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NATIONAL CLINICAL GUIDELINES FOR WEIGHT MANAGEMENT AND PREVENTION OF ADULTHOOD OBESITY

Edition 1 | 2025

Foreword

Obesity continues to be a worldwide public health problem with an increasing burden on all health sector resources. Preventing obesity, diagnosing it early, and treating it properly are goals that all health care systems in the world should work for.

This first publication of the National Clinical Guidelines for Weight Management and Prevention of Adulthood Obesity incorporates the new updates in the international guidelines and includes recommendations intended to optimize patient care tailored to our settings in UAE health care facilities.

To effectively manage obesity, it is crucial to involve a multidisciplinary team, including public health nutritionists, endocrinologists, surgeons, and policymakers, to achieve optimal results through a holistic approach. Thus, within these guidelines, multicomponent lifestyle interventions comprising diet, physical activity, and strategies to support behavior change have been recommended as part of a continuous care model of obesity management. For adults with a BMI of $\geq$35 kg/m^2 and for whom pharmacological treatment has been unsuccessful, guidelines suggest that bariatric surgery could be offered.

I would like to extend my congratulations to the members of the national obesity taskforce for their hard work, and I hope that this document will further elevate the standard of care for managing people with obesity in the UAE.

Special thanks to **Dr. Arya Sharma**, Professor of Medicine, University of Alberta, Edmonton, Canada, and **Dr. Elamin Abdelgadir**, Consultant Endocrine, Dubai Hospital for reviewing the guidelines.

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National Clinical Guidelines for Weight Management and Prevention of Adulthood Obesity, 2024

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List of Abbreviations

Abbreviation	Description
4Ms	Mental health, Mechanical, Metabolic, Monetary health / Milieu
ACEi	Angiotensin-converting enzyme inhibitors
ADHA	Attention deficit hyperactivity disorder
ADHD	Attention deficit hyperactivity disorder
ADIPOQ	Adiponectin
AGB	Adjustable gastric banding
AgRP	Agouti-related peptide
AHI	Apnea-hypopnea index
ARB	Angiotensin II receptor blockers
ASD	Autism spectrum disorder
BDMR	Brachydactyly mental retardation syndrome
BID	Bis in die, twice a day
BMI	Body mass index
BP	Blood pressure
BPD	Biliopancreatic diversion
BPM	Beats per minute
CBC	Complete blood count
CBT	Cognitive-behavioral therapy
CCB	Calcium channel blocker
CDSS	Clinical decision support systems
CHO	Carbohydrates
COEQ	Control of Eating Questionnaire
COR	Contrave obesity research diabetes
CPAP	Continuous positive airway pressure
CVD	Cardiovascular diseases
DASH	Dietary approaches to stop hypertension
DBP	Diastolic blood pressure
DEBQ	Dutch eating behavior questionnaire
DHEAS	Dehydroepiandrosterone sulfate
DMST	Dexamethasone suppression test
DNA	Deoxyribonucleic acid
DS	Down syndrome
DVT	Deep venous thrombosis
ECG	Electrocardiogram
ECHO	Echocardiogram

EEG	Electroencephalogram
eGFR	Estimated glomerular filtration rate
EMR	Electronic medical records
EOSS	Edmonton obesity staging system
ESCWA	Economics and Social Commission for Western Asia
ESRD	End-stage renal disease
FDA	Food and Drug Administration
FFQ	Food frequency questionnaires
FIB-4	Fibrosis-4
FITT	Frequency, intensity, timing and type
FSH	Follicle stimulating hormone
GAD-7	Generalised Anxiety Disorder - 7 Questionaire
GCC	Gulf cooperation council
GERD	Gastroesophageal reflux disease
GI	Glycemic Index
GIP	Gastric inhibitory polypeptide
GIPR	Gastric inhibitory polypeptide receptor
GJ	Gastro-jejunostomy
GLP-1	Glucagon-like peptide 1
GPPAQ	General practice physical activity questionnaire
GRAS	Generally Recognized as Safe
HAES	Health at Every Size
HCC	Hepatocellular carcinoma
HCV	Hepatitis C virus
HDL	High density lipoprotein
HL	Health literacy
HLE2	Health Literacy Environment of Hospitals and Health Centers
HR	Heart rate
HRQoL	Health-related Quality of Life
HTN	Hypertension
IARC	International Agency for Research on Cancer
IF	Intermittent fasting
IFSO	International Federation for Surgery of Obesity & Metabolic Disorders
IGF2	Insulin-like growth factor 2
IOM	Institute of Medicine
IR	Insulin resistance
IU	International units

IUD	Intrauterine device
IWQOL-Lite	Impact of Weight on Quality of Life-Lite
LDL	Low density lipoprotein
LV	Left ventricular
LEP	Leptin
LH	Luteinizing hormone
LSG	Laparoscopic sleeve gastrectomy
MACE	Major adverse cardiovascular events
MAFLD	Metabolic dysfunction associated fatty liver disease
MAOI	Monoamine oxidase inhibitors
MASH	Metabolic dysfunction associated steatohepatitis
MC4R	Melanocortin-4 receptor
MEN2	Multiple endocrine neoplasia type 2
MGB	Mini gastric bypass
MNT	Medical nutrition therapy
MTC	Medullary thyroid cancer
NSAID	Nonsteroidal anti-inflammatory drugs
OA	Osteoarthritis
OAGB	One anastomosis gastric bypass
OSA	Obstructive sleep apnea
PA	Physical activity
PAR-Q	Physical activity readiness questionnaire
PARmed-X	Physical activity readiness medical examination
PCOS	Polycystic ovary syndrome
PE	Pulmonary embolism
PHQ9	Patient Health Questionnaire-9
POMC	Pro-opiomelanocortin
PT	Prothrombin Time
PTH	Parathyroid hormone
PWS	Prader-willi syndrome
PYY	Peptide YY
RCT	Randomized controlled trial
RD	Registered dietitian
ROS	Reactive oxygen species
RR	Relative risk
RYGB	Roux-en-Y Gastric Bypass
SADI-S	Single Anastomosis Duodenal-Ileal bypass with Sleeve

SBP	Systolic blood pressure
SG	Sleeve gastrectomy
SGLT-2	Sodium-glucose cotransporter-2
SURPASS	Study of Tirzepatide [LY3298176] versus Semaglutide Once Weekly as Add-on Therapy to Metformin in Participants with Type 2 Diabetes
SMART	Specific, Measurable, Achievable, Relevant, Time-bound
SMS	Smith Magenis syndrome
SSRI	Selective serotonin reuptake inhibitors
STEP	Semaglutide Treatment Effect in People with Obesity
T2DM	Type 2 diabetes mellitus
TBIC	Total iron-binding capacity
TSH	Thyroid stimulating hormone
UAE	United Arab Emirates
UK	United Kingdom
UNICEF	United Nations International Children's Emergency Fund
USA	United States of America
VLCD	Very low-calorie diet
VLCKD	Very low calorie ketogenic diet
WAGR	Wilms tumor, Aniridia, genitourinary abnormalities, and range of developmental delays
WBIS	Weight Bias Internalization Scale questionnaire
WC	Waist circumference
WHO	World health organization
XENDOS	Xenical in the Prevention of Diabetes in Obese Subjects
YFAS	Yale food addiction scale

CHAPTER 1. Epidemiology of obesity

Dr. Buthaina Bin Belaila and Dr. Marwa Khalil

HIGHLIGHTS
The prevalence of adult obesity in the UAE has been increasing dramatically in the last few decades.
Obesity is a complex and multifactorial chronic disease.
Obesity significantly increases the risk of developing numerous chronic diseases.
Obesity is a preventable disease.

