

BMJ Open Prioritising patients for bariatric surgery: building public preferences from a discrete choice experiment into public policy

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ABSTRACT

Objectives: To derive priority weights for access to bariatric surgery for obese adults, from the perspective of the public.

Setting: Australian public hospital system.

Participants: Adults (N=1994), reflecting the age and gender distribution of Queensland and South Australia.

Primary and secondary outcome measures: A discrete choice experiment in which respondents indicated which of two individuals with different characteristics should be prioritised for surgery in repeated hypothetical choices. Potential surgery recipients were described by seven key characteristics or attributes: body mass index (BMI), presence of comorbid conditions, age, family history, commitment to lifestyle change, time on the surgical wait list and chance of maintaining weight loss following surgery. A multinomial logit model was used to evaluate preferences and derive priority weights (primary analysis), with a latent class model used to explore respondent characteristics that were associated with variation in preference across the sample (see online supplementary analysis).

Results: A preference was observed to prioritise individuals who demonstrated a strong commitment to maintaining a healthy lifestyle as well as individuals categorised with very severe ($\text{BMI} \geq 50 \text{ kg/m}^2$) or (to a lesser extent) severe ($\text{BMI} \geq 40 \text{ kg/m}^2$) obesity, those who already have obesity-related comorbidity, with a family history of obesity, with a greater chance of maintaining weight loss or who had spent a longer time on the wait list. Lifestyle commitment was considered to be more than twice as important as any other criterion. There was little tendency to prioritise according to the age of the recipient. Respondent preferences were dependent on their BMI, previous experience with weight management surgery, current health state and education level.

Conclusions: This study extends our understanding of the public's preferences for priority setting to the context of bariatric surgery, and derives priority weights that could be used to assist bodies responsible for commissioning bariatric services.

Strengths and limitations of this study

- This study uses a robust methodology grounded in welfare choice theories to derive weights that could be used to prioritise patients for bariatric surgery, from the perspective of the general public.
- This study represents the preferences of a large sample of adults, representative of the general population in Australia by age and gender.
- The sample was recruited from a research panel in Australia, which may limit generalisability of the findings.

INTRODUCTION

Obesity is a substantial public health problem with increasing prevalence in most countries. Bariatric surgery is recognised as a cost-effective intervention for the management of adult obesity, leading to sustained weight loss and remission from obesity-related conditions (most notably, type II diabetes mellitus).^{1–5} Guidelines recommend bariatric surgery be considered after non-surgical interventions have failed for those with a body mass index (BMI) greater than 40 kg/m^2 , or greater than 35 kg/m^2 with comorbid conditions.^{4 6} Waiting lists for bariatric surgery are growing fast and outstripping the availability of the procedure in many high-income countries. The capacity of health systems, especially publicly funded systems, to expand service provision is limited in terms of budgetary allocation and the required medical expertise. In this limited resource setting, criteria are inevitably required to prioritise access.

There is also increasing evidence that the distribution of bariatric surgery is not associated with need. For example, in Australia, access is extremely limited in the public

hospital system, with only 7% of bariatric surgeries performed in public hospitals.⁷ Perversely but perhaps unsurprisingly, the lowest rates of access are reported in lower socioeconomic groups who have the highest obesity prevalence and would be likely to benefit most.⁸ Provision of bariatric surgery varies across the six Australian States^{3 7} and anecdotally has resulted in a lack of access in some areas, with long waiting lists where access is limited. Given the socioeconomic inequality, and its demonstrated cost-effectiveness for the treatment of obesity, there is pressure to expand the provision of bariatric surgery services in public hospitals.³

Public opinion is widely acknowledged as an important consideration in priority setting,^{9–12} and several models of public participation are available to guide engagement approaches.^{13–17} A clear consensus on how public opinion should be incorporated in healthcare decision-making and the impact of its inclusion is lacking.^{10 18–20} Nevertheless, normative ethical (eg, procedural justice),²¹ economic^{22–24} and political (eg, deliberative democracy)²⁵ arguments provide strong support for the consideration of public preferences alongside other clinical and economic evidence when developing prioritisation criteria. Rationales for public engagement in priority-setting include promoting public confidence in the health system, increasing the transparency, accountability and legitimacy of rationing decisions and improving the responsiveness of the health system.^{9 21 26 27} Moreover, considering public preferences is likely to be of particular importance when policy decisions allocate priorities across population groups or incorporate social value judgements, as may be anticipated in the case of obesity.^{25 28–30} In the context of priority-setting for public resource allocation, it has been argued that it is the preferences of the general public rather than any subgroup who benefit that should be considered. The public as a whole fund the health system through taxation and pay any opportunity cost associated with funding a particular intervention. Moreover, using the ‘average’ preference of a representative sample of the general public avoids any self-interest that might be associated with decision-making.^{24 31}

