Quality indicators must be able to be reliably defined, readily collected across multiple sites and hold both face and construct validity.[9,10] These types of registries are termed Clinical Quality Registries (CQR).

There has been a rapid rise in the uptake of bariatric procedures across Australia and Aoteoroa New Zealand over the past three decades. In 2008 the Australia and New Zealand Metabolic and Obesity Surgery Society (ANZMOSS), identified the need for a metabolic bariatric surgery CQR to monitor and potentially improve outcomes in our countries. The Australia and New Zealand Bariatric Surgery Registry (BSR) curates community level national data on the safety of metabolic bariatric surgery as well as weight loss and health improvement, using change in diabetes medication as a surrogate measure of health. The pilot study began in 2012, with national rollout in Australia commencing in 2014 and in Aoteoroa New Zealand in 2018.

We hypothesised that the positive outcomes from clinical trials regarding the safety and efficacy of metabolic bariatric surgery would be reproduced at a community level. The primary aim was to document safety outcomes from metabolic bariatric surgery in our countries. Secondary aims were to record the efficacy of bariatric procedures at a community level both in terms of weight loss and change in treatment of diabetes as well as documenting changes in practice over the period of data capture. In this report we present the outcomes from the first 122 567 participants with completed metabolic bariatric procedures enrolled in the Australian arm of the BSR.

Methods

Study design

The BSR is a longitudinal community level national registry that aims to prospectively collect identifiable information from all persons undergoing a primary or revisional metabolic bariatric surgical procedure in Australia, excluding endoscopic procedures that are performed with the intention of being reversed within a year of the procedure.

Primary metabolic bariatric procedures are defined as the first instance of a person having a metabolic bariatric procedure. Revisional procedures are those that occur subsequent to the primary procedure and are grouped as corrective (to correct an issue), reversals (removal of gastric band, surgery to undo the effect of gastric bypass or gastroplasty) or conversions (where one type of metabolic bariatric surgery is changed to another).

Setting

Data was collected from all participating hospitals in Australia. Baseline data was collected from the treating surgeons (or their delegate) on the day of surgery following completion of the bariatric procedure. 90-day data was provided by the treating surgeon or the patient. Annual follow up of efficacy outcome measures were collected from either the surgeon or the patient.

Participants

All people who undergo a metabolic bariatric procedure in Australia are eligible to participate in the BSR. Participants whose entry into the BSR is with their first metabolic bariatric procedure are termed primary participants. Participants whose entry into the BSR is with a revisional procedure are termed legacy participants.

Variables

Variables were identified through a consensus process. Selected data elements were trialled in the pilot, and only those variables that were reliably collected >80% of the time were included in the final dataset. Demographics of participants, weight and height, diabetes treatment and operative details were collected on the day of surgery. Safety outcome data were collected at 90-days. Weight, diabetes treatment and need for reoperation were collected annually with a planned maximum 10-years of collection for primary participants only. Children (age less than 18 years) were excluded from analyses of change of weight and BMI as height could not be recorded longitudinally. The variables collected by the BSR and their definitions are provided in supplemental material (Supplemental 1 and 2).

Data sources

Data was provided to the BSR on a paper form by secure fax or mail, direct entry into a web-based database, or monthly downloads from surgeons' cloud-based electronic medical record (EMR). Data is stored on an SQL database within Monash University's ISO2700 compliant data centre.

Case ascertainment was determined through data linkage of the registry data with discharge coding from contributing hospitals. If missing data was identified, surgeons were requested to provide missing information. Further comparison was made with the Commonwealth Medicare Benefits Schedule (MBS) statistics to identify procedures in Australia that had occurred in hospitals not participating and were therefore not included in the BSR. Data audit is regularly undertaken to ensure consistency and accuracy of all data with data sources being cross referenced, and internal checks of data validity regularly undertaken.

Ethical review

Ethical approval of the BSR protocols was first granted in 2012 (Alfred Health HREC 221/18). Local approval has also been received from all contributing hospitals. Clinical Trials ID NCT03441451.