1.1 Introduction

Obesity is a complex, multifactorial, and preventable chronic disease that affects more than one-third of the world's population [1-3]. If the current trend of increasing obesity prevalence continues, projections suggest that by 2030, 38% of the global adult population will be classified as overweight, and 20% including 1 in 5 women and 1 in 7 men, will be living with obesity [4]. According to the World Health Organization (WHO), obesity is defined using body mass index (BMI), which is determined by dividing a person's weight in kilograms by the square of their height in meters (kg/m^2), with a BMI of 30 kg/m^2 or higher classified as obesity [5].

Obesity can have detrimental effects on both the physical health and psychosocial well-being of individuals affected. Studies have shown that health-related quality of life is significantly lower in individuals living with obesity compared to the general population. This is mainly caused by the associated impairments in mental health (including increased rate of anxiety and depression), mobility, and potential pain and/or discomfort [6]. The mental wellbeing of people living with obesity can be also adversely affected by weight bias, stigma, social inequalities and discrimination [7].

The root causes of obesity are complex and involve multiple factors that are present in daily life. Socioeconomic development and modernization have led to a sedentary lifestyle, which, combined with the widespread availability and easy access to unhealthy food, complicates the management of obesity [8].

The United Arab Emirates (UAE) is on the verge of an obesity epidemic. The rate of adult obesity in the country has risen sharply over the past few decades. Based on the most recent National Health Survey conducted in 2018, 27.8% of the respondents had a BMI of ≥30 kg/m^2, with a higher prevalence among females (30.6% in females vs 25.1% in males) and among the Emirati population (36.9% in Emirati vs 26.3% in non-Emirati). The highest prevalence was observed in the age group of 30–44 years. Recognizing the enormous health and economic burden of obesity on individuals, families and the nation, the UAE has committed to the WHO global target to halt the rise in overweight and obesity by the year 2030 [9].

1.2 Pathophysiology of obesity

The pathogenesis of obesity is a complex process that involves the regulation of energy intake, appetite, and level of physical activity (**Figure** 1-1). It also involves complex interactions with the availability of health services, socioeconomic levels, and hereditary and environmental causes.

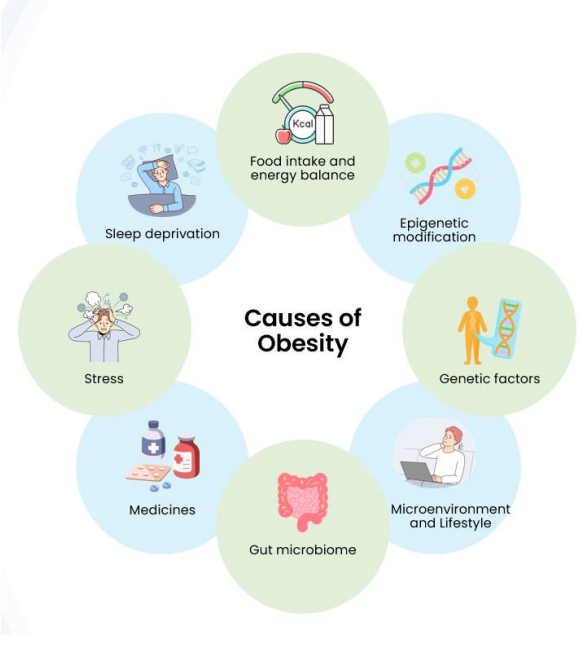

Figure 1-1 Causes of obesity

1.2.1 Food intake and energy balance

Obesity results from a continuous positive energy balance over time. Fat accumulation in the body is caused by an imbalance between the calories consumed from food and those expended. It is important to understand energy management and systematically evaluate the underlying causes that affect energy intake, expenditure, and metabolism [10, 11].

1.2.2 Lifestyle

A lack of physical activity and increased time spent on computers and other electronic screens are associated with the development of overweight and obesity [12]. Unhealthy eating behaviors, such as high consumption of saturated fats and food rich in added sugars, are also associated with a high risk of obesity and being overweight [13].

1.2.3 Sleep deprivation

Disturbance in sleep pattern is associated with a number of health consequences. Significantly higher obesity rates have been shown in adults who sleep 7 hours or less at night [14]. Epidemiological studies have also shown that sleep durations of less than 6 hours at night are associated with higher BMI [15, 16].

1.2.4 Stress

Research has shown an association between stress and obesity, which is mainly related to higher levels of cortisol (a stress hormone) [17]. Cortisol, or glucocorticoid, is associated with the redistribution of white adipose tissues and

increased hunger and cravings towards energy rich foods high in sugar and fat [18]. Simultaneously, elevated glucocorticoid levels can lead to increased stress-related eating [19].

1.2.5 Medicines

Certain medications can lead to weight gain or body fat redistribution, contributing to the development of obesity or overweight, particularly in susceptible individuals [20]. Examples include diabetes medications [21], neuropsychotropic medications such as atypical antipsychotics, antidepressants, and antiepileptic drugs [21], β-blockers [22], glucocorticoids [23], anti-retroviral agents [24] and hypolipidemic drugs [25, 26].

1.2.6 Microenvironment and gut microbiome

The gut harbors a large number of symbiotic microbes (gut microbiota) [27]. These active gut microbiotas produce short-chain fatty acids, vitamins, and anti-inflammatory substances, as well as potentially harmful substances such as neurotoxins and carcinogens [28]. Imbalances in microbial populations ("dysbiosis") has been shown to be associated with a variety of diseases, including obesity, nutritional deficiency, diabetes, inflammatory bowel disease, neurological disorders, and malignancy [29].

1.2.7 Genetic factors

Many genes have been identified to be associated with energy homeostasis regulating pathways. Genetic causes of obesity can be classified as:

- **Monogenic causes:** These result from single gene mutations, that are primarily located within the leptin-melanocortin pathway. Mutations in genes such as *AgRP* (Agouti-related peptide), *PYY* (Peptide YY), and *MC4R* (melanocortin-4 receptor) were found to be associated with obesity [30].
- **Syndromic causes:** These result from neurodevelopmental abnormalities associated with specific phenotypes, which may result from changes in a single gene or alterations in a broader chromosomal region affecting multiple genes [31]. Prader-Willi Syndrome (PWS), for example, is a neurodevelopmental disorder characterized by hypothalamic dysfunction due to deficiencies in specific imprinted genes [32]. Other examples of syndromes associated with obesity include Brachydactyly Mental Retardation Syndrome (BDMR), Smith Magenis syndrome (SMS), Kleefstra syndrome, and WAGR (Wilms tumor, Aniridia, genitourinary abnormalities, and range of developmental delays) syndrome [32].