Consequently, this preference study aimed to assess the relative importance of potential criteria and trade-offs the public would make when prioritising access to bariatric surgery for obese adults in Australia, and to use these preferences to develop ‘priority weights’ that could be assigned to criteria to prioritise access to bariatric surgery for adults.

METHODS

This paper presents a substudy of a larger project aiming to investigate methods for engaging the public in healthcare decision-making.^{32 33} A discrete choice experiment (DCE) was used to measure preferences and derive importance for different criteria that might

be used to prioritise bariatric surgery for individuals. The DCE is a stated preference method that has gained popularity as an approach to eliciting preferences in health,^{34–37} including for setting priorities.³⁸ In the context of priority setting, it allows the derivation of ‘priority weights’ for different criteria on a common interval scale, and quantification of the trade-offs people would be willing to make between different criteria.

DCE survey instrument

The DCE was undertaken according to best practice guidelines.³⁹ In the DCE, respondents were asked to make 19 (18+1 repeat choice; explained below) hypothetical choices between two different patients who would both benefit from surgical management for their obesity. Potential surgery recipients were described according to seven different characteristics or attributes which were chosen to represent possible prioritisation criteria (table 1). These attributes and the description of their levels were developed using a two stage process. First, a literature review was undertaken to indicate generic criteria of potential importance to the public in priority setting.³⁸ Second, the initial generic criteria were refined in consultation with research partners and an expert focus group to include potential condition-specific criteria to prioritise obese patients for bariatric surgery.

The levels of the attributes varied between the hypothetical patients in the choice sets according to a systematic D_p -efficient design, utilising prior coefficient values obtained from a pilot study. This approach maximised the statistical efficiency of the design while ensuring that all main effects and selected two-way interaction effects could be estimated independently.⁴⁰ The final design consisted of 162 different choice sets (example choice set in figure 1), which were divided into 9 blocks of 18 choice sets. A 10th D-efficient block of 18 choice sets was also used to allow comparison of the data to other samples who completed this block only, for purposes related to the wider project which are beyond the scope of the current paper.³² Thus, there were 10 survey versions, each consisting of 18 different choice sets. One choice set was reversed and repeated as a 19th choice set in each version as an indicator for internal choice consistency; responses to the 19th repeat choice set were excluded from the DCE analysis (as this was a duplicate choice set and not part of the experimental design). Respondents were randomised to one of the 10 survey versions.

Extensive pilot testing was undertaken to confirm the face validity of the instrument, prior to main data collection. This involved face-to-face completion of the survey by an adult convenience sample ($n=20$), with qualitative exploration of understanding of the instrument along with estimation of a preliminary choice model. The final survey (see online supplementary material) presented some background information on obesity, an explanation of the choice task, followed by the 19 choice sets.

Table 1 Attributes and levels

Attribute	Level
Current level of obesity	<ul style="list-style-type: none"> ► Obesity (BMI 30 to less than 40 kg/m²) ► Severe obesity (BMI 40 to less than 50 kg/m²) ► Very severe obesity (BMI greater than 50 kg/m²)
Obesity-related conditions	<ul style="list-style-type: none"> ► Already has obesity-related conditions ► Is at risk of developing obesity-related conditions
Age of person needing surgery	<ul style="list-style-type: none"> ► 20 years ► 35 years ► 50 years
Family history	<ul style="list-style-type: none"> ► At least one parent or sibling is obese, has had weight issues since childhood ► No family history of obesity
Chance of maintaining a substantial (at least half) reduction in excess weight	<ul style="list-style-type: none"> ► 30% ► 50% ► 70%
Has shown commitment by responding to prescribed lifestyle intervention (ie, physical activity and diet)	<ul style="list-style-type: none"> ► Has maintained a healthy lifestyle plan for several months, resulting in some weight loss, however is still in need of surgery ► Has not maintained a healthy lifestyle plan and has had no weight loss
Time already spent on surgery waiting list	<ul style="list-style-type: none"> ► 6 months ► 1 year ► 2 years

BMI, body mass index.