Participant consent

Participants over the age of 18 years are notified they will be invited to participate in the BSR after their bariatric procedure through flyers and posters displayed in surgeon's rooms. A formal invitation to participate is sent to the patient following their procedure along with a Participant Information Sheet. Patients who opt-out of participation, or are unable to consent to participation, are excluded, except for those who have died during or immediately after their procedure.

Bias

To minimize the risk of selection bias, the BSR aims to collect baseline information from >80% of all persons undergoing a metabolic bariatric surgery procedure in Australia. For perioperative safety measures the aim is >90% follow-up. For outcome measures recorded annually (weight change, diabetes treatment, need for reoperation) the aim is >70% follow-up.

Sample size

The overall sample size is dictated by the number of metabolic bariatric procedures undertaken each year in Australia.

Statistical methods

Hypothesis testing was conducted using independent Student's *t*-tests, ANOVA and Pearson's Chi-Squared tests. Missing data has been stated as being lost to follow-up. Associations between the type of primary procedure selected and various patient/site characteristics were investigated using univariate multinomial logistic regressions. Clustered standard errors were used to account for variation between surgeons. Data preparation and analysis were performed in Power BI™ (Microsoft, California, USA), IBM SPSS statistics v26 (IBM, New York, USA) and Stata V17.0 (Stata Corp, Texas, USA).

Results

Participants

There were 125 600 people notified to the BSR by 230 surgeons at 136 sites in Australia from 23 February 2012 to 31 December 2021. 2905 people (2.3%) declined to participate and a further 128 people had a procedure that was abandoned after commencement, meaning data from 122 567 people who underwent 134 625 completed bariatric procedures was entered into the BSR (Fig. 1). These included 102 297 primary procedures and 32 328 revisional procedures.

Data completeness

According to comparisons with national hospital procedure coding data, the case acquisition rate in to the BSR at baseline was 41.9% in 2015, 79.8% in 2019 and 75.1% in 2021 (Supplemental material 3). Peri-operative follow-up information was available at 90-days from 117 198 procedures (87.1%). Annual follow-up data with weight was available for 55.4% of primary participants at year one, dropping to 16.4% by year 5 (Fig. 2).

Demographics and setting

There were 96 823 (79.0%) participants recorded in the registry as female, 25 738 (21.0%) recorded as male and 6 (<0.01%) recorded as another term.

The mean age on the day of any surgery was 44.0 years (SD 11.8; range 12.9–87.9 years). The mean age at the time of a subsequent or revisional procedure was 48.6 years (SD 11.3; range 15.1–87.9) which was significantly older than primary participants (42.6 years; SD 11.6; range 12.9–84.5; mean difference = 6.1 years; 95% CI = 5.94–6.22; $P < 0.001$) (Table 1).

Procedure types

The most common primary procedure was Sleeve Gastrectomy (SG) (80.0%) whereas the most common revisional conversion procedure was Roux-en-Y Gastric Bypass (RYGB) (21.8%; Table 1). The change in procedure type performed in Australia over the reporting period is shown in Supplemental material 4.

Univariate multinomial regression estimates for procedure type selection were undertaken utilizing data from 2017 to 2021. This time period was chosen due to better patient accrual in these years than in the early years of the BSR reducing the risk of selection bias (Supplemental material 3). The characteristics of this subset are provided in supplemental material 5. When compared to SG, RYGB was more likely to be performed in people: over the age of 40 years, with an initial BMI >40 k/m^2, with diabetes or having their procedure in a public hospital. RYGB was less likely to be performed than SG in NSW/ACT and WA. When compared to SG, OAGB was more likely to be performed in people: over the age of 40 years, with an initial BMI >40 k/m^2, who identify as males, with diabetes and when surgery was performed in SA/NT. When compared to SG, AGB was more likely to be performed in people: with an initial BMI <40 k/m^2, having their procedure in a public hospital and when the procedure was performed in Vic/Tas and SA/NT (Table 2).

Defined adverse events

The BSR captured a total of 148 deaths in registry participants (0.1%). 29 deaths were assessed as possibly or definitely related to the bariatric procedure (0.02% of total participants). Sepsis was the leading cause of death (48.3%) followed by venous thromboembolism (20.7%).

