The Australian Obesity Management Algorithm

Introduction

Obesity is a complex and multi-factorial chronic disease with genetic, environmental, physiological and behavioural determinants that requires long-term care. In 2017-18, 67% of Australians aged 18 years and over were above normal weight, with 31% having obesity [1]. Obesity is associated with a broad range of complications including type 2 diabetes, cardiovascular disease, dyslipidaemia, non-alcoholic fatty liver disease, polycystic ovary syndrome, sleep apnoea, depression, osteoarthritis and certain types of cancers. Obesity and its related complications place a considerable financial burden on Australia. In 2014-15, the direct and indirect costs of obesity were estimated at $8.65 billion [2].

This statement has been developed by a working group with representatives from the Australian Diabetes Society, the Australian and New Zealand Obesity Society, the Australian and New Zealand Metabolic Obesity Surgery Society and the Royal Australian College of General Practitioners. Membership of the working group is shown in Appendix 1.

The aims of the document are to:

1) Assist general practitioners (GPs) in treatment decisions for non-pregnant adults with obesity
2) Provide a practical clinical tool to guide the implementation of existing guidelines for the treatment of obesity in the primary care setting in Australia [3, 4]

Although the focus of this document is on weight loss interventions for the management of obesity, maintaining a healthy lifestyle and preventing weight gain in individuals whose weight is in the healthy or overweight range is an important and essential strategy to prevent a worsening of the current obesity epidemic in Australia.

Section1: Guiding principles

1. The benefits of weight loss

Weight loss in people with obesity has proven medical benefits in reducing the risk of diabetes and other obesity-related complications. For example, the 10-year follow-up of the US Diabetes Prevention Program showed that diabetes incidence was reduced by 34% in the lifestyle group and 18% in the metformin group, compared with placebo [5]. The weight loss required to achieve some of these medical benefits is relatively small. For example, the reduction in diabetes risk has been achieved with weight loss in the order of 5% [3]. However, some people with more severe obesity will require greater degrees of weight loss to improve their health, function and wellness.

2. The role of primary care

Primary care is critical to addressing Australia's obesity problem. While there is a common view that little can be done to assist individuals with obesity, this document illustrates that there are viable and effective treatment options but it is important that these are considered in the context that obesity is a complex chronic disease that requires long-term care, with many similarities to managing diabetes. Management of obesity in primary care requires a personalised approach, often in a shared care arrangement, with regular monitoring and the application of a variety of weight loss strategies, intensified over time if weight loss and health targets are not achieved.

Routine and regular consideration and assessment of weight are essential initial steps that allow identification of:

- individuals whose weight is affecting their health and who may benefit from weight management interventions, and/or
- individuals who are gaining weight and require counseling and weight management interventions to prevent further weight gain

Available resources could be better used in the management of obesity. For example, individuals with obesity are eligible for Medicare funded enhanced primary care plans including reimbursed allied health visits. In addition, people with type 2 diabetes and/or Aboriginal and Torres Strait Islander people are eligible for additional care plan services.

3. Weight bias – stigma - discrimination

Weight bias in obesity care is a common and important obstacle that can interfere with effective obesity treatment. Individuals with obesity face persistent societal prejudice, stigmatisation and discrimination. Unfair treatment or prejudice because of body weight is referred to as "weight bias" and translates by

stigmatisation and discrimination into inequities in employment, education and health-care. Common negative stereotypes of individuals with obesity include that they are lazy, unmotivated, lacking in self-discipline, less competent and noncompliant. Weight bias and stigmatisation, especially when internalised by those living with obesity, negatively affects psychological well-being and physical health. Weight bias is common among healthcare providers with accumulating evidence that individuals with obesity are perceived as lacking self-control, unmotivated to improve health, noncompliant with treatment, and personally to blame for their weight [6]. These attitudes affect outcomes and those who perceive bias from their healthcare providers have less trust in them, experience more difficulty losing weight and avoid preventive health services and medical appointments. Conversely, provider weight bias may result in less desire to help individuals with obesity compared to those with healthier weight. Healthcare professionals with obesity may also be reluctant to give weight loss advice to their patients with overweight and/or obesity. It is important for healthcare professionals to reflect on their attitude towards individuals with obesity and the potential for weight bias as they can be major barriers to appropriate care.

4. A personalised approach

Weight and weight loss are sensitive issues for many people. Most individuals with obesity will have attempted multiple weight loss interventions and may not be ready to make another attempt. Poor body image, low self-esteem, psychological problems and eating disorders, such as binge eating and food addiction, are common and will impact the effectiveness of treatment options. Health professionals should be aware that even weight measurement may be upsetting for some people. The objective of reducing weight should be discussed at the outset and differing expectations between medical and non-medical benefits reconciled. This should be used to inform the setting of individual realistic and sustainable weight loss targets according to the treatment selected.

Section 2: Treatment options for obesity

1. Lifestyle interventions

Supervised lifestyle interventions are an essential component of all weight loss strategies. Treatment goals focus on reducing energy intake and increasing energy expenditure. General advice on healthy eating is defined in the Australian Dietary Guidelines and the Australian Guide to Healthy Eating [7, 8]. Similar weight loss can be achieved with diets of different macronutrient content [9, 10]. Involving a multidisciplinary team, such as an accredited practicing dietitian, exercise physiologist, lifestyle coach or psychologist, should be considered and can be accessed through a chronic care plan. For some individuals, established commercial programs may be appropriate.