It also collected information about the respondent's sociodemographic characteristics, health including their current health state (AQoL-8D⁴¹), and self-reported height and weight (which was used to estimate respondent BMI).

Sample

The DCE was administered between November 2013 and February 2014 as part of an online survey to a target sample of 2000 adults residing in Queensland and South Australia, recruited from an online survey panel. Quotas were used to ensure the sample was representative by age and gender for each State. A target sample of 2000 was chosen to ensure precise estimation of preference parameters while also allowing flexibility in modelling heterogeneity.⁴²

Data analysis

A multinomial logit model (MNL) was used to evaluate preferences across the whole sample.⁴² The model coefficients indicate the relative importance of each attribute level in explaining respondent choice. While the main focus of this paper is on the average preferences (based on the MNL model) of the sample, the extent to which preferences differed across respondent subgroups was explored in an online supplementary analysis using a latent class model.⁴³ The latent class model can be understood as a process of clustering groups of individuals with similar preferences into a defined number of distinct preference classes. The

modelling approach is detailed in the online supplementary appendix.

To develop a prioritisation system based on the preferences of the public that could be used to prioritise individuals for bariatric surgery, 'priority weights' were derived based on the MNL model coefficients, to indicate the relative importance of the different criteria. This was achieved by estimating the marginal rate of substitution between each prioritisation criterion and effectiveness (ie, chance of maintaining weight loss).³⁹ The marginal rate of substitution (and therefore priority weight) for each criterion was estimated by dividing the marginal utility for that criterion level by the marginal utility for effectiveness. For example, the weight for prioritising an individual with 'very severe obesity' rather than 'obesity' is equal to the difference between the coefficients from the MNL model between these two attribute levels, divided by the coefficient for a one percentage increase in the chance of maintaining weight loss (ie, priority weight= $((0.28\ 751 - (-0.30\ 626))/0.01\ 530)=38.80\ 850$; from results presented in [tables 3](#) and [4](#); calculations performed prior to rounding of decimal places). This represents the amount of effectiveness that respondents were willing to trade in order to prioritise an individual who met other desirable criteria that were considered to be relevant. Importantly, this approach ensures the priority weights are presented on an interval scale; thus, the weights can be summed for any individual patient requiring surgery in order to rank patients. We illustrate how the priority weights may be used in practice, using three hypothetical patients.

The following two people both need surgical management for their obesity. Surgery is likely to be the only way to reduce their body weight and their health risks. Both people meet the hospital's clinical criteria for surgery, and the surgery has been recommended by their doctors. However, demand for the surgery is very high, and only one person can have their surgery now. The other person will have to wait at least another 12 months for surgery. Who should have their surgery now?

	Person A	Person B
Current level of obesity	Very Severe Obesity (BMI greater than 50 kg/m ²)	Obesity (BMI 30 to less than 40 kg/m ²)
Obesity-related conditions	Is at risk of developing obesity-related conditions	Already has obesity-related conditions
Age of person needing surgery	50 years	20 years
Family history	At least one parent or sibling is obese, has had weight issues since childhood	No family history of obesity
Chance of maintaining a substantial reduction in excess weight	30%	30%
Has shown commitment by responding to prescribed lifestyle intervention	Has maintained a healthy lifestyle plan for several months, resulting in some weight loss, however is still in need of surgery	Has maintained a healthy lifestyle plan for several months, resulting in some weight loss, however is still in need of surgery
Time already spent on surgery waiting list	6 months	2 years
Who should have their surgery now?	Person A	Person B

Figure 1 Example choice set.

RESULTS

Respondent characteristics

A total of 4632 individuals accessed the survey link; of these, 2473 met the eligibility criteria related to age and Australian State and started the survey. The survey was completed by 1994 adults. The characteristics of respondents are given in [table 2](#). The sample had a mean age of 46.6 years (range 18–88 years), 52.1% were female, 60% had a BMI ≥ 25 (indicating they were overweight or obese) and 7.1% reported previous experience with weight management surgery for themselves or a family member. Compared to adults in Australia, the sample were similar in gender, age, indigenous identity, BMI and private health insurance status. On average, the sample had a slightly lower education level, were less likely to be employed, had a lower household income and lower health status than the general population.