1.2.8 Epigenetic modification

Epigenetics, which includes the dynamic and adjustable molecular changes that describe the interaction of the body with its environment, may contribute to an increase in obesity prevalence [33]. Epigenetic modifications involve the effect of environmental factors, such as lifestyle and nutrition, on gene expression without altering the DNA sequence [34]. Many genes associated with obesity and metabolic diseases are regulated epigenetically. DNA methylation is an important epigenetic mechanism [35]. The *LEP* (leptin) and *ADIPOQ* (adiponectin) genes are known to be closely linked to obesity [36]. These hormones are primarily produced by adipose tissues and are responsible for regulating energy balance and metabolism. Alterations in DNA methylation of the *LEP* and *ADIPOQ* genes have been found to play an important role in obesity [36]. Another example is the inhibition of the methylation of the *IGF2* (insulin-like

growth factor 2) gene, which has also been found to be associated with paternal obesity [37]. Consideration of genetic and epigenetic causes of obesity provides valuable tools for the clinical treatment of obesity [38].

1.3 Obesity-associated diseases

Fat accumulation in non-adipose tissue and inflammation caused by visceral fat are major contributors to obesity-related diseases, including type 2 diabetes mellitus (T2DM), cardiovascular diseases (CVD), liver diseases, cancer, and other disorders (**Figure** 1-2).

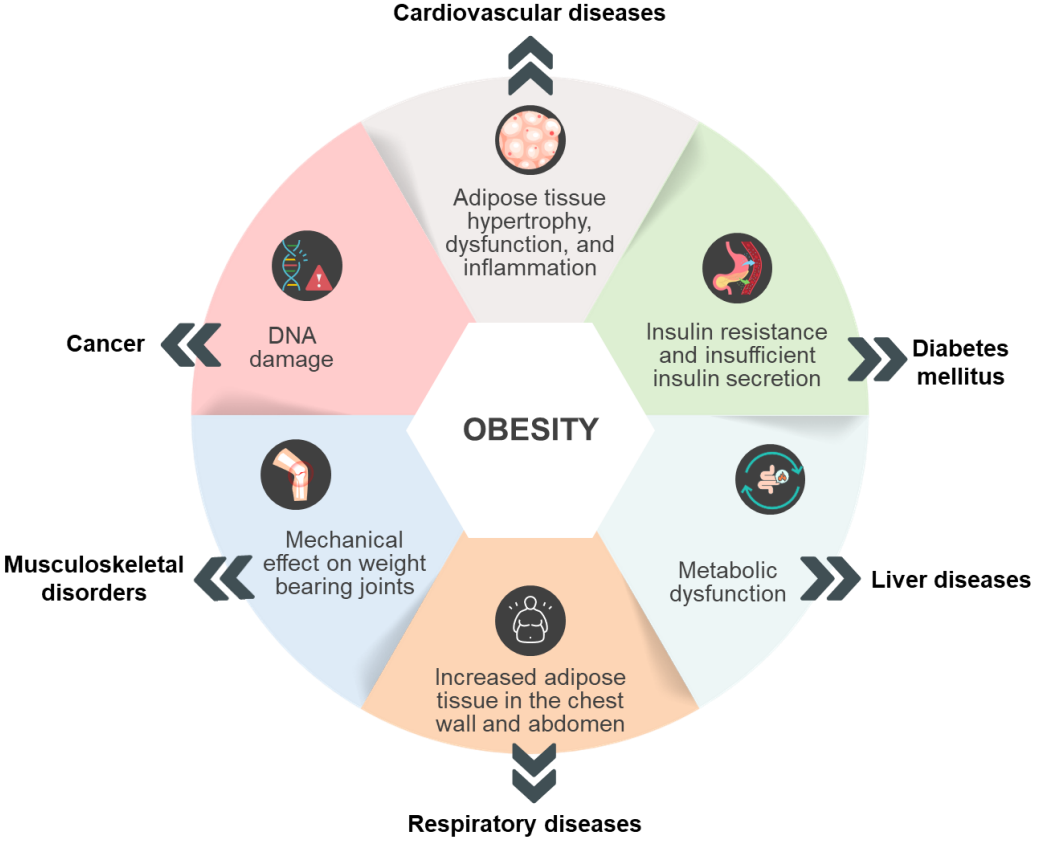

Figure 1-2 Obesity-related disorders

1.3.1 Obesity and cancer

According to the International Agency for Research on Cancer (IARC) Working Group [39-41], obesity is known to be associated with many types of cancer including breast, uterine, ovarian, esophageal, stomach, colon/rectal, liver, gallbladder, pancreatic, renal, thyroid, and meningeal cancers, as well as multiple myeloma [42-45]. The relationship between obesity and cancer is biologically complex [46]. Many studies have indicated that DNA damage associated with obesity may contribute to genetic instability, primarily through the effects of reactive oxygen species (ROS) [47].

1.3.2 Obesity and cardiovascular diseases

Clinical trials and epidemiological studies have shown that obesity can increase the risk of CVDs [48-51], including coronary artery disease, heart failure and atherosclerosis [52]. Furthermore, obesity is strongly associated with other

CVD risk factors, such as hypertension (HTN), insulin resistance, and dyslipidemia [53]. Obesity leads to adipose tissue hypertrophy, dysfunction, and inflammation, which ultimately change the structure and function of the cardiovascular system [54]. This includes left ventricular (LV) remodeling, increased LV mass, left atrial enlargement, and increased stroke volume [55, 56]. Obesity-associated HTN is a serious risk factor for CVD [57]. Obesity is associated with sodium reabsorption in the renal tubules and vasoconstriction, which, in turn, increases the cardiac load and raises blood pressure [58, 59].

1.3.3 Obesity and type 2 diabetes mellitus

Obesity is a known risk factor for type 2 diabetes mellitus (T2DM) and approximately one-third of patients with obesity develop T2DM [60, 61]. It has been shown that patients with obesity and a BMI >35 kg/m^2 are 20 times more likely to develop T2DM than those with a normal weight (BMI 18.5–24.9 kg/m^2). Notably, 80% of patients with T2DM have overweight or obesity [62, 63]. Insulin resistance and insufficient insulin secretion are well-established factors for the development of T2DM in individuals with obesity [64-66].

1.3.4 Obesity and liver diseases

Obesity significantly impacts liver metabolism, contributing to the development and progression of metabolic dysfunction-associated steatotic liver disease (MASH). It is strongly linked to hepatic inflammation and steatosis, exacerbating liver disorders such as alcoholic liver disease and hepatitis B. MASH has become a leading cause of chronic liver disease and is now the most rapidly increasing driver of hepatocellular carcinoma (HCC) [67, 68]. Furthermore, obesity-related factors, including weight gain and insulin resistance, are associated with accelerated fibrosis in chronic hepatitis C virus (HCV) infection [69].

1.3.5 Obesity and respiratory diseases

Obesity adversely affects lung function. With obesity, increased adipose tissue in the chest wall and abdomen interferes with the expiratory reserve volume and functional residual capacity of the lungs. Obesity has been proven to be associated with obstructive sleep apnea, asthma, chronic obstructive pulmonary disease, and pulmonary HTN [70].

1.3.6 Obesity and musculoskeletal disorders

Obesity is a risk factor for the development of musculoskeletal disorders [71]. The association between high BMI and musculoskeletal disorders can be explained by the metabolic factors associated with obesity and the mechanical effect on weight bearing joints [72, 73].

1.4 Obesity prevention and management

The public health approach to obesity prevention involves actions at the primary, secondary, and tertiary levels [74, 75].