1.1 Reducing energy intake

The following are options for reducing energy intake and achieving an energy deficit:

1.1.1 Reduced Energy Diet (RED)

The aim of a RED is to produce a modest energy deficit of 2000-4000 kJ/day (480-960 kcal/day). This can be achieved by encouraging the intake of vegetables, fruit, wholegrains, legumes, nuts, seeds, lean meat, poultry, fish, eggs and low fat milk, cheese and yogurt and by minimising the intake of processed and energy dense foods such as biscuits, cakes, confectionary, pastries, pies, processed meats, commercial burgers, fried foods and chips. The intake of sugar-sweetened drinks, such as fruit juices, soft drinks, and energy drinks, as well as alcoholic drinks should be avoided. Snacking and portion sizes should also be reduced. A detailed review of the person's diet will help identify processed and energy dense foods that can be changed to healthier alternatives.

1.1.2 Low Energy Diet (LED)

The aim of a LED is to reduce total daily energy intake to 4200-5000 kJ (1000-1200 kcal). Generally, a more prescriptive diet is needed to achieve this energy deficit. Specific meal plans can be provided or prepared low energy meals can be obtained from commercial providers. LEDs can also be achieved by substituting one or two meals with one or two specially formulated meal replacements. For individuals who have not responded to a RED/LED, Very Low Energy Diets should be advised (See Section 1.1.3).

1.1.3 Very Low Energy Diet (VLED)

The aim of a VLED is to reduce energy intake to less than 3300 kJ/day (800 kcal/day) by substituting meals with formulated meal replacements. VLEDs can be considered as an initial weight loss strategy when supervised lifestyle interventions have been unsuccessful in reducing weight or when rapid weight loss is required (e.g. prior to bariatric or general surgery that is conditional on weight loss). While following a VLED, physical activity should be encouraged. VLEDs are low in carbohydrate, inducing a mild ketosis after 2-3 days that has an anorexic effect. It should be stressed to the individual that VLEDs do not contain pharmacologically-active ingredients.

VLED in practice

VLEDs are often recommended for 12 weeks but can be continued for 6-12 months under careful supervision [11]. The duration of the VLED depends on the person's weight at baseline and the target weight. Recently three large studies [12, 13, 14] have demonstrated that these diets be prescribed effectively in primary care with excellent outcomes. Participants achieved a mean weight loss of 10.2 to 14.5 kg

(approximately 10 to 14.5% initial body weight) after an eight to 20 week VLED. At 1 year there were improvements in metabolic parameters in all the studies. In DiRECT [12], which enrolled only subjects with type 2 diabetes, 46% were in remission at 12 month and 36% were still in remission at 2 years [15]. Subjects were reviewed by allied health professionals one to two weekly while on the VLED and then monthly.

Before starting a VLED, baseline blood tests should be taken (refer 1.1.3.1). Regular clinical review is essential and should occur at least monthly. Individuals may follow a partial or a complete VLED regimen. The partial regimen is more palatable and is based on 2 meal replacements per day (typically breakfast and lunch) and 1 serve of lean protein (usually for dinner) with vegetables (Appendix 2). A teaspoon of olive oil should be added to induce contraction of the gall bladder and reduce the risk of gallstones. Water, tea, coffee, and diet drinks are allowed. Milk (other than small quantities in tea or coffee) should be avoided. The complete VLED regimen is based on 3 meal replacements per day, plus vegetables. The choice of the program (partial *vs* complete) depends on the target weight and the individual's ability to tolerate the VLED.

1.1.3.1 Assessments while on a VLED

- **Baseline assessments:** weight and waist circumference; biochemistry (electrolytes, creatinine, liver function tests, fasting glucose, lipids, uric acid, thyroid function) and haematology (full blood count, iron studies) predominantly for comparison with subsequent tests after commencing the VLED.
- **Progress assessment:** weight and waist circumference; blood pressure (lying and standing); periodic biochemistry and haematology as clinically indicated. Consider discontinuing VLED if abnormalities develop (e.g. electrolyte abnormality, anaemia).

1.1.3.2 Contraindications to VLED

- Pregnancy or lactation
- Severe psychological disturbance (e.g. unstable anxiety disorders, major depression), alcoholism or drug dependence
- Recent myocardial infarction, cerebrovascular event or unstable angina
- Porphyria
- Age >65 years (VLED in this age group should be used with caution as there are limited safety data)

1.1.3.3 Special Groups

- ***Diabetes on insulin or sulphonylureas:*** Doses of sulphonylurea or insulin should be reduced by 50% on commencement of the VLED. Subsequent dosage adjustments (either increase or decrease) are based on frequent structured self-monitoring of blood glucose. If hypoglycaemia occurs, it takes

precedence over the diet and must be treated with appropriate carbohydrate ingestion.

- ***Chronic kidney disease:*** Individuals with an estimated glomerular filtration rate (eGFR) < 60 mL/min/1.73m^2 need closer supervision and should have electrolytes assessed more frequently. Special consideration is needed in individuals with eGFR < 30 mL/min/1.73m^2.
- ***Taking Warfarin:*** The diet increases vegetable intake and may alter the international normalised ratio (INR). Individuals on warfarin should be instructed to test INR one week after commencing the VLED in order to adjust the warfarin dose. The absolute quantity of green vegetables is not the issue, rather the level of intake must be kept constant throughout the VLED.

1.1.3.4 Weight loss response and maintenance after a VLED

Individuals are considered to be responding to the VLED if they reduce their weight by 1.0 to 1.5 kg per week. Once the target weight is reached, individuals are weaned off the VLED and food is progressively re- introduced over a period of 8 weeks. For individuals following the complete VLED, the usual plan is to transition to 2 meal replacements and one meal of food per day for 4 weeks, followed by 4 weeks with 1 meal replacement and 2 meals of food per day. After 8 weeks, the individual should be following the standard healthy diet (refer to Australian Guide to Healthy Eating) but, due to metabolic adaptation [12], caloric intake must remain lower than at baseline and physical activity maintained, otherwise weight will be rapidly regained. Weight should be monitored at monthly intervals. Weight loss maintenance may include intermittent periods of VLED (either 2 weeks every 3 months or triggered by reaching agreed action weight) or the use of commercial weight loss programs. Some weight regain is normal, expected and physiological, requiring continued intensive phases for most individuals. If more than approximately 3 kg of the weight lost is regained [3], consider restarting the VLED with the addition of pharmacotherapy [17].