Choice responses

A total of 35 892 choice observations were available for analysis in the preference model (18 choices from each of 1994 respondents). The majority (72.5%) of respondents provided a consistent response to the repeat choice set. Exclusion of inconsistent respondents made no notable impact on the findings (in terms of significance and rank of the model parameters; data not presented). Therefore, all respondents were included for the analyses.⁴⁴ Most (64.3%) respondents reported that

they found the survey to be only slightly difficult or not difficult at all.

Priority criteria

The MNL raw coefficients are presented in [table 3](#) and the prioritisation criteria considered to be important for the public are presented in [table 4](#) and graphically in [figure 2](#). On average, there was a strong preference to prioritise those who had shown commitment to lifestyle change before surgery (weight 79.81, 95% CI 75.79 to 83.88). There was also a significant preference to prioritise very severely obese individuals (BMI ≥ 50 kg/m²) over obese individuals (BMI ≥ 30 kg/m²). However, this criterion (weight 38.81, 95% CI 36.41 to 41.23) was considered to be only half as important as prioritising those who had shown lifestyle commitment. The preference to treat severe obesity (BMI ≥ 40 kg/m²) over obesity (BMI ≥ 30 kg/m²) was less strong. Respondents also wanted to prioritise those who already have obesity-related comorbidity, with a family history of obesity, with a greater chance of maintaining weight loss, or who had spent a longer time on the wait list.

There was little inclination to prioritise by age. A small weight was assigned on average to treating a 50-year-old (3.62; 95% CI 1.30 to 5.93) rather than a 20-year old. The priority weight assigned to treating a 35-year old (3.84; 95% CI -0.31 to 8.00) was greater than for a 50 or 20-year old. Given the small and non-linear weights given to prioritising by age, we would not recommend including age as a prioritisation criterion in the development of any policy.

The estimated prioritisation criteria from the public perspective could be adopted into decision-making. A 'referent case', an individual who is obese (BMI ≥ 30 but < 40 kg/m²), is at risk of comorbid conditions rather than having developed them, has no family history of obesity, has not maintained a healthy lifestyle, has spent a maximum of 6 months on the waiting list, and is assumed to have a 30% chance of maintaining a substantial (at least 50%) reduction in excess weight, scores zero points. Other patients in need of surgery could be prioritised relative to this benchmark 'referent case'. [Table 5](#) indicates the priority weights given by the public sample to three hypothetical patients; if managed according to public preferences, priority would be allocated to the patient with the most points.

While the MNL model provides the results of the average respondent from a public sample that reflects the age and gender distribution of the Australian population and therefore provides the relevant weights from a policy perspective, four sociodemographic characteristics (BMI, history of weight loss surgery, AQL utility score and education level) were significantly associated with membership of a particular preference class in the latent class model ($p \leq 0.05$; see online supplementary appendix). Notably, respondents who were not overweight or obese, who had no experience of weight loss

Table 2 Respondent characteristics

Characteristic		Number	Per cent (n=1994)*	Australia†
Gender	Female	1038	52.1	50.2%
Age	Mean (SD)	46.6 (16.5)		
	≥50 years	849	42.60	41.5% (≥ 15-year)
State	Qld	1484	74.40	
	SA	510	25.60	
Indigenous	Yes	50	2.50	2.5%
Born in Australia‡	Yes	1472	73.80	72.3%
Main language spoken at home	English	1875	94.00	
Education (highest)	Certificate, Diploma or degree	892	44.70	59% (25–64 year)
Employment	Part or full time	1075	53.90	60.5% (≥15-year civilian population)
Worked in health system	Yes (during past 10 years)	227	11.40	
Income (annual household)‡	>AU\$100 000	374	21.80	35.1% (>AU\$104 400)
Private health insurance	Hospital cover	945	47.40	47%
Health				
AQoL-8D health state utility	Mean (SD)	0.69 (0.21)		Mean 0.86
	≥0.8	750	37.84	
BMI	≥25	1171	60.10	61.4%
Perceived weight‡	Overweight or obese	1052	53.50	
Health service				
Hospital admissions	≥1 in past 12 months	399	20.01	13.2%
GP visits	≥4 in past 12 months	679	34.10	31.9%
Previous weight management surgery	For self or close family member	141	7.10	

*Valid per cent for AQoL-8D health state utility (12 missing responses); Income (277 missing or prefer not to say); BMI (calculated from height and weight with 46 missing or prefer not to say); Perceived weight (29 missing or prefer not to say).