- **Primary prevention**: Primary prevention aims to prevent the development of overweight and obesity, thereby reducing the number of new cases. Effective strategies include promoting lifestyle changes and supporting healthy behaviors, such as increasing physical activity, eating healthy food, improving sleep quality, and relieving stress. Public health measures, such as implementing taxes on sugar-sweetened beverages, displaying calories on restaurant menus, and improving infrastructures to encourage physical activity, can have a significant impact in decreasing exposure to an obesity-promoting environment at the population level.
- **Secondary prevention**: Secondary prevention aims to reduce the rate of established cases of overweight and obesity in the community. This involves early detection and management of the cases to prevent progression and avoid complications. This could be achieved through regular screening and further assessment of complications, early intervention as required, and consultations on methods to stabilize weight.
- **Tertiary prevention**: Tertiary prevention aims to support individuals with obesity in managing long-term effects and complications associated with the disease. The objective is to improve the quality of life of the individual.

Maintaining weight loss after obesity treatment remains a major challenge that requires a multi-disciplinary continuous care approach (**Figure** 1-3) that emphasizes sustainable lifestyle changes [76]. Individuals can benefit from continuing support through counseling or support groups, which helps to reinforce healthy behaviors and provide motivation [77]. Regular physical activity [78], balanced diet [79] and monitoring progress [80] are crucial in managing obesity and successful weight loss maintenance.

The care model for the management of obesity is shown in **Figure** 1-3.

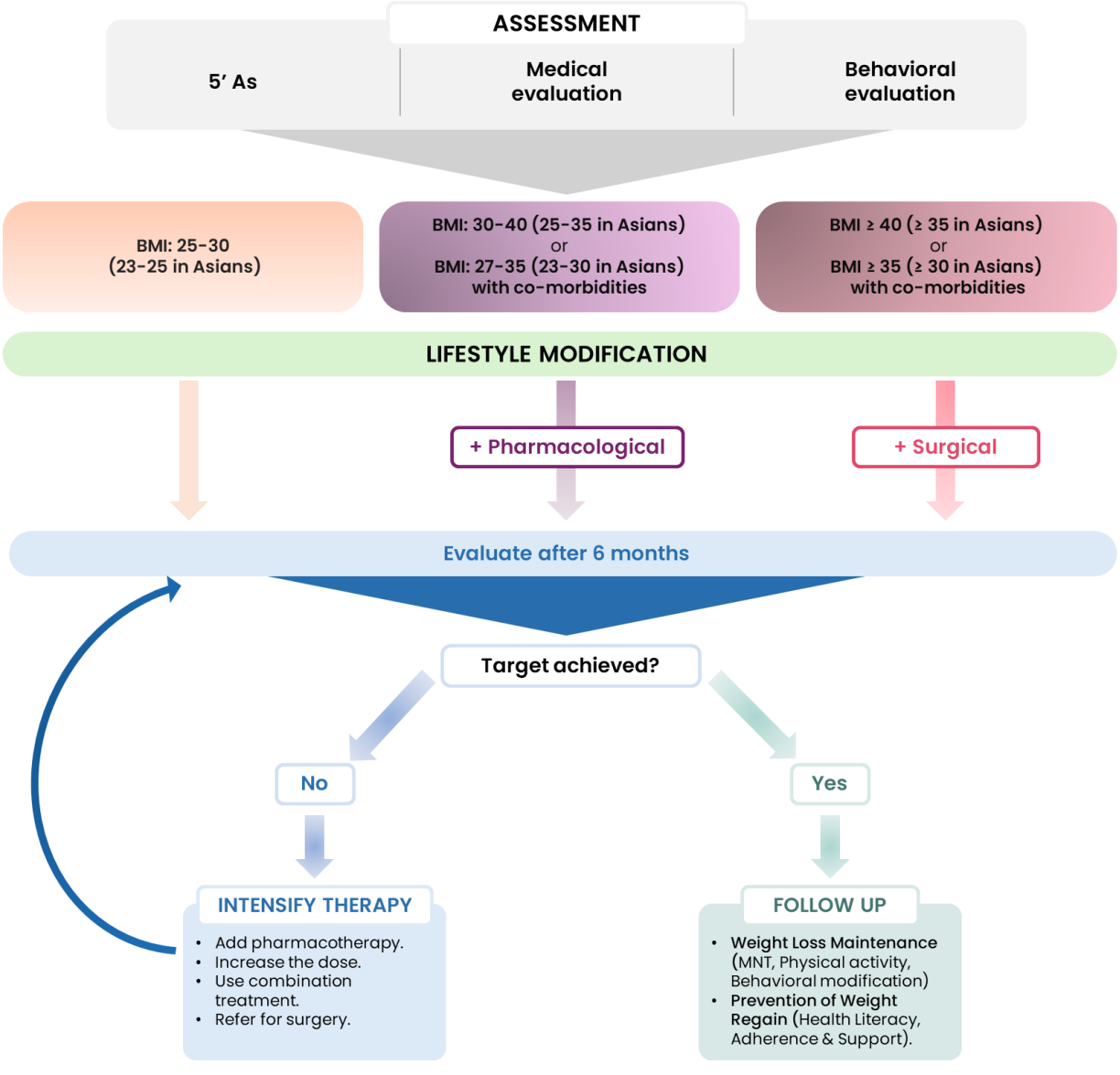

Figure 1-3 Obesity continuous care model

CHAPTER 2. Assessment of people living with obesity

Dr. Fathelrahman Ahmed

HIGHLIGHTS
Screening tools for obesity include body mass index (BMI) and waist circumference (WC). Combining BMI and WC in clinical assessments provides a more precise identification of higher-risk obesity phenotypes compared to using either measurement alone, especially in individuals with lower BMIs.
Assessment of obesity - Edmonton Obesity Staging System - 4Ms Framework for Assessment of Obesity - Medical history, physical examination, and laboratory and diagnostic tests
In patients with obesity, early intervention is required to treat and prevent obesity-related complications.
Technology-based assessment tools can facilitate efficient storage, handling, and timely acquisition and evaluation of obesity-related information.

2.1 Introduction

When screening for obesity, healthcare providers should approach patients with empathy and sensitivity, acknowledge the complexity of the disease and the difficulty in sustaining behavioral change as well as avoid stereotypes and oversimplification of the disease using the 5As' template :

1. ASKING for permission to discuss weight and explore readiness
2. ASSESSING obesity-related risks and root causes of obesity
3. ADVISING on health risks and treatment options
4. AGREEING on health outcomes and behavioral goals
5. ASSISTING in accessing appropriate resources and providers [81, 82]

The aims of clinical assessment are:

- To establish the diagnosis
- Identify the causes and consequences of abnormal or excess adiposity on a patient's physical, mental and functional health [83].

The factors to be considered for a clinical assessment of obesity are shown in **Figure 2-1**.