1.1.3.5 VLED non-responders

If no weight is lost or less than 1.0 kg is lost per week over 4 weeks, review the person's adherence to the VLED or other factors that may be affecting weight loss. If there are no remedial factors, pharmacotherapy should be added to the VLED.

1.2 Increasing energy expenditure

Regular physical activity is essential for well-being and to address obesity-related complications. All adults are recommended to follow the guidelines for physical activity [18, 19]. People with musculoskeletal problems may need alternative forms of exercise, such as water-based activities. Individuals with cardiovascular or respiratory disease may also need a gentler regimen. These people may benefit from seeing an exercise physiologist or engaging in community-based programs.

2. Pharmacotherapy (Table 1)

Weight loss pharmacotherapy may be useful in assisting with the initial weight loss, to maintain weight loss at the end of a VLED or to prevent weight regain. While weight loss pharmacotherapy will usually be required long-term, data on its long-term safety and effectiveness are limited. Only four medications have been approved by the Australian Therapeutic Goods Administration (TGA) for the treatment of obesity: phentermine, orlistat, liraglutide and naltrexone/bupropion.

2.1 TGA approved pharmacotherapy

Phentermine (Duromine®, Metermine®)

Phentermine, delivered in a slow release resin complex, is a centrally acting adrenergic agonist that suppresses appetite [20, 21]. Side effects include tachycardia, hypertension, insomnia and dry mouth. Phentermine should not be used with anti-depressant drugs or in individuals with coronary artery disease, arrhythmias or uncontrolled hypertension because of its cardiac stimulant actions. Phentermine is registered for short-term use (12 weeks) as an adjunct to lifestyle management of obesity. In conjunction with a hypocaloric diet, weight reduction of 5-10% is achieved by 12 weeks of treatment [20]. The longer-term safety of phentermine has been evaluated in the SEQUEL trial in which combined phentermine and topiramate (Qysmia) was continued for 2 years [22].

Orlistat (Xenical®)

The primary action of orlistat is to inhibit pancreatic and gastric lipase, reducing fat absorption by 30%. Side effects include steatorrhoea, oily spotting and flatulence if more than 30 g of fat is consumed. Potential complications of its long-term use are deficiencies of fat-soluble vitamins A, D, E and K and the development of oxalate kidney stones. In conjunction with lifestyle intervention, results from the XENDOS study reported a weight loss of 10.6 kg at 1 year and 5.8 kg at 4 years in the orlistat group compared to 6.2 kg and 3.0 kg weight loss in the placebo group, respectively. A 37% reduction in progression to type 2 diabetes was also reported in the orlistat group [23]. The safety of orlistat has been established over the 4 years of the XENDOS study.

Liraglutide 3 mg (Saxenda®)

Liraglutide is a once-daily glucagon-like peptide-1 (GLP-1) receptor agonist that slows gastric emptying and suppresses appetite. The starting dose is 0.6 mg daily by subcutaneous injection, with a weekly increment of 0.6 mg to minimise gastrointestinal side effects. While the recommended daily dose is 3.0 mg, which is also the maximum dose, some patients may achieve good weight loss with lower doses. Since liraglutide is a blood glucose-lowering medication, other glucose-lowering medications may need to be adjusted in people with diabetes. Common adverse effects include nausea, vomiting and diarrhoea, which can be reduced by slowing the

dose escalation schedule. There is an increased risk of gallstones and cholecystitis requiring cholecystectomy independent of weight loss. While occurring very rarely, there also appears to be an increased risk of pancreatitis [20]. Results from the SCALE trial, a 56-week placebo-controlled trial, demonstrated that treatment with Liraglutide 3 mg in combination with lifestyle intervention, resulted in a mean weight loss of 8% compared to 2.6% in the placebo group [24]. Recent results from the LEADER Study, investigating the long-term effects of Liraglutide 1.8 mg in people with type 2 diabetes, demonstrated superior cardiovascular outcomes compared with placebo [25]. However, there are no cardiovascular outcome data for the weight loss recommended dose of 3 mg.

Naltrexone and bupropion (Contrave®)

Naltrexone and bupropion are available in an extended release (ER) tablet formulation, each containing 8 mg naltrexone and 90 mg bupropion. The main side effects of this combination therapy are nausea and vomiting [26], hence the recommendation to gradually escalate the dose starting with one tablet daily and increasing the daily dose by one tablet per week to two tablets twice daily, which is the TGA approved maintenance dose for weight loss. Word finding difficulties are also described but resolve on drug discontinuation. Although the precise mode of action of naltrexone and bupropion as anorectic agents is unknown, they are thought to act in both the hypothalamic hunger system and the mesolimbic reward centres of the brain [27]. The COR-I phase 3 clinical trial, in 1742 participants with BMI of 30-45 kg/m^2 or BMI 27-45 kg/m^2 with dyslipidaemia or hypertension, showed naltrexone 32 mg/bupropion 360 mg ER, when added to a hypocaloric diet and exercise resulted in an average weight loss of 6.1% versus 1.3% in placebo ($p < 0.001$) at 56 weeks [28]. A further study in patients with type 2 diabetes and obesity found that naltrexone 32 mg/bupropion 360 mg ER treatment resulted in a 5% decrease in body weight from baseline (vs 1.8% placebo, $p < 0.001$) and a 0.6% reduction in HbA1c as compared to 0.1% on placebo ($p < 0.001$) [29].