†Source for Australian demographic norms: Australian Bureau of Statistics (ABS) Catalogue 31010DO001_201403 Australian Demographic Statistics, Mar 2014 (gender, age); ABS Catalogue 2076.0 Census 2011 (Indigenous status); ABS Catalogue 3412.0 Migration, Australia, 2012–2013 (country of birth); ABS Catalogue 4102.0 Australian social trends 2007: Qualification of Australians (education); ABS Catalogue 6202.0 Labour Force Australia Oct 2014 (employment); ABS R Catalogue 6523.0 Household Income and Income Distribution, Australia, 2011–2012 (income); ABS Catalogue 4364.0 National Health Survey 2004–2005 (private health insurance); AQoL website <http://www.aqol.com.au/index.php/norms> (AQoL-8D); AIHW 2010⁷ (BMI); ABS Catalogue 4839.0.55.001 Health Services: Patient Experiences in Australia, 2009 (hospital admissions and G.P. services).

‡Income, born in Australia and perceived weight were not entered into the LC model, since they displayed correlations above 0.3 with other included variables.

BMI, body mass index; GP, general practitioner.

Table 3 MNL model parameters

Attribute	Level	Coefficient	p Value	Lower 95% CI	Upper 95% CI
Level of obesity	Obesity	−0.306	Ref		
	Severe obesity	* 0.019	0.094	−0.003	0.041
	Very severe obesity	*** 0.288	≤0.001	0.266	0.309
Obesity-related conditions	At risk of comorbidity	−0.205	Ref		
	Already has comorbidity	*** 0.205	≤0.001	0.191	0.219
Age of person	20 years	−0.038	Ref		
	35 years	0.021	0.519	−0.042	0.084
	50 years	0.017	0.341	−0.018	0.053
Family history	No family history	−0.082	Ref		
	Family history	*** 0.082	≤0.001	0.070	0.094
Chance of maintaining weight loss	per %	*** 0.015	≤0.001	0.014	0.016
Commitment	Not maintained health lifestyle	−0.611	Ref		
	Maintained healthy lifestyle	*** 0.611	≤0.001	0.589	0.632
Time on wait list	per month	*** 0.031	≤0.001	0.029	0.033

Ref: Referent level for the model specified with fixed parameter (given effects coding parameter for referent is equal to the negative sum of the parameters for the other levels for the attribute.⁶³).

***, **, *: Significance at 1%, 5%, 10% level.

MNL, multinomial logit model.

Table 4 Priority weights (based on marginal rates of substitution for MNL model)

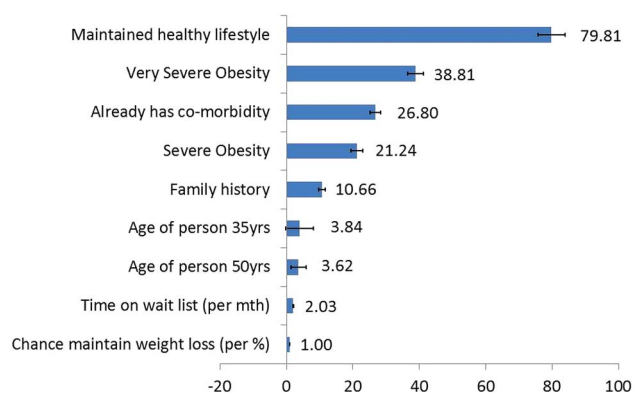
Attribute	Level*	Priority weight (ie, MRS chance in %) [†]
Level of obesity	Severe obesity	21.24 (19.46 to 23.04)
	Very severe obesity	38.81 (36.41 to 41.23)
Obesity-related conditions	Already has comorbidity	26.80 (25.24 to 28.37)
Age of person	Age 35 years	3.84 (−0.31 to 8.00)
	Age 50 years	3.62 (1.30 to 5.93)
Family history	Family history	10.66 (9.75 to 11.58)
Commitment	Maintained healthy lifestyle	79.81 (75.79 to 83.88)
Chance maintain weight loss	Per % above 30%	1.00 (fixed weight)
Time on wait list	Per month above 6 months	2.03 (1.89 to 2.16)