Information on procedures where at least one defined adverse event (DAE) occurred at 90-days post-operative has been obtained for 117 198 procedures (87.1%). 4269 DAE were recorded (3.6% of procedures where follow-up has been obtained). 1922 (45.0%) DAE occurred in primary procedures including 884 unplanned return to theatres, 1292 unplanned readmissions and 119 unplanned ICU admissions. 2347 (55.0%) DAE occurred in revisional procedures, with 1823 unplanned return to theatres, 825 unplanned readmissions and 117 unplanned ICU admissions. Bypass procedures had significantly higher incidences of defined adverse events in both the primary and revisional setting ($P \leq 0.001$) (Table 3).

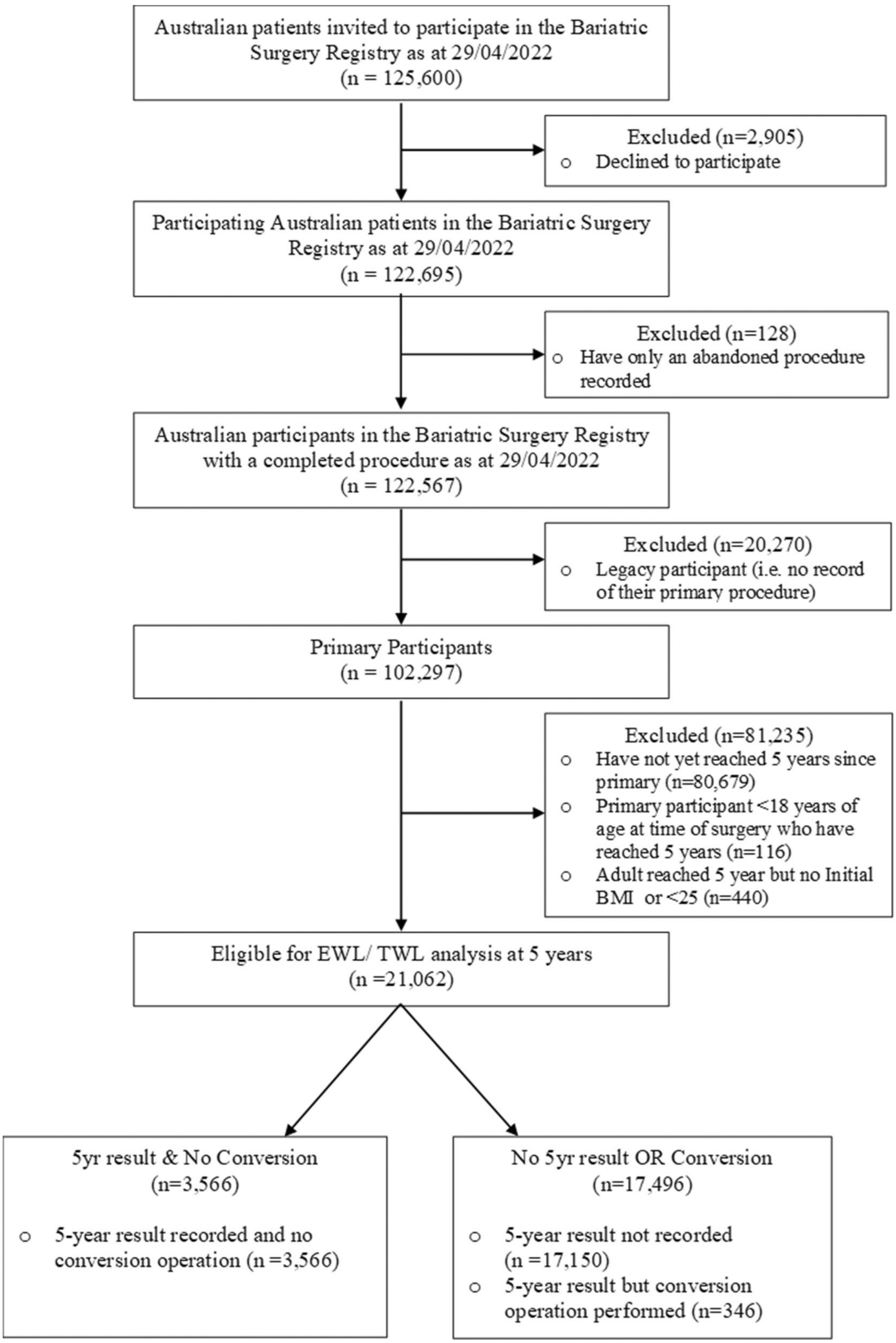
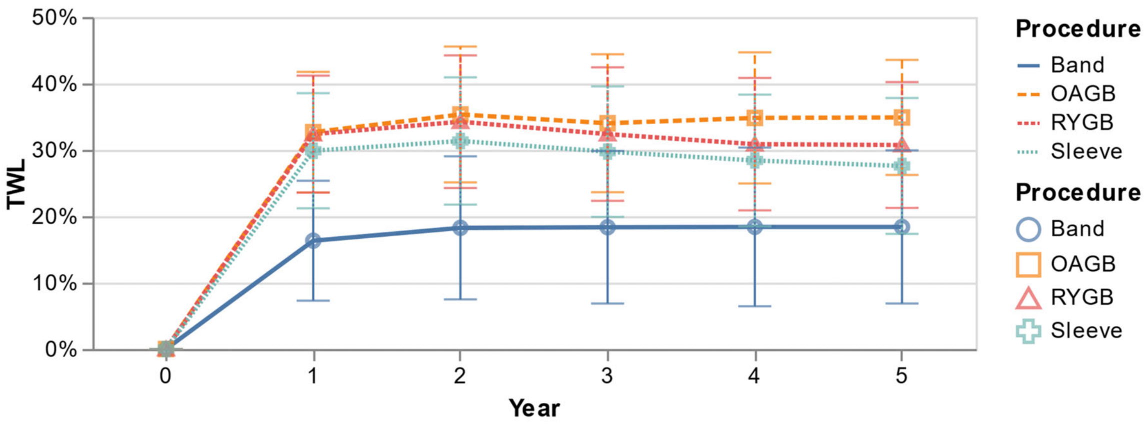