2.2 Off Label Pharmacotherapy

Other medications not approved by TGA for weight loss therapy are being used off label in Australia for the management of obesity by experienced practitioners in obesity care.

Topiramate

Topiramate is an anticonvulsant medication currently available in Australia on authority for difficult to control epilepsy and migraine. The drug has a powerful appetite suppressant effect, resulting in weight loss. A meta-analysis of 10 randomised controlled trials of at least 16 weeks duration concluded that the topiramate-treated group had additional weight loss of 5.3 kg compared with the placebo-treated group [30]. An Australian trial program has established the use of topiramate in the management of obesity [31]. Effective doses are between 25 and 100 mg per day. Side effects include depression, difficulty concentrating, paraesthesia (common) and closed angle glaucoma (rare). This medication can be considered for use “off label” in the management of people with

obesity when other medications have been ineffective or are contraindicated. A thorough knowledge of side-effects, precautions and contraindications of topiramate are essential and individuals need to be counselled appropriately.

Combined low dose Phentermine and Topiramate

The combination of these two monotherapies is useful for weight loss maintenance. An Australian study investigating the safety, tolerability and efficacy of the combination showed that in about 40% of people the combination was not well tolerated, predominantly due to topiramate (25 mg mane) side effects. In those who tolerated the combination, the 10% weight loss achieved with a VLED was maintained over a mean duration of pharmacotherapy of 10 months. A group of people who continued phentermine-topiramate for 22 months had a further mean weight loss of 6.7 kg [31].

Table 1 Pharmacotherapy for the treatment of obesity

Drug	Phentermine Duromine® Metermine®	Orlistat Xenical®	Liraglutide Saxenda®	Naltrexone/bupropion Contrave®	Topiramate	Phentermine-Topiramate
TGA status	Approved	Approved*	Approved	Approved	Not Approved	Not Approved
Available doses	15 – 30 – 40 mg	120 mg	0.6 - 3 mg	Nal. 8 mg/Bup. 90mg	25 – 50 – 100 mg	Phe. 15 mg Top. 12.5 – 25 – 50 – 100 mg
Starting dose	15-30 mg mane	120 mg tds	0.6 mg daily	Nal 8 mg/Bup. 90mg mane	12.5 mg mane	Phe 15 mg mane Top. 12.5 mg mane
Dosage form	Tablet	Tablet	Injection	Tablet	Tablet	Tablet
Maximal dose	40 mg mane	120 mg tds	3.0 mg daily	Nal. 16 mg/Bup. 180 mg bd	50 mg bd	Phe. 15 mg mane Top. 50 mg bd
Contraindications	Uncontrolled hypertension Cardiac disease Glaucoma Pregnancy History of drug abuse MAO inhibitors SSRI use	Anorexia Pregnancy Fat soluble vitamin deficiency Chronic malabsor-ption syndrome Cholestasis	History of pancreatitis or medullary cell thyroid cancer	Hypersensitivity to naltrexone, bupropion or any of the excipients Uncontrolled hypertension Seizure disorder or history of seizures Known CNS tumour Acute alcohol or benzodiazepine withdrawal Anorexia nervosa or bulimia (current or past) Pregnancy Severe hepatic impairment End stage renal	Glaucoma Renal Stones Pregnancy (if used for weight loss)	Uncontrolled hypertension Cardiac disease Glaucoma History of drug abuse MAO inhibitors or SSRI use Glaucoma Renal stones

				failure MAO inhibitor use		
Side effects	Hypertension Tachycardia Insomnia Anxiety/ depression Restlessness Dry mouth Diarrhoea/ constipation	Steatorrhoea Excessive flatus Fat soluble vitamin deficiency	Nausea Vomiting Diarrhoea Constipation Pancreatitis Cholecystitis	Nausea Vomiting Constipation Dizziness Headache Insomnia Dry mouth Word finding difficulty	Paraesthesia Confusion Memory loss Glaucoma Renal stones Nausea Vomiting Pancreatitis	Hypertension Tachycardia Insomnia Restlessness Dry mouth Diarrhoea/ constipation Paraesthesia Confusion Memory loss Glaucoma Renal stones
Cost of medication Dose No./day Cost/month	15 - 40 mg[1] 1 $117.00	120 mg[1] 3 $107.20	3 mg 1 $387	Nal Bup 32 mg 360 mg 4 Tablets of 8/90 mg $240	Top 25 mg up to 4 (100mg) $15	Phen Top 15 mg[1] 25 mg[1] 1 up to 4 $105 + $15

Mane, in the morning; tds, 3 times per day; bd, twice a day; MAO, monoamine oxidase; SSRI, selective serotonin reuptake inhibitors. TGA, Therapeutic Goods Administration. *Available through the veteran system. [1]Estimated price from pharmacy websites. The estimates of price per month are calculated by dividing the cost by the number of tablets per script, multiplied by the dose/day. Prices listed as October 2019.

3. Bariatric surgery

Bariatric surgery remains the most efficacious weight loss intervention in individuals with obesity. Bariatric surgery should be considered as part of a comprehensive treatment delivered by a multidisciplinary team including GPs, physicians, surgeons, dietitians and psychologists. The potential benefits of surgery need to be assessed for each individual by suitably trained and experienced practitioners and balanced against the individual risk profile. Components of successful bariatric surgery care include an informed patient, tailored operation, committed multi-professional team care and long-term follow up. All individuals considered for bariatric surgery need a careful risk to benefit assessment and optimisation of health prior to surgery. Not all individuals in whom surgery is a potential treatment option will be suitable for surgery, especially if they have multiple and advanced complications. These people should be referred to multidisciplinary tertiary institutions for ongoing care. It is beyond the scope of this document to provide a detailed description of available bariatric surgical procedures, however these are discussed in the 2013 NHMRC Guidelines [3].