*Referent levels for marginal rates of substitution (MRS): obesity, at risk of comorbid conditions, 20 years old, no family history of obesity, has not maintained a healthy lifestyle, has spent a maximum of 6 months on the waiting list and has a 30% chance of maintaining a substantial (at least 50%) reduction in excess weight.

[†]Bracket indicates 95% CI, estimated using the delta method.⁶⁴

MNL, multinomial logit model.

surgery, or with better overall health were more likely to belong to a preference class for whom lifestyle commitment was considered to be particularly important. Respondents who were not overweight or obese or who had attained a lower education level were more likely to belong to a class for whom lifestyle commitment was considered to be unimportant. Finally, respondents who were overweight or obese were more likely to belong to a class who considered age should be a prioritisation criterion; though, some prioritised 20-year-olds and some prioritised 50-year-olds. Therefore, individuals differing on these characteristics (BMI, history of weight loss surgery, AQL utility score and education level) may systematically allocate different priorities across patients requiring surgery than the general public.

**Figure 2** Priority weights for surgery according to criteria (from multinomial logit model model).

Footnote to figure 2: Priority weights are relative to a score of zero for an individual who has obesity, is at risk of comorbid conditions rather than having developed them, has no family history, has not maintained a healthy lifestyle, has spent 6 months on the waiting list, and has a 30% chance of maintaining a substantial (at least 50%) reduction in excess weight. Priority points for time on wait list are per each month over 6 months and for change of maintaining weight loss are for each % over 30%.

DISCUSSION

This is the first study to derive preferences of the public that could be used to prioritise elective surgery in the contentious policy area of bariatric surgery, where current demand strongly exceeds the health system's willingness and capacity to supply. The public clearly consider a demonstrated commitment to establishing and maintaining a healthy lifestyle to be the most important prioritisation criterion. Severity of obesity at baseline, the existence of comorbidities and the likely sustained effectiveness of the intervention were all considered to be important, and consistently so, across all preference subgroups. Prioritising surgery for those with a family history of obesity was relevant for the sample overall, but to a lesser extent than the other criteria. Time on the waiting list was also important for the sample overall. The priority weights developed in this study according to a rigorous and systematic methodology can be used to assign priority for access to individuals who may benefit from bariatric surgery. Although this study was undertaken in Australia, it has relevance for other countries, especially relatively high-income countries with well-developed public health systems.

The indicated importance of these criteria, particularly a desire to prioritise the most severely obese and those with comorbidities, are largely consistent with previous studies that suggest public preferences in other health priority setting contexts would prioritise those who are most severely affected by the condition being treated.³⁸ They are also largely consistent with existing obesity guidelines, which recommend the use of BMI and/or comorbidities as criteria for surgery.^{4 6} However, the strong preference to prioritise those who have shown a prior commitment to changing their lifestyle in support of weight loss, which was by far the most important criterion in this study, is somewhat of an exception. In general, the importance of lifestyle or personal responsibility for illness (when previously explored in preference studies) suggest these may be relevant to the public, but they have generally been found to be of

Table 5 Illustrative priority for three hypothetical patients, compared to a 'referent case'