Fig. 1. Participation in the Australian arm of the Australia and New Zealand Bariatric Surgery Registry.



Years since surgery	1	2	3	4	5
Adult Participants reached time point (n)	90,708	72,548	56,177	37,617	21,502
Adult Participants with follow-up available (n)	58,416	34,810	19,660	10,301	4,797
Adult Participants with total weight loss data available and have NOT had a conversion procedure (n)	48,270	26,330	14,715	7,765	3,566

Fig. 2. Weight loss according to metabolic bariatric procedure for adult participants who had not undergone a conversion surgery.

Weight loss outcomes

21 502 adult participants have reached 5-years of follow up. 5-year follow-up weight was available for 3566 (16.5%) of participants who had not had a conversion procedure, with the sample size required for 95% confidence and 5% margin of error being 378.

Total body weight loss (TBWL) for participants at 5-years who had undergone an AGB were 17.6% (SD 11.8%), SG 26.5% (SD 10.3%), OAGB 34.88% (SD 8.67%) and RYGB 30.73% (SD 9.47%) ($P < 0.001$) (Fig. 2).

Participants included in weight loss analysis at 5-years were significantly older (44.8 years (SD 11.9) versus 42.2 years (11.5); $P < 0.001$; 95% CI 2.106–2.937), more often treated in a government funded hospital (13.3% versus 9.5%; $P < 0.001$), more commonly male (25.4% versus 22.7%; $P = 0.002$) and more likely to be requiring insulin at baseline (4.7% versus 3.5%; $P = 0.001$) when compared to the group with missing information or who had undergone a conversion surgery. Initial BMI was comparable (43.7 (SD 7.9) versus 43.9 (SD 7.9); $P = 0.09$; 95% CI −0.5 to 0.04).