The NHMRC clinical practice guidelines for the management of overweight and obesity [3] state that, taking into account the individual situation, bariatric surgery may be considered for adults with:

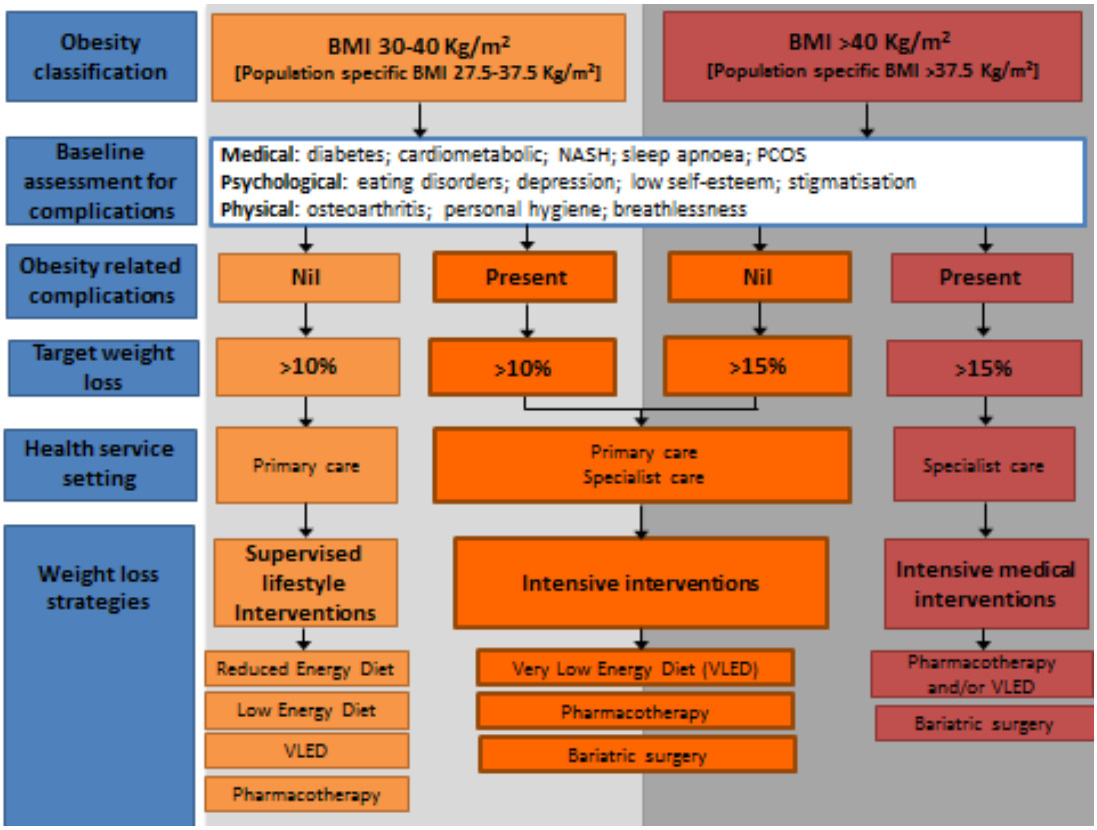
- BMI > 40 kg/m^2
- BMI > 35 kg/m^2 and comorbidities that may improve with weight loss
- BMI > 30 kg/m^2 who have poorly controlled type 2 diabetes and are at increased risk of cardiovascular disease

Recently, the Australian Diabetes Society endorsed the 2nd Diabetes Surgery Summit meeting guidelines [32] on metabolic surgery as a treatment option for individuals with type 2 diabetes, which state that:

- Metabolic bariatric surgery is recommended for individuals with:
    - BMI ≥ 40 kg/m^2 regardless of the level of glycaemic control or complexity of glucose lowering regimens
    - BMI 35.0–39.9 kg/m^2 with inadequate glycaemic control despite lifestyle and optimal medical therapy
- Metabolic bariatric surgery should be considered in individuals with BMI 30.0–34.9 kg/m^2 with inadequately controlled hyperglycaemia despite optimal medical treatment by either oral or injectable medications (including insulin).

Section 3: Algorithm for the management of obesity

Figure 1 Australian algorithm for the management of obesity



Application of the algorithm

The first step in the application of the algorithm is a baseline assessment and categorisation of individuals for treatment guidance based on BMI and the presence of obesity-related complications.

1. Baseline assessment

1.1 Categorise the obesity

The algorithm considers two categories of BMI: BMI 30-40 kg/m^2 and BMI >40 kg/m^2. While BMI has some limitations, it remains a useful measure for guiding management decisions. It is well documented that the association between BMI and fat distribution differs across populations. Asian and Australian Aboriginal & Torres Strait Islander populations are characterised by higher adiposity for a given BMI [33, 34]. As such, the lower BMI cut-offs for overweight and obesity recommended for Asian populations could also be considered for Australian indigenous populations (**Table 2**).