	'Referent case'	Patient 1	Patient 2	Patient 3
Commitment	No <i>0 points</i>	No <i>0 points</i>	No <i>0 points</i>	Yes <i>79.81 points</i>
Level of obesity	Obese (BMI 30 to <40 kg/m ²) <i>0 points</i>	Severe (BMI ≥40 kg/m ²) <i>21.24 points</i>	Very severe (BMI ≥50 kg/m ²) <i>38.81 points</i>	Very severe (BMI ≥50 kg/m ²) <i>38.81 points</i>
Obesity-related conditions (comorbidity)	No <i>0 points</i>	No <i>0 points</i>	Yes <i>26.80 points</i>	Yes <i>26.80 points</i>
Family history	No <i>0 points</i>	No <i>0 points</i>	No <i>0 points</i>	No <i>0 points</i>
Time on wait list	≤6 months <i>0 points</i>	12 months <i>(6×2.03) points</i>	12 months (6×2.03) <i>points</i>	6 months <i>0 points</i>
Assumed chance maintain substantial reduction in weight loss	30% <i>0 points</i>	30% <i>0 points</i>	40% <i>(10×1.00) points</i>	50% <i>(20×1.00) points</i>
Total priority points	<i>0 points</i>	<i>33.42 points</i>	<i>87.79 points</i>	<i>165.42 points</i>

BMI, body mass index.

relatively minor importance compared to other prioritisation criteria, and may well be context dependent.^{38 45} However, personal responsibility has been found to be a strong predictor of public opinion around the allocation of donor livers, where public preferences have favoured allocation to naturally occurring rather than alcoholic liver disease.⁴⁶ The public have also supported rationing treatment for patients with 'unhealthy lifestyles' in opinion polls.⁴⁷ Furthermore, the perceived importance of lifestyle commitment is also rational, in that weight loss maintenance after most forms of surgery requires continued lifestyle change that is, there will be regression in any weight loss if an appropriate diet and physical activity regimen are not adopted. Nevertheless, we are not aware of any previous preference study that has attempted to quantify priorities for bariatric surgery from a public perspective, and as such this applied study makes an important contribution to develop priority weights that could be assigned to encapsulate the general public's preferences in prioritising access to bariatric surgery for adults.

Age as a criterion for access to care is a contentious issue, and has been found to be of varying importance for the public in previous studies.^{38 48–56} Age was not important for most respondents to this study in the context of prioritising bariatric surgery. This is consistent for example with the deliberations of the National Institute for Health and Care Excellence Citizens' Council in the UK, that age should not be considered as a prioritisation criterion (in health technology assessment), unless it is associated with the level of health outcome.⁵⁷ However, variation in preferences was observed across respondents in the latent class model, including for the age criterion (which was important for some classes). Interestingly, the age of the respondent was not found to be associated with preference for prioritising bariatric surgery in the latent class model; suggesting, self-interest does not explain choices for priority

setting by age. The supplementary finding of variation of preferences across respondents highlights the need to ensure a relevant and representative sample is achieved when canvassing preferences to inform policy. It seems likely that the differing opinions around prioritising by age found in previous studies may be explained at least in part by the distinct preference samples involved.³⁸ Our results suggest that, at least in the context of prioritising for bariatric surgery in Australia, recipient age should not be a prioritisation criterion (beyond any capacity it has to impact on outcomes). Whether this also applies in other contexts and countries is an empirical question requiring further investigation.

The choice tasks given to respondents in this study were of necessity somewhat simplified to enable their administration to laypersons in a survey format. However, the clinical decision-making context around the appropriateness of bariatric surgery for specific individuals and who would benefit most, is complex. For example, the benefits of surgery may extend beyond weight loss and include metabolic outcomes, leading to the emergence of 'metabolic surgery' which has differing therapeutic goals and a lower BMI criterion threshold, with some effects occurring independent of weight loss.^{58 59} Thus, the potential criteria used in this DCE may not be the only criteria of clinical relevance for selection of individuals for surgery. The inadequacy of BMI as a primary clinical criterion for selection for surgery and potential of other clinical criteria to augment selection has been highlighted.^{58 60} Further, those with a higher BMI and comorbidities such as diabetes, obstructive sleep apnoea and cardiac disease, may be at greater risk of adverse events from surgery.⁵⁸ Thus, the optimal selection of candidates for bariatric surgery from a clinical perspective so as to balance the benefits and risks of surgery is not straight forward. Nevertheless, despite these potential limitations, the current study focused on prioritising individuals for surgery assuming

surgery was considered to be clinically appropriate. Respondents were instructed in the survey to imagine that each of the potential surgery recipients had been clinically assessed to be in equal need of surgery to manage their obesity. Thus, any 'real world' clinical consideration around the benefit of surgery was held constant in each hypothetical choice and should not have impacted the hypothetical decisions.

Individuals participating in this study differed in their preferences for the importance of different prioritisation criteria. While respondent age was not observed to affect priority choices, BMI was perhaps unsurprisingly associated with preference class membership, reaffirming the need to give careful consideration to whose preferences are sought to inform priority decisions—the public or individuals with some direct or indirect experience of the condition.^{31 33 61 62} This study takes the normative position that it is the preferences of the public, rather than individuals with a specific condition, that are relevant for informing priority setting decisions. Moreover, for health services funded by taxation of the public, the public are a key stakeholder in how those funds are used. Therefore, the public's perspective is important for allocating funds to specific services. While this is an accepted approach in health economics in the context of priority setting,³⁸ the exploratory latent class analysis in this study suggests that the preferences of an obese population around priorities for bariatric surgery may differ to those of the general public. Although associations between preference and individual characteristics were tested for many sociodemographic characteristics, it is perhaps surprising that only four sociodemographic characteristics were associated with membership of different preference classes at conventional levels of significance in this large sample. It seems possible that class membership, particularly for potentially contentious decisions, might depend more strongly on attitudes and beliefs, cultural differences, and/or individual tastes, all of which are challenging to observe or measure, than on sociodemographic characteristics. However, we can conclude that the representativeness of the sample should be a key methodological consideration for preference studies that seek to inform public policy; and is likely to matter in particular where recipient age or personal responsibility is a criterion under consideration.

Consequently, the main limitation of this study is that we recruited from a panel sample. Although the sample was representative of the Australian public by age and gender, these two characteristics were not found to be significantly associated with preferences and we cannot be sure whether the sample reflects the diversity of the population on a wider range of characteristics that might be associated with preferences—not least because we have been unable to identify what those characteristics are. Although the sample only recruited from two Australian states, these states account for 27.2% of the Australian population. The sample differed descriptively

from the Australian population on a number of characteristics (education level, employment status, household income and health status). Of these, only health status and education level were found to be associated with preference class in secondary latent class analyses (see online supplementary material). Therefore, it is not known to what extent this recruitment approach may have impacted the representativeness of the overall sample preferences. Further research into characteristics beyond sociodemographics that might impact preferences, such as attitudes and beliefs, and the extent to which samples are representative on these less tangible characteristics, is needed. The implementation of the findings may also be limited since application of the priority weights requires an ability to predict the category into which each patient fits for each of the attributes, before their treatment. This may be challenging for the attribute 'chance of maintaining weight loss', since effectiveness is difficult to predict *a priori*. Nevertheless, estimates of effectiveness are available in the international literature. Alternatively, if distinguishing likely effectiveness between potential patients is considered to be unreliable, this attribute could be excluded from the priority estimates for all potential patients.

To support their capacity to make decisions in the DCE, respondents were provided with some basic information on obesity, its consequences, and its management at the start of the survey. However, obesity and its management is a complex issue and although the pilot study suggested the survey was easy to understand, respondent understanding of the obesity information was not tested in the main survey. Further studies investigating public opinion for prioritising bariatric surgery using a Citizens' Jury, which represents a deliberative approach in which participants are informed and can challenge experts before making recommendations on the issues, are planned as part of the parent study within which this DCE is undertaken.³²

In conclusion, this study extends our understanding of public preferences for priority setting in the allocation of bariatric surgery in public health services, and derives weights that could be used to prioritise patients for surgery. As such, it provides an exemplar for the growing interest in deriving public preferences to inform prioritisation decisions in healthcare. As preference for prioritisation criteria varied across respondents, achieving a representative sample on relevant characteristics including those that may be difficult to measure is likely to be an important methodological challenge when determining preferences to inform public policy. When setting priorities for the allocation of health services, evidence of public preferences offers a valuable contribution to political debate about the need for prioritisation and the defence of chosen priorities.

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Contributors JAW, JR, EK, PB, AW, PL, PH, RK, PAS conceived and advised on the study. JAW, JR, PAS developed the DCE and guided data collection. JAW led data analysis and interpretation, and drafted the manuscript. All authors contributed to data interpretation, reviewed the draft manuscript, contributed academic content and approved the final version. The authors acknowledge the project team and partners for support with data collection. JAW acts as overall guarantor for this study.

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Prioritising patients for bariatric surgery: building public preferences from a discrete choice experiment into public policy

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