Diabetes outcomes

13 904 (13.6%) of primary participants were recorded as being treated for diabetes at baseline. 12560 of this cohort have reached their one-year anniversary with information on diabetes treatment available at this timepoint for 7256 (57.8%). Of these, no medication requirement for diabetes was reported by 5194 (71.6%).

3291 (23.7%) primary participants who were recorded as being treated for diabetes at baseline are now 5-years post procedure with data on diabetes treatment available for 716 (21.8%). No medication for diabetes was required by 437 (61.0%) (Fig. 3).

Revisional surgery

There have been 3742 (3.7%) primary participants who have undergone 5109 subsequent procedures following their index procedure, with 1693 (45.2%) of these primary participants converting their original primary procedure to another type of bariatric procedure. The median time to first conversion was 3.0 years (IQR = 2.6 years).

Indications for subsequent procedures were available for 63% of procedures as this is not a mandatory field of the BSR. The top five reasons for any subsequent procedure were reflux, stricture or stenosis, leak from staple line or anastomosis, weight regain and AGB port replacement.

Discussion

These data confirm, in a real-world setting, that metabolic bariatric surgery provides both substantial weight loss and improvement in health, as indicated by reduced need for diabetes treatment. These positive changes appear to be durable in the medium term (5-years). Importantly, we have confirmed the immediate safety of metabolic bariatric surgery with a very low mortality and morbidity rate at 90-days post operation in a real-world dataset which are broadly equivalent to "best-practice" benchmarking targets that were ascertained from data provided by 19 high volume expert centres.[11] However, there is an emerging requirement for surgery to convert

Table 1 Characteristics of the participants and procedures captured by the Australian BSR: 122567 participants with 134 625 completed procedures

	Registry outcomes
Sex (*n*)	
Total participants	**122 567**
Female participants	96 823
Primary procedures on female participants	79 766
Revision procedures on female participants	27 148
Male participants	25 738
Primary procedures on male participants	22 525
Revision procedures on male participants	5180
Another term – all primary	6
Mean (SD) age day of surgery	
All procedures	**44.0 (11.8)**
Primary procedures	42.6 (11.6)*
Revision procedures	48.6 (11.3)*
Procedures on female participants	43.5 (11.7)
Primary procedures on female participants	41.9 (11.5)
Revision procedures on female participants	48.2 (11.2)
Procedures on male participants	46.0 (11.8)
Primary procedures on male participants	44.8 (11.6)
Revision procedures on male participants	51.2 (11.3)
Mean (SD) BMI day of surgery (kg/m^2)	
Total	**41.7 (7.6)**
Primary procedures	42.4 (7.2)#
Any subsequent procedure	39.5 (8.3)#
Revision – corrective	36.4 (8.7)
Revision– conversion	40.1 (8.1)
Revision – reversal	39.0 (8.4)
Procedure type – primary (*n*)	
Total	**102 297**
Sleeve gastrectomy	81 887
Roux-en-Y gastric bypass	7059
One anastomosis gastric bypass	6559
Adjustable gastric band	6345
SADI/SIPS	224
Other	223
Procedure type – subsequent (*n*)	
Total	**32 328**
Conversion surgery	*17 959*
Sleeve gastrectomy	5674
Roux-en-Y gastric bypass	7033
One anastomosis gastric bypass	2978
Adjustable gastric band	1952
SADI/SIPs	322
Surgical reversal gastric band	*9712*
Surgery to correct a complication	*4657*
Dilatation of stricture	991
Port revision	1191
Lavage/washout/drainage	523
Other	1952

Note: *95% CI = 5.94–6.22; $P < 0.001$. #95% CI = 4.03–4.43; $P \leq 0.001$.

one type of metabolic bariatric surgery to another (conversion surgery).