Table 2 The classification of weight by BMI

Classification	General population BMI (kg/m^2)	Population-specific BMI (kg/m^2)*
Normal range	18.5 –24.9	18.5 – 22.9
Overweight	25.0 – 29.9	23.0 – 27.49
Class I obesity	30.0 – 34.9	27.5 – 32.4
Class II obesity	35 – 39.9	32.5 – 37.4
Class III obesity	≥40	≥37.5

* Cut-offs apply to Asian population but could be used for Australian indigenous populations

1.2 Assess for obesity-related complications

Assessment of obesity-related complications provides additional guidance for the treatment pathway. Complications are grouped under medical, psychological and those resulting in physical limitations. The majority of individuals with a BMI > 40 kg/m^2 will have obesity-related complications. Some complications are more responsive to weight loss including type 2 diabetes, non-alcoholic steatohepatitis (NASH), polycystic ovary syndrome (PCOS) and hypertension and will benefit most from weight loss treatments. Although there are various systems to stage obesity, this algorithm adopts a simplified approach to obesity staging. Given the chronic progressive nature of obesity, assessment of obesity-related complications needs to be ongoing and repeated at regular intervals.

2. Set weight loss targets

The algorithm provides a general weight loss target of 10-15 % in individuals with BMI 30-40 kg/m^2 and > 15% in individuals with BMI >40 kg/m^2. These targets are indicative only and personalised weight loss targets should be set between the clinician and the person with obesity. As noted earlier, lesser degrees of weight loss can still have medical benefits, especially in the prevention of diabetes.

3. Using Health Services

The management of obesity requires a multidisciplinary team and a long-term chronic disease approach. The algorithm suggests that primary care is ideally placed to manage the care of people with BMI 30- 40 kg/m^2 without obesity-related complications. Shared care arrangements between GPs and specialist services

should be considered for people with BMI 30-40 kg/m^2 with complications or BMI >40 kg/m^2 without complications. Finally, individuals with BMI >40 kg/m^2 with complications should be considered for referral to specialist care.

4. Weight loss strategies

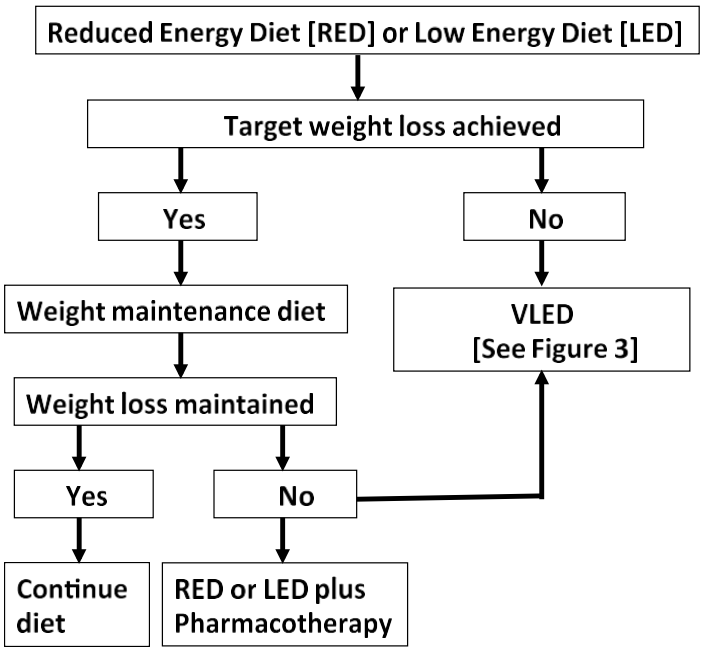
4.1 Management of individuals with BMI 30-40 kg/m^2 without complications (Figure 2)

Supervised lifestyle intervention is the mainstay of management for individuals with BMI 30-40 kg/m^2 without established complications. Initially this includes a reduced energy diet or a low energy diet, combined with a program to increase regular physical activity. Referral to multidisciplinary care such as an accredited practicing dietitian, exercise physiologist, lifestyle coach or an established commercial weight loss program can be considered.

If weight loss is insufficient or weight regain is experienced, a VLED can be considered or a RED/LED can be combined with pharmacotherapy.

Figure 2 **BMI 30-40 kg/m^2 without obesity-related complications**

Management Flow Diagram



4.2 Management of individuals with BMI 30-40 kg/m^2 with obesity-related complications OR BMI >40 kg/m^2 without complications (Figure 3)

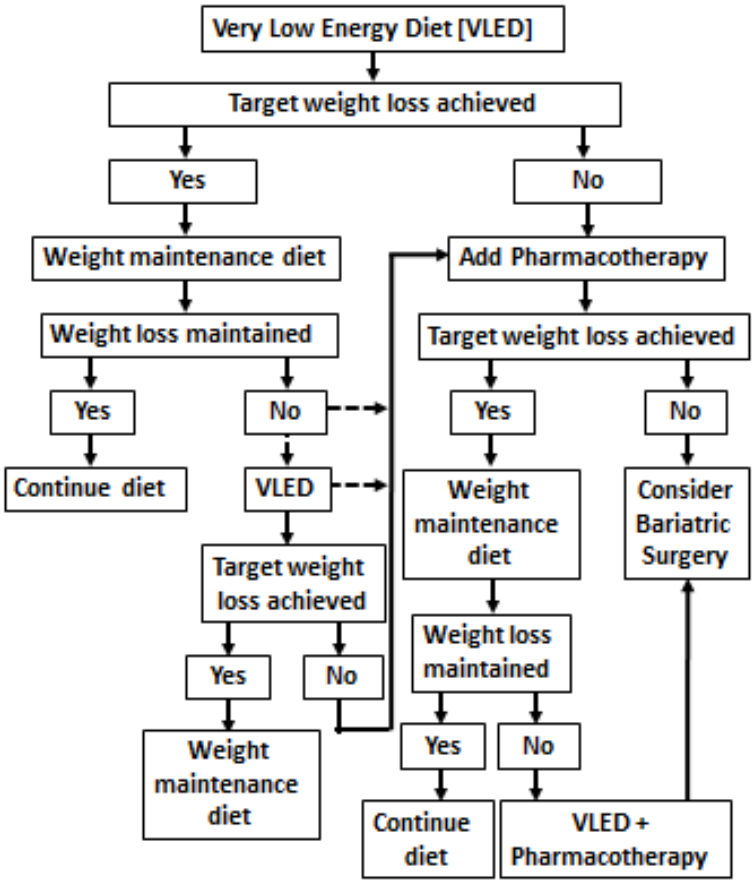
This group of individuals requires more intensive interventions. Three main options are available and the choice of therapies should be guided by previous weight loss interventions and response.