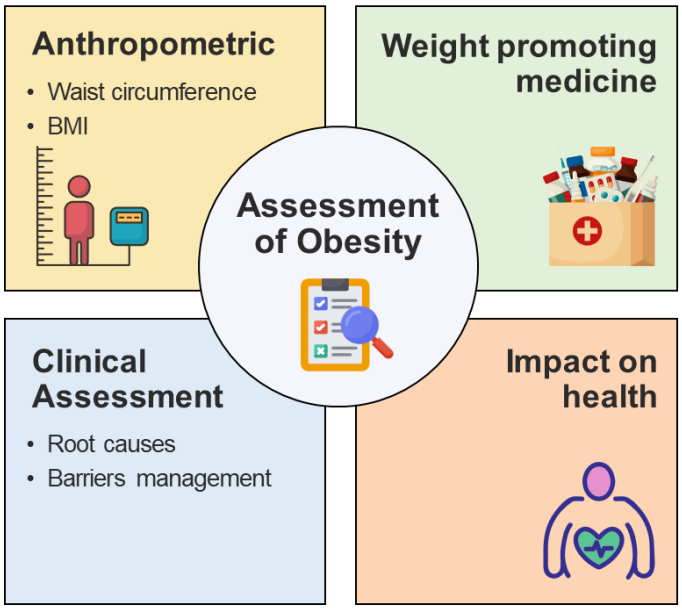

Figure 2-1 Assessment of obesity

2.2 Anthropometric measurements

Screening for obesity should be performed regularly by measuring body mass index (BMI) and waist circumference (WC) at all clinical settings in a non-judgmental, stigma-free supportive environment with appropriate equipment. Evaluation of BMI and WC is recommended as a practical screening tool to identify patients with obesity [84]. Regular BMI and WC screening can help detect patients at risk of developing obesity. Educating these patients about the risks and consequences of obesity and implementing preventive measures can significantly impact their health [85, 86].

2.2.1 Body mass index

Historically, BMI has been utilized as a surrogate measure of body fat and is an objective parameter for defining obesity in both epidemiological and clinical research [82, 87-90]. For most populations, overweight (BMI ≥25 kg/m²) indicates an elevated risk and necessitates further evaluation of other anthropometric, biochemical, and hemodynamic parameters [91, 92]. A BMI of ≥30 kg/m² is associated with increased cardiovascular risk factors and all-cause mortality, making it a useful screening criterion to identify obesity in the general population [91, 93]. However, large epidemiological studies have indicated that Asian populations may experience higher levels of adiposity and cardiometabolic risk at lower BMIs, leading to the suggestions of alternative cut-off points for these populations [94-99]. In adults of South, Southeast, or East Asian ethnicity, the recommended BMI cut-off for overweight should be ≥23 kg/m² and ≥ 25 kg/m² for obesity.

[Recommendation] Ethnicity should be considered when using BMI cut-off points to determine the classification of obesity. The recommended classification of obesity based on specific BMI cut-offs by ethnicity are presented in **Table** 2-1 [100, 101].

Table 2-1. Recommended classification of BMI by ethnicity

Category	BMI (kg/m²)
Caucasian, European, and North American ethnicities	
Underweight	<18.5
Normal (healthy weight)	18.5 – 24.9
Overweight	25 – 29.9
Obesity Class 1	30 – 34.9
Obesity Class 2	35 – 39.9
Obesity Class 3	40 – 49.9
Obesity Class 4	50 – 59.9
Obesity Class 5	≥60
South, Southeast, and East Asian ethnicities	
Underweight	< 18.5
Normal range	18.5 – 24.9
Overweight – At risk	23 – 24.9
Overweight – Moderate risk	25 – 29.9
Overweight – Severe risk	≥30

Abbreviation: BMI, body mass index

Notes: Measuring BMI

1. All anthropometric measurements should be conducted barefoot and in light clothing.
2. Weight and height should be measured by trained professionals using standardized techniques and equipment and recorded to the nearest 0.1 kg and 1 cm.
3. BMI should be calculated as weight (kg) divided bythe square of the body height in meters (kg/m²).

While BMI is a simple, reproducible, and objective measure, it has limitations that clinicians should be aware of when employing these tools [102, 103]. These include:

- It does not directly measure body fat, cardiovascular risk, or health.
- It does not provide information about body fat distribution.
- It does not account for muscle mass, leading to overestimation of body fat in muscular individuals.
- It may underestimate body fat in individuals with lost muscle mass (e.g., sarcopenic obesity).
- It does not distinguish between gender or ethnicity.
- It is less accurate in certain populations (e.g., the elderly, very muscular persons, people with extremely tall or short statures, people with physical disability, individuals with a BMI < 35 kg/m²) and in individuals with a high WC, who are at an increased risk of developing cardiometabolic conditions such as T2DM and hypertension [104, 105].

2.2.2 Waist circumference

Health Canada recommends that the diagnosis of obesity not be based solely on BMI [106]. Nonetheless, due to its simplicity, objectivity, and reproducibility, BMI continues to be valuable in epidemiological and population-based surveillance studies. In a clinical setting, BMI and the recommended cut-offs should serve solely as a simple screening tool. When combined with clinical indicators such as WC and a thorough evaluation of cardiometabolic and other obesity-related complications, BMI can help identify individuals who might benefit from targeted

obesity management. Although WC is independently linked to increased cardiovascular risk, it is not a reliable predictor of visceral adipose tissue in individuals [107].

[Recommendation] Ethnicity should be considered when using WC cut-off points to define abdominal adiposity. **Table** 2-2 shows the recommended WC cut-off points for defining increased and significant abdominal adiposity by ethnicity.

Table 2-2. Proposed waist circumference cut-off points (cm) to define increased abdominal adiposity by predominant ethnicity

	Increased abdominal adiposity/ cardiovascular risk		Significant abdominal adiposity/ greater cardiovascular risk	
Predominant ethnicity	**Women**	**Men**	**Women**	**Men**
Caucasian Europid/United States/ Mid-East Mediterranean*	80	94	88	102
Latino Central/South American†	83	88	90	94
Sub-Saharan African*	80	94		
African American	90	80	99	95
African	71.5	76.5	81.5	80.5
Asian	80	85		
Chinese‡	81	83		
Korean§	75	80	85	90

Notes:

Measuring WC¶

1. Remove clothing from the waistline.
2. Stand with a straight back and feet shoulder-width apart (25 to 30 cm or 10 to 12 inches).
3. Palpate the abdomen to locate the inferior margin of the last rib at the level of the mid-axillary line.
4. Palpate and identify the crest of the ileum on both sides. Use the area between the thumb and index finger to feel for the hip bone at the level of the mid-axillary line. This is the part of the hip bone at the side of the waist, not at the front of the body.
5. WC should be measured at the end of a normal expiration, midway between the inferior margin of the last rib and the crest of the ileum in a horizontal plane, using a stretch-resistant tape that provides a constant 100g tension. The measurement should be recorded to the nearest centimeter. Have the patient take two normal breaths, and on the exhale of the second breath, tighten the tape measure, so it is snug but does not dig into the skin.

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‡ Grammatikopoulou, M.G., Chourdakis, M., Gkiouras, K., Roumeli, P., Poulimeneas, D., et al., Edmonton obesity staging system among pediatric patients: a validation and obesogenic risk factor analysis, J Endocrinol Invest 41(8) (2018) 947-957.

§ Sharma, A.M., Kushner, R.F., A proposed clinical staging system for obesity, Int J Obes (Lond) 33(3) (2009) 289-95.

¶ Chetty VT, Poddar M, Tran S, APH., P., Obesity: General Considerations. Textbook of Internal Medicine South Asian Edition, McMaster, 2021.