Similar to international experience, SG is the most popular primary procedure in our country.[12] Whilst TBWL was significantly better with the bypass procedures (RYGB and OAGB) than the LSG and LAGB at 5-year follow up, which is similar to the findings of the Scandinavian Registries at 12-months.[13] All procedures provided durable weight loss that was above 15 %TBWL, a level which has been shown to correlate with improved metabolic health in previous cohort studies[14] and randomized controlled trials.[15]

Table 2 Univariate multinomial regression estimates for procedure type selection

A: RYGB versus sleeve (ref)	RRR (95% CI)	*P*-value
Age (at day of surgery)		
<40 years	0.62 (0.56–0.69)	<0.001
≥40 years	Reference	–
Initial BMI		
<40 kg/m^2	0.74 (0.64–0.87)	<0.001
≥40 kg/m^2	Reference	–
Sex		
Female	Reference	–
Male	0.99 (0.89–1.11)	0.87
Diabetes status		
Yes	2.72 (2.29–3.24)	<0.001
No	Reference	–
Site type		
Public	2.02 (1.04–3.91)	0.04
Private	Reference	–
Site jurisdiction		
NSW/ACT	0.29 (0.13–0.62)	0.001
VIC/TAS	1.03 (0.51–2.09)	0.93
QLD	Reference	–
SA/NT	2.24 (0.95–5.29)	0.06
WA	0.17 (0.06–0.48)	0.001

B: OAGB versus sleeve (ref)	RRR (95% CI)	*P*-value
Age (at day of surgery)		
<40 years	0.76 (0.68–0.85)	<0.001
≥40 years	Reference	–
Initial BMI		
<40 kg/m^2	0.58 (0.44–0.77)	<0.001
≥40 kg/m^2	Reference	–
Sex		
Female	Reference	–
Male	1.12 (1.00–1.26)	0.05
Diabetes status		
Yes	1.93 (1.54–2.41)	<0.001
No	Reference	–
Site type		
Public	0.71 (0.33–1.54)	0.38
Private	Reference	–
Site jurisdiction		
NSW/ACT	1.07 (0.41–2.83)	0.89
VIC/TAS	0.55 (0.20–1.55)	0.26
QLD	Reference	–
SA/NT	4.27 (1.04–17.50)	0.04
WA	0.63 (0.12–3.33)	0.59

C: Adjustable gastric band versus sleeve (ref)	RRR (95% CI)	*P*-value
Age (at day of surgery)		
<40 years	0.86 (0.73–1.02)	0.08
≥40 years	Reference	-
Initial BMI		
<40 kg/m^2	1.59 (1.23–2.04)	<0.001
≥40 kg/m^2	Reference	-
Sex		
Female	Reference	-
Male	0.98 (0.87–1.11)	0.77
Diabetes status		
Yes	1.00 (0.73–1.36)	0.98
No	Reference	–
Site type		
Public	3.32 (1.24–8.83)	0.02
Private	Reference	–
Site jurisdiction		
NSW/ACT	0.50 (0.15–1.67)	0.26

C: Adjustable gastric band versus sleeve (ref)	RRR (95% CI)	P-value
VIC/TAS	16.68 (5.19–53.61)	<0.001
QLD	Reference	–
SA/NT	4.41 (1.16–16.84)	0.03
WA	1.65 (0.38–7.25)	0.51

Note: Sleeve gastrectomy is the reference category for the multinomial regressions (procedure selection against each predictor variable). RRR = relative-risk ratio (of having procedure type of focus selected instead of sleeve). RRR > 1: more likely to choose this procedure over sleeve.

Obesity is a major risk factor for diabetes and weight reduction is an important part of any treatment strategy for diabetes.[15–17] There have been 12 RCT comparing metabolic bariatric surgery to medical treatment for diabetes. All but one of these trials demonstrated that 'remission' of diabetes (broadly defined as no medication required to achieve glycaemic control) was more likely in the surgical arms, with rates of remission reported from 22% to 90% at 1–5-years post-surgery. Remission rates in the four trials reporting on 5-year outcomes ranged from 15% to 55%.[1]

Whilst the BSR did not collect HbA1C or other direct measures of glycemic control, the need for medication as a treatment for diabetes was recorded at baseline and annually. Our real-world data confirmed the positive findings of previous RCT, showing that 71%