1. VLED is an initial option for individuals who have not tried this previously and are willing to use meal replacements. If effective in achieving adequate weight loss, the meal replacements can be reduced and the diet can be replaced with a weight maintenance diet. If weight is regained the VLED can be reintroduced.

2. Pharmacotherapy can be considered in individuals who do not have an adequate initial response to the VLED, or who regain weight once the VLED is relaxed.

3. Bariatric surgery is an option for individuals who do not respond to the VLED plus pharmacotherapy, or who have previously tried this approach without satisfactory weight loss, or who have type 2 diabetes.

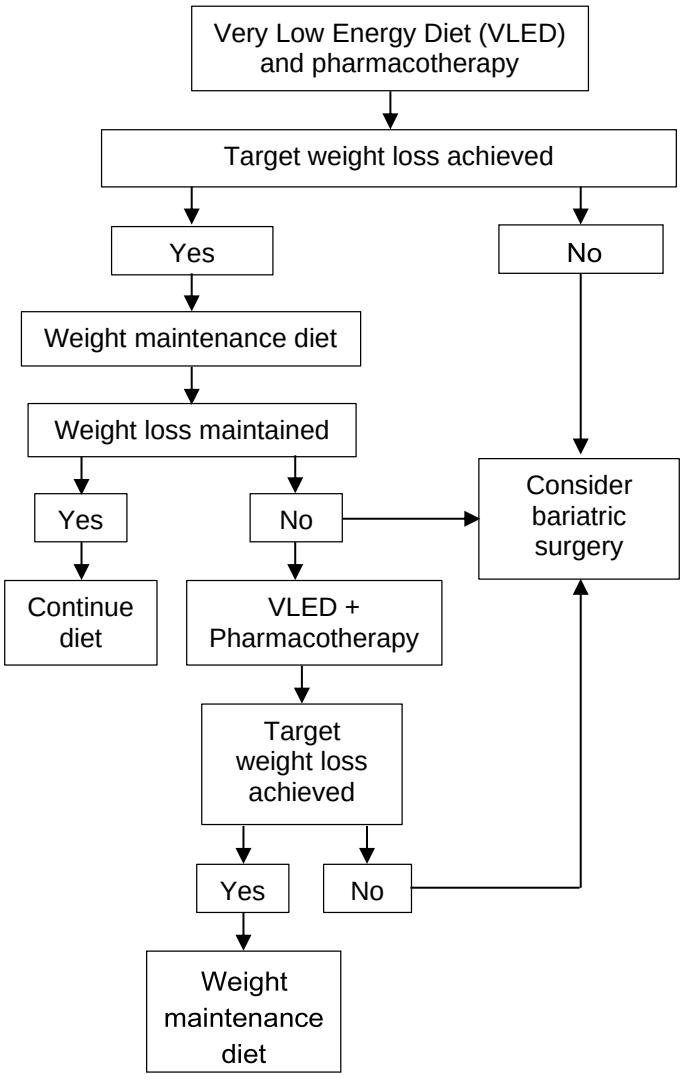
Figure 3 **BMI 30-40 kg/m^2 with obesity-related complications or BMI >40 kg/m^2 without obesity-related complications Management flow diagram**



4.3 Management of individuals with BMI > 40 kg/m^2 with obesity-related complication (Figure 4)

These individuals should be considered for intensive medical interventions and are best managed in specialist care. The combination of a VLED and pharmacotherapy should be considered as initial treatment. Subsequent management is guided by response. Bariatric surgery should be recommended, especially in the presence of weight responsive complications or when previous interventions have not resulted in sustainable weight loss or health improvements.

Figure 4 BMI >40 kg/m^2 with obesity-related complications Management flow diagram



Section 4: Special clinical situations

1. Age

The nadir for lowest mortality associated with weight is not constant and varies with age, ethnicity and the presence of other disease. Obesity defined by BMI ≥ 30 kg/m^2 does not carry the same mortality risk in older adults (>65 years) as in younger adults. With ageing, lowest mortality is associated with a BMI higher than the normal range [35]. Thus, the mortality risk associated with weight loss (including intentional) increases with age, generating an altered risk to benefit ratio. Healthy ageing should therefore focus on lifestyle, quality nutrition and physical activity to improve cardiovascular fitness, optimise functional independence and quality of life.

1.1 Young adults (18-35 years)

Adolescence and early adulthood are often associated with a decrease in physical activity and rapid weight gain. Particular attention should be given to early detection and management of individuals on a positive weight trajectory and with high cardio-metabolic risk. Interventions should be initiated early to prevent weight gain, complications and end-organ damage.

1.2 Older adults (>65 years)

There is no clear BMI target in this age group. The main goal in older adults with obesity is to improve physical function and minimise the impact of obesity-related complications. In individuals with BMI 30 - 40 kg/m^2 and BMI ≥ 40 kg/m^2 without complications, the aims of treatment are to maintain health and physical function, prevent weight gain and generate a more moderate intentional weight loss. In individuals with a BMI ≥ 40 kg/m^2 with obesity-related complications, more intensive therapies are indicated, but the importance of maintaining physical function, body composition and quality nutrition may require specific lifestyle programs. When engaging older adults in intensive therapies, cardiovascular fitness should be considered.