The integration of both anthropometric measurements (BMI and WC) can provide valuable and complementary information in the assessment of obesity and the estimation of cardiometabolic risk. When used together in clinical assessment, these measurements can better identify the higher-risk phenotype of obesity than either BMI or WC alone, particularly in patients with lower BMIs [108-111]. Among patients with a normal BMI, an increase in WC

may indicate intra-abdominal fat deposition and an increased risk of cardiometabolic disease [112]. It's recommended to use waist circumference to height ratio in addition to BMI as a predictor for cardiometabolic disease

Classification of the degree of central adiposity based on waist-to-height ratio:

- Healthy central adiposity: waist-to-height ratio 0.4 to 0.49, indicating no increased health risks
- Increased central adiposity: waist-to-height ratio 0.5 to 0.59, indicating increased health risks
- High central adiposity: waist-to-height ratio 0.6 or more, indicating further increased health risks.

For patients with an elevated BMI (<35 kg/m²), having an increased WC may indicate a greater risk of developing significant cardiometabolic outcomes. However, patients with a BMI >35 kg/m² are likely at an increased risk of cardiometabolic risk factors regardless of their WC. While measuring WC in patients with a BMI >35 kg/m² may not change obesity management, it can offer patients valuable insights into the efficacy of treatment during long-term follow-up. Some patients may observe changes in adipose distribution prior to substantial changes in body weight or BMI.

2.3 Weight promoting medicines

Regular assessment of BMI and WC, along with cardiometabolic risk factors, can also help to detect persons at higher risk of developing obesity and enable the healthcare professional to avoid the use of weight-promoting medications (**Table** 2-3) [102] and counseling on weight gain avoidance during high-risk periods, such as pregnancy or a sedentary lifestyle due to injury.

Table 2-3. Summary of weight-promoting medications and alternate therapies

Medication	Class	Drug name	Potential weight gain	Alternative therapy
Antihyperglycemics	Thiazolidinedione	Pioglitazone	↑↑	Biguanide (metformin)
	Sulfonylureas	Glipizide	↑	DPP4i (alogliptin, linagliptin, sitagliptin, saxagliptin)
		Glyburide	↑↑	GLP-1 analogs (exenatide, liraglutide, dulaglutide, semaglutide)
		Glimepiride	↑↑	AGI (acarbose, miglitol)
		Chlorpropamide	↑↑	SGLT2 inhibitors (canagliflozin, dapagliflozin, empagliflozin)
		Tolbutamide	↑↑	Pioglitazone/metformin
		Gliclazide	↑↑	Glipizide/metformin Glyburide/metformin
	Meglitinides	Repaglinide	↑	
Antidepressants	Tricyclics	Amitriptyline	↑↑↑	Bupropion
		Doxepin	↑↑↑	Nefazodone
		Imipramine	↑↑	Duloxetine
		Nortriptyline	↑↑	Venlafaxine
	Atypical	Mirtazapine	↑↑	Desvenlafaxine
	MAOIs	Phenelzine	↑↑↑	Trazodone
		Tranylcypromine	↑↑↑	Levomilnacipran
				Vilazodone
				Vortioxetine
				Selegiline (topical MAOIs)

Medication	Class	Drug name	Potential weight gain	Alternative therapy
	Selective Serotonin Reuptake Inhibitors (SSRIs) Lithium	Sertraline Paroxetine	↑	Fluvoxamine (variable weight effect)
		Citalopram	↑↑	
		Escitalopram	↑↑↑	
		Fluoxetine	↑↑	
		Lithium	↑↑↑	
			↑↑	
Antipsychotics		Haloperidol	↑↑	Ziprasidone Lurasidone Aripiprazole
		Loxapine	↑↑	
		Clozapine	↑↑	
		Chlorpromazine	↑↑	
		Fluphenazine	↑↑	
		Risperidone	↑	
		Olanzapine	↑↑	
		Quetiapine	↑↑	
		Iloperidone	↑↑	
		Sertindole	↑	
Anticonvulsants		Valproic Acid	↑↑↑	Topiramate Zonisamide Lamotrigine
		Carbamazepine	↑↑↑	
		Gabapentin	↑↑↑	
Corticosteroids	Oral steroids	Prednisone	↑↑↑	Budesonide NSAIDs
		Prednisolone	↑↑↑	
		Cortisone	↑↑↑	
	Inhaled steroids	Ciclesonide	↑	
		Fluticasone	↑	
Hormone replacement therapy	Estrogens		↑↑	
	Progestogens		↑	
Antihistamines		Diphenhydramine	↑	Oxymetazoline
Beta-blockers		Propranolol	↑	ACEi ARBs CCBs (may cause fluid retention) Timolol
		Metoprolol	↑	
		Atenolol	↑↑	
Antihypertensive		Clonidine	↑	Prazosin ACEi ARBs Diuretics

Abbreviations: ACEi, Angiotensin-converting enzyme inhibitors; AGI, alpha-glucosidase inhibitors; ARBs, angiotensin II receptor blockers; CCBs, calcium channel blockers; DPP4i, dipeptidyl peptidase-4 inhibitors; GLP-1, glucagon-like peptide-1; MAOIs, monoamine oxidase inhibitors; NSAIDs, nonsteroidal anti-inflammatory drugs; SGLT2, sodium-glucose cotransporter-2; SSRIs, selective serotonin reuptake inhibitors.
↑ up to 5 kg weight gain; ↑↑ 5 to 10 kg weight gain; ↑↑↑ more than 10 kg weight gain.

2.4 Assessing the impact of excess or abnormal adiposity on health

The association between obesity diagnosis and the onset of obesity-related complications is significant but not always linear, as comparable levels of excess adiposity obesity can have varying impacts on health and quality of life for different patients [102]. Several studies have identified a category of "metabolically healthy" individuals with obesity, who despite having elevated BMI and WC, demonstrate no objective evidence of increased cardiometabolic risk [104, 113]. Although these "metabolically healthy" individuals with obesity do not exhibit concurrent cardiometabolic risk factors, they should not be considered as medically healthy as they are at increased risk of mortality [113] and are more likely to experience other non-metabolic conditions associated with obesity, such as depression, sleep apnea, and joint/back pain. The Edmonton Obesity Staging System (EOSS) [51, 114] can be used to analyze the information gathered in an obesity assessment to understand the severity of disease and guide the extent of treatment required.

2.4.1 Edmonton Obesity Staging System (EOSS)

The EOSS categorizes obesity severity (from stage 0 to 4) based on the impact of obesity-related complications on physical and psychological health (**Figure** 2-2) [51, 114]. EOSS has been shown to be a better predictor of all-cause mortality when compared with BMI or WC measurements alone in population studies [90, 115]. It is also a measure of the mental, metabolic, and physical impact that obesity has had on the patients' health, uses these factors to determine their stage of obesity (from stage 0–4) and informs on the appropriate management strategies.

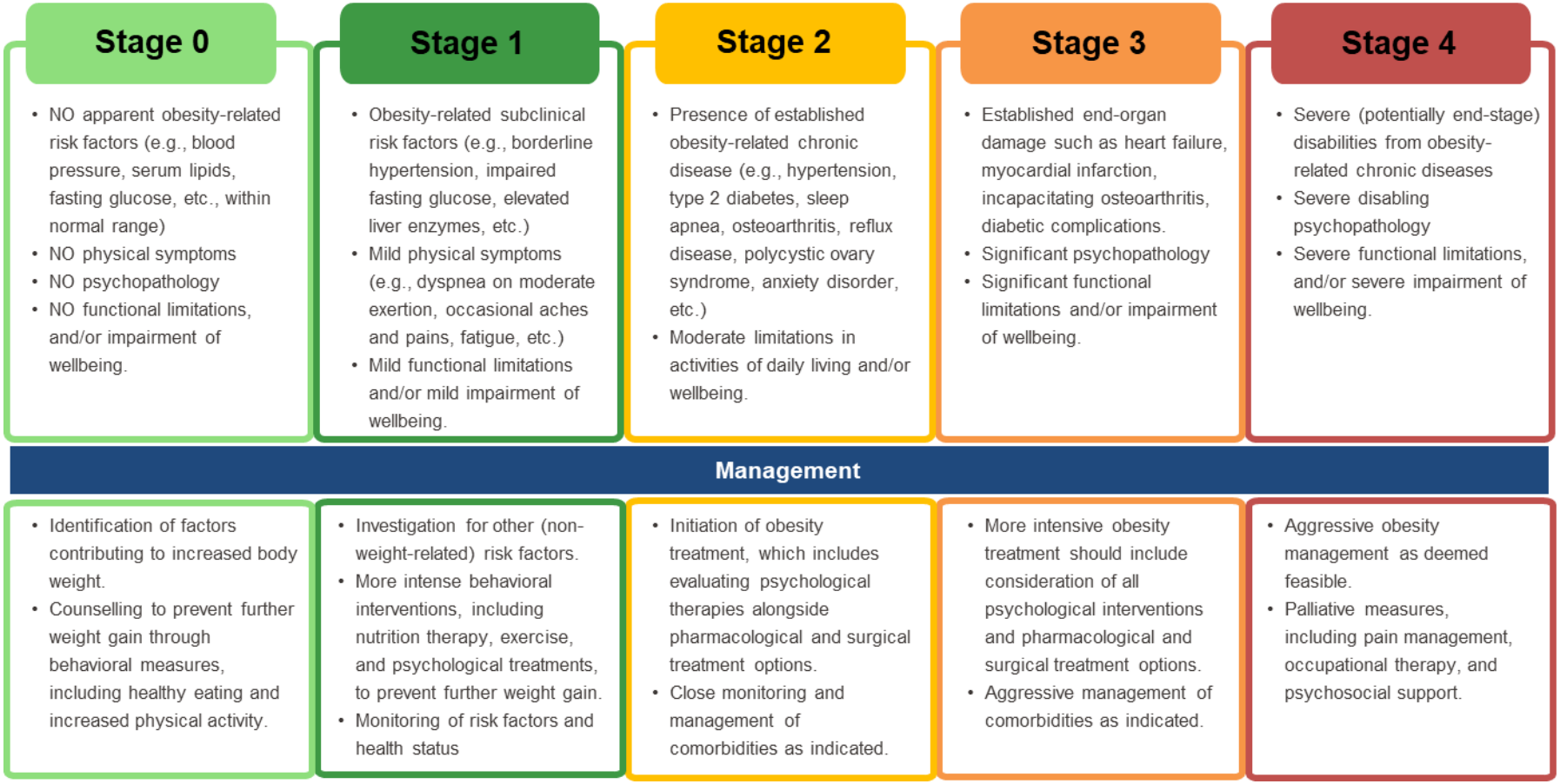

Figure 2-2 Edmonton Obesity Staging System

2.4.2 4Ms Framework

The 4Ms Framework (**M**ental health, **M**echanical, **M**etabolic, **M**onetary health / Milieu) can serve as a valuable tool for primary care physicians to develop a comprehensive understanding of the patients' unique challenges and tailor interventions accordingly, It helps physicians to identify drivers, barriers, and complications of obesity [116]. **Table** 2-4 summarizes the components of the 4Ms framework [117].

Table 2-4. Components of the 4Ms framework for assessment of obesity

Category	Complications	Frequency	Investigations	Treatment notes
Mental	Knowledge/cognition	++ *		
Health	Expectations	++ *		
	Self-image	++ * (F>M)		
	Internalized weight bias	+++	This can be accomplished through sensitive questioning/ dialogue/motivational interviewing (e.g., "Can you share with me if or how your weight affects your perception of yourself?") or by Weight Bias Internalization Scale questionnaire (WBIS)†.	Unresolved perception of weight bias can have an influence on obesity management. Coping strategies to address internalized weight bias should be incorporated into behavioral interventions, consistent with the principles of cognitive behavioral therapy and acceptance and commitment therapy.
	Mood/anxiety	++ * (F>M)	PHQ-9‡, General Anxiety Disorder (GAD-7)§	If starting pharmacotherapy, consider options that do not increase weight.
	Addiction	++ *	Yale Food Addiction Scale	
	Sleep	++ *		
	Attention	++ *		
	Personality	++ *		

Category	Complications	Frequency	Investigations	Treatment notes
Mechanical	Osteoarthritis	+ +	History, X-ray	
	Gout	+++	Uric acid level	Avoid steroids if possible
	Sleep apnea	+++	STOP-BANG sleep apnea questionnaire[¶], Berlin Questionnaire[#], overnight sleep study	CPAP therapy if indicated
	Plantar fasciitis	++ *		
	Gastroesophageal reflux	+ +		
	Urinary incontinence	++ *		
	Intertrigo	++ *		
	Idiopathic intracranial hypertension (pseudotumor cerebri)	+		
	Thrombosis	+		
Metabolic	Type 2 diabetes	+++	HbA1C, fasting glucose	Consider medication options that are weight neutral, promote weight loss.
	Hyperlipidemia	+++	Total cholesterol, triglycerides, HDL-C	
	Nutritional deficiency	+++	25 hydroxy-vitamin D, iron studies, serum B12 level	Vitamin D 1000-3000 units/day, supplement as needed to achieve therapeutic levels.
	Gout	+++	Uric acid	Avoid prednisone if possible
	Hypertension	+ +	Ensure appropriate cuff size (bladder width 40% of arm circumference, length 80–100% of arm circumference)[**]	DASH diet, consider secondary causes (e.g., sleep apnea, pain) Prioritize medications that affect the renin-angiotensin system, avoid beta blockers as first line.
	Endocrine		Total testosterone, estradiol, prolactin, 17-hydroxy-progesterone, LH/FSH, DHEAS, TSH if clinical suspicion of hypothyroidism	Consider metformin if insulin resistant
	PCOS/hypogonadism	+		
	Infertility	+		

Category	Complications	Frequency	Investigations	Treatment notes
	Cardiovascular disease	+ +	ECG, ECHO,	
	Left ventricular hypertrophy, atrial fibrillation		treadmill/bicycle/nuclear stress test if indicated and if patient able	
	Chronic venous stasis/ ulcers/thrombophlebitis			
	Stroke, DVT/PE			
	Neurological		Hx: Headache, pulsatile	
	Pseudotumor cerebri	+	tinnitus, papilledema	
	Gastrointestinal disease			
	Fatty liver		Liver enzyme elevation,	
	Gallstones	++/+++	increased liver stiffness	
		+++	(elastography) abdominal ultrasound, FIB-4 score	
	Oncology	+	Routine cancer screening	Patients with obesity are at high risk for certain cancers and are less likely to be screened due to technical issues with diagnostic testing and delays in seeking medical attention.
	Colorectal, gallbladder, pancreatic, breast, renal, uterine, cervical, prostate			
	Skin	+++		
	Acanthosis, skin tags	++*		
	Candida	+*		
	Intertrigo	+*		
	Tinea	+*		
	Folliculitis			
Monetary Health/ "Milieu"	Socioeconomic status	+		
	Education			
	Access to food			
	Occupation			
	Disability			
	Clothing			
	Weight loss programs			
	Access to pharmacotherapy			
	Surgery			
	Vitamins			

(+) Rare but increased risk with obesity
(++) Uncommon; screen if appropriate
(+++) Common; screen most patients
Abbreviations: CPAP, continuous positive airway pressure; DASH, Dietary approaches to stop hypertension; DHEAS, dehydroepiandrosterone; DVT/PE, deep venous thrombosis/pulmonary embolism; ECG, electrocardiogram; ECHO, echocardiogram; FIB-4, Fibrosis-4, F, Female; GAD, generalized anxiety disorder; Hx, history; LH/FSH, luteinizing hormone/follicle stimulating hormone; M, Male; RR, Relative Risk; PCOS, polycystic ovarian syndrome; PHQ-9, Patient

Health Questionnaire-9; TSH, thyroid stimulating hormone.
Notes:

[*] Depending on patient population
+ RR 1–2 (rare) but increased risk with obesity; ++ RR 2–3 (uncommon) screen if appropriate; +++ RR >3 (common) screen most patients
[†] Durso, L.E., Latner, J.D., Understanding self-directed stigma: development of the weight bias internalization scale, Obesity (Silver Spring) 16 Suppl 2 (2008) S80-6.
[‡] Costantini, L., Pasquarella, C., Odone, A., Colucci, M.E., Costanza, A., et al., Screening for depression in primary care with Patient Health Questionnaire-9 (PHQ-9): A systematic review, J Affect Disord 279 (2021) 473-483.
[§] Swinson RP. The GAD-7 scale was accurate for diagnosing generalised anxiety disorder. Evid Based Med 11(6) (2006) 184.
[¶] Chung, F., Yang, Y., Brown, R., Liao, P., Alternative scoring models of STOP-bang questionnaire improve specificity to detect undiagnosed obstructive sleep apnea, J Clin Sleep Med 10(9) (2014) 951-8.
[#] Chung, F., Yegneswaran. B., Liao, P., Chung, S.A., Vairavanathan, S., et al., Validation of the Berlin questionnaire and American Society of Anesthesiologists checklist as screening tools for obstructive sleep apnea in surgical patients. Anesthesiology 108(5) (2008) 822-30.
[**] Pickering, T.G., Hall, J.E., Appel, L.J., Falkner, B.E., Graves, J.W., et al., Recommendations for blood pressure measurement in humans: an AHA scientific statement from the Council on High Blood Pressure Research Professional and Public Education Subcommittee, J Clin Hypertens (Greenwich) 7(2) (2005) 102-109.

2.5 Clinical assessment for obesity

[Recommendation] Once the diagnosis of obesity has been established, the primary goal for the clinical assessment for obesity should be:

- To identify the possible causes leading to weight gain.
- To determine the extent to which weight has affected the patient's health.
- To systematically look for barriers in their management [100].

To perform an efficient and complete obesity assessment, the following assessments should be made:

- Medical history (**Table** 2-5**)**
- Physical examination (**Table** 2-6)
- Clinically indicated investigations (**Table** 2-7)
- Obesity-related diseases (**Table** 2-8)

2.5.1 Obesity-centered medical history

Guidance on taking an obesity-centered medical history is provided in **Table** 2-5 [118].

Table 2-5. Key components of an obesity-centered medical history

Interview component	Details	Implication/Significance /Recommendedactions
Weight history	Document the age of onset of obesity and major weight trajectoriesover time Previous weight loss attempts and response to interventions (including behavioral interventions, medications, endoscopicand surgical interventions) Highest and lowest weight Major life event(s) associated with weight change Current phase of weight (e.g., gaining, losing, stable)	Can help to understand patients' weight journey, success/failures of past attempts and causes of weight gain/loss in the past, childhood vs. adult obesity Can help to establish realistic expectations Can help to prevent future weight gain and target behavioral and psychological treatment Can help to make appropriate goals (e.g., weight stabilization if currently gaining weight) Key Processes[†,‡] o Show compassion o Real listening (paraphrase and summarize to ensure you understand and validate the patient's thoughts) o Help patients make sense of their story (find root causes, foster insight, find patterns, identify values/goals, reflect on the timeline to acknowledge the effect of weight towards life)
Nutrition history	Assess nutrition literacy Assess energy intake Identify current nutritional restrictions (celiac disease, allergies)	Is there concern about physiological hunger, emotional eating, mindless eating, or knowledge deficit?[§] See Chapter 3 on Medical nutrition therapy for details
Physical activity	Current physical activity, including time spent in sedentaryactivities Limitations to activity (e.g., pain, time, motivation) Identify social limiting factors restricting access to increasing physical activity	Help the patient make self-directed activity goals Address limitations independently (e.g., pain management forjoint pain, etc.) See Chapter 4 on Physical activity in obesity management Key processes[†,‡] o Recognize strengths o Shift beliefs o Reframe misconceptions o Help establish whole-person value goals and functional outcomes instead of weight-based goals
Depression and anxiety screening	Screen for depression and anxiety	Consider referral to psychiatry/psychology

Interview component	Details	Implication/Significance /Recommendedactions
Other mental health issues/drivers	Screen for attention deficit hyperactivity disorder, post-traumatic stress disorder, and chronic grief. Psychological impact of previous weight journey	Consider referral to psychiatry/psychology. Review challenges with body image and self-esteem.
Addiction/dependency	Smoking status Alcohol intake Use of cannabinoids and other psychoactive substances Current or previous abuse of the substance Excessive use of caffeine-containing beverages (e.g., sugar-sweetened beverages)	Consider referral to psychiatry/psychology

Notes:

† Akpinar, E., Bashan, I., Bozdemir, N., Saatci, E., Which is the best anthropometric technique to identify obesity: body mass index, waist circumference or waist-hip ratio?, Coll Antropol 31(2) (2007) 387-93.

‡ Retat, L., Pimpin, L., Webber, L., Jaccard, A., Lewis, A., et al., Screening and brief intervention for obesity in primary care: cost-effectiveness analysis in the BWeL trial, Int J Obes (Lond) 43(10) (2019) 2066-2075.

§ Sharma, A.M., Padwal, R., Obesity is a sign - over-eating is a symptom: an aetiological framework for the assessment and management of obesity, Obes Rev 11(5) (2010) 362-70.

2.5.2 Obesity-centered physical examination

Guidance on performing an obesity-centered physical examination is provided in **Table** 2-6 [102].

Table 2-6. Key components of an obesity-centered physical examination.

Component	Examination
Vital signs	• Blood pressure (appropriately sized cuff), heart rate
Anthropometric measurement	• Weight, height, WC, BMI
Head and neck	• Neck circumference, Mallampati score • Thyroid exam • Cushing's (moon facies, prominent supraclavicular and dorsocervical fat pad) • Polycystic ovary syndrome (acanthosis nigricans, hirsutism, acne)
Cardiorespiratory	• Heart rate and rhythm • Signs of heart failure (added heart sounds, pedal edema, pulmonary rales)
Gastrointestinal	• Liver scan