Table 3 Defined adverse events by procedure

Type of procedure	Number completed	Completed perioperative follow up		Defined adverse events	
		n	%	*n*	%
Total	**134 625**	**117 198**	**87.1%**	**4269**	**3.6%**
Primary	**102 297**	**88 948**	**87.0%**	**1922**	**2.2%**
Sleeve gastrectomy	81 887	70 729	86.4%	1174	1.7%
Roux-en-Y gastric bypass	7059	6144	87.1%	406	6.6%
One anastomosis gastric bypass	6559	5746	87.6%	204	3.6%
Adjustable gastric band	6345	5995	94.5%	122	2.0%
SADI/SIPs	224	168	75.0%	9	5.4%
Other	223	166	74.4%	7	4.2%
Revision	**32 328**	**28 250**	**87.5%**	**2347**	**8.3%**
Sleeve gastrectomy	5674	4984	87.9%	148	3.0%
Roux-en-Y gastric bypass	7033	6257	89.1%	666	10.6%
One anastomosis gastric bypass	2978	2523	84.7%	148	5.9%
Adjustable gastric band	1952	1775	90.9%	86	4.8%
SADI/SIPs	322	240	74.5%	25	10.4%
Surgical reversal gastric band	9712	8293	85.4%	126	1.5%
Dilatation of stricture	991	938	94.8%	452	48.2%
Port revision	1191	1034	87.0%	81	7.8%
Lavage/washout ± drainage	523	474	92.4%	202	42.6%
Other	1952	1732	88.9%	413	23.8%

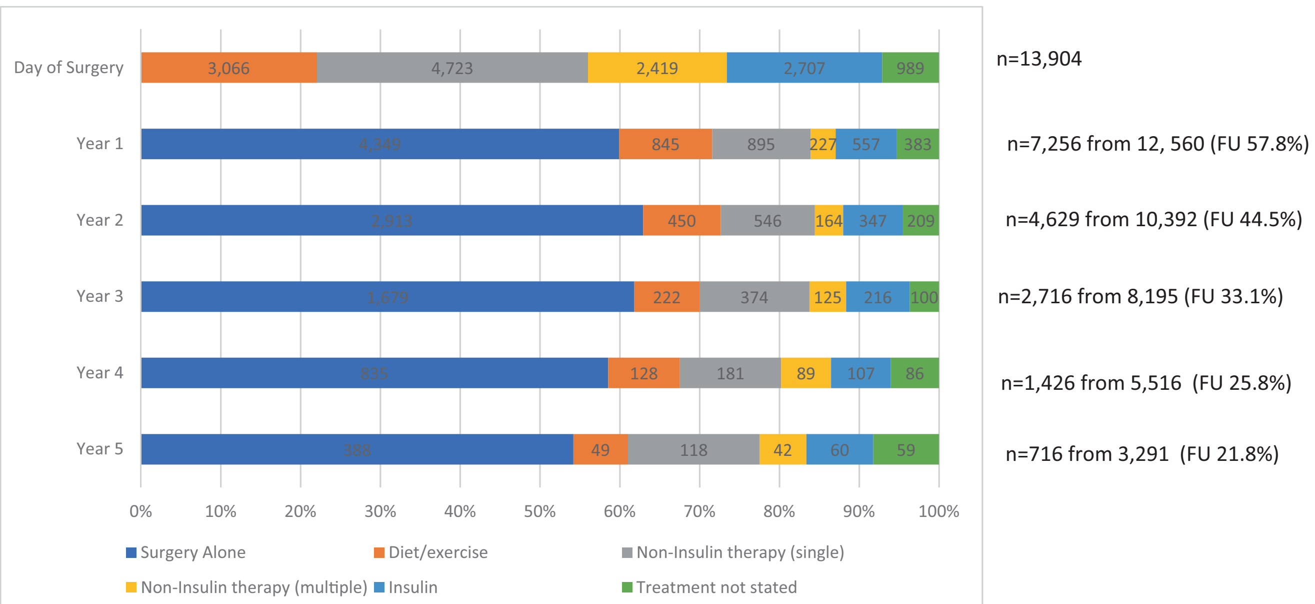


Fig. 3. Diabetes treatment before and after bariatric surgery.

of people with diabetes who underwent a metabolic bariatric procedure required no medication to treat their diabetes by 1 year. At 5 years, no medication was required by 61% of the participants with diabetes upon whom there is follow-up data. These data are limited by low follow-up rates particularly at later time points, however, they are similar to those reported by the Scandinavian Obesity Surgery Registry[18] providing surety that the RCT from specialist centres translate at a community clinical level.