2. Pregnancy

Obesity during pregnancy is associated with an increased risk of obstetric complications, hypertension, gestational diabetes, fetal macrosomia, birth defects and increased risk of obesity in the offspring. In women with BMI > 30 kg/m^2, a total weight gain not exceeding 9 kg is recommended [36, 37]. Gestational weight gain (GWG) should be closely monitored in women with obesity, as well as in women with a healthy pre-pregnancy weight, as excessive GWG is associated with poorer maternal and neonatal outcomes. In women with excessive weight gain, weight management strategies should be implemented. If indicated, bariatric surgery should be performed at least 12 to 18 months prior to pregnancy. All medications available for weight loss in Australia (either on-label or off-label) are category B for use in pregnancy.

Section 5: Implementation in primary care and linkage with specialist care

Obesity is a chronic disease that requires lifelong management. GPs play a key role in identifying individuals with obesity and implementing appropriate interventions to support weight loss and/or prevent weight regain. Primary care should assist individuals to access obesity support services that address the social complexity surrounding obesity. General practices can strategically improve services for these individuals and carers through personal education, education of practice staff, development of obesity focused practice resources (e.g. weighing scales to monitor individuals across the obesity ranges as a matter of routine) and development of a referral network of specialist services or multidisciplinary teams able to address obesity and weight-related complications. Practice systems that exist for chronic disease management can be used for weight management such as recall systems and reviews focusing on high risk individuals with complications and those who have had bariatric surgery [19, 38-41].

APPENDIX 1 – Membership of working group

Australian Diabetes Society representatives:

A/Professor Sof Andrikopoulos, Department of Medicine, University of Melbourne, Melbourne

Professor Stephen Colagiuri (Convenor), Boden Institute, University of Sydney, Sydney

Professor Joe Proietto, Department of Medicine, University of Melbourne, Melbourne

Australian and New Zealand Obesity Society representatives:

Professor John Dixon, Baker IDI Heart and Diabetes Institute, Melbourne

A/Professor Tania Markovic, Metabolism & Obesity Services, Royal Prince Alfred Hospital, Sydney

Australian and New Zealand Metabolic Obesity Surgery Society representatives:

Professor Jeffrey Hamdorf AM, Medical School, The University of Western Australia, Perth

Royal Australian College of General Practitioners representatives

Dr Georgia Rigas, Chair – RACGP SI Obesity Management Network
Dr Gary Deed, Mediwell, Brisbane

Project Officer:

Dr Nathalie Kizirian, Boden Institute, University of Sydney, Sydney

APPENDIX 2: Examples of foods allowed and to avoid while on a VLED

Allowed			Avoid
Low starch vegetables			
Alfalfa sprouts Asparagus Bean Sprouts Bok Choy Broccoli Brussels sprouts Cabbage Capsicum Carrots Cauliflower	Celery Cucumber Eggplant Endive Green beans Konjac noodles Lettuce (all types) Leeks Mushrooms Onions	Radishes Shallots Silverbeet Snow peas Spinach Squash Tomatoes Watercress Zucchini	Corn Green peas Legumes Lentils Potatoes Sweet potato Parsnip Pumpkin Turnip
Soups			
Stock cubes Bonox (in moderation)	Vegetable soups made from allowed vegetables Miso soup		All other soups
Sauces and condiments			
Lemon & lime juice Vinegar Worcestershire sauce Tabasco sauce	Soy sauce Chilli Diet, oil free or fat free salad dressings	Mustard Tomato paste	Cream High calorie simmer sauces and dressings
Herbs and spices			
All spice Basil Celery flakes Chilli Chives Cinnamon Cloves Coriander Cumin	Curry powder Dill Fennel Garlic Ginger Lite salt Mint Mustard seed Nutmeg	Oregano Paprika Parsley Pepper Rosemary Sage Thyme Tumeric Taragon	
Others			
Low joule jellies Artificial sweeteners Tea, coffee, diet drinks			Fruit and fruit juice Alcohol Milk Sugary drinks Flavoured mineral waters Discretionary foods

APPENDIX 3: Summary of weight loss interventions[1]

Intervention	Summary of effect
Lifestyle change	>10% weight loss in few studies; weight loss difficult to maintain for many individuals. Study results: • Dietary change: average weight loss 3-5 kg at 12months; 0 kg at 5 years • Dietary change and exercise: average weight loss 5-10 kg at 12 months; 0-3 kg at 5 years • Lifestyle change and psychological intervention: average weight loss 3-4 kg at 5 years
Combined lifestyle change and pharmacotherapy	>10% weight loss in some but not all studies; weight loss maintained > 2 years in some but not all participants. Study results: • Orlistat and dietary change: average weight loss 6-10 kg at 12 months; 2-3 kg at 5 years • Phentermine and dietary change: average weight loss 6.4 kg 12 weeks [16] • Liraglutide and lifestyle change: average weight loss 8% at 56 weeks [20] • Naltrexone/bupropion and lifestyle change: average loss 6.1% at 56 weeks [23]
Bariatric surgery with maintained lifestyle changes	>15% weight loss consistently across studies; weight loss likely to be maintained >5 years • Laparoscopic adjustable gastric banding: average weight loss 20% at 12 months; 12% at 10 years • Vertical gastrectomy: average weight loss 25% at 12 months; 16% at 10 years [38] • *Roux-en-Y* gastric bypass: average weight loss 33% at 12 months; 30% at 10 years

[1] Adapted from the 2013 NHMRC table 6.4 [3].

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