There has been an increase in conversion surgery over the period of this report. Bypass procedures (RYGB and OAGB) appear to be the most popular conversion options following LSG and LAGB, which is again similar to international experience.[12] It is important for people who undergo a bariatric procedure to understand that they may need a subsequent procedure to continue to manage their obesity or treat unwanted side-effects and emphasizes the need for patients to remain in long-term follow-up.

The strengths of this series are the number of patients who were enrolled in the registry over a 10-year period, the 75% participation rate at baseline, high follow-up rates at 90-days post-operatively and the processes that ensures data integrity and accuracy. The limitations are the lost to follow-up rate at each annual timepoint, as well as missing data, particularly weight loss data at annual follow-up increasing the risk of selection bias. People with diabetes were more likely to be followed up than those without diabetes. However, the normal distribution of weight loss data, with very consistent standard deviation and standard error rates, indicates the estimated margin of error is 1.25% at 5-years post-operative. Older age and insulin use at the time of primary surgery are factors that have previously been associated with poorer weight loss outcomes after MBS.[19] Patients with these characteristics were over represented in the cohort available for weight loss analysis at 5-year, providing further reassurance about the validity of the weight loss findings.

This paper was intended to provide a high-level overview of the important outcomes from metabolic bariatric surgery in a real-world context. Future analyses are planned to address important issues such as revisional surgery, patterns of care and outcomes in people living with both obesity and diabetes in more detail. Patient reported outcomes will also be included in the registry from 2025, further strengthening reporting.[20,21]

Conclusion

These data from a longitudinal, prospective national registry confirm at the community level that metabolic bariatric surgery provides substantial weight loss that is sustained to 5-years. There is major change in diabetes treatment with many requiring no pharmacotherapy. Surgery is safe, however, there is a need for repeated surgery either for unwanted side-effects or loss of treatment effect.

Author contributions

Wendy A. Brown: Conceptualization; data curation; formal analysis; funding acquisition; methodology; project administration; resources; supervision; writing – original draft; writing – review and editing. **Dianne L. Brown:** Conceptualization; data curation; formal analysis; methodology; project administration; supervision; writing – review and editing. **Jennifer F. Holland:** Data curation; funding acquisition; project administration; resources; supervision; writing – original draft. **Angus Campbell:** Data curation; formal analysis; software. **Jenifer Cottrell:** Data curation; funding acquisition; project administration; resources; supervision. **Susannah Ahern:** Conceptualization; data curation; formal analysis; funding acquisition; methodology; writing – review and editing. **Jennifer Reilly:** Data curation; formal analysis; validation; writing – review and editing. **Patrick Garduce:** Formal analysis; methodology. **James Wetter:** Data curation; formal analysis; project administration; software. **Jeffrey M. Hamdorf:** Conceptualization; funding acquisition; project administration; resources; writing – original draft; writing – review and editing. **Michael Talbot:** Conceptualization; funding acquisition; methodology; project administration; supervision; writing – original draft; writing – review and editing. **Samuel Baker:** Conceptualization; funding acquisition; methodology; resources; writing – review and editing. **Andrew D. MacCormick:** Conceptualization; data curation; formal analysis; funding acquisition; methodology; project administration; supervision; writing – original draft; writing – review and editing. **Ian D. Caterson:** Conceptualization; data curation; formal analysis; funding acquisition; investigation; methodology; project administration; resources; supervision; writing – original draft; writing – review and editing.

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Data availability statement

The BSR curates personal information that is identified at the level of the individual. The BSR does not have ethical approval to share individual level data with any external party. Under Australian Privacy Laws these data cannot be shared unless a specific privacy waiver or ethical approval is obtained. The BSR may share aggregated data upon request.

Conflict of interest

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Supporting information

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Data S1. Supporting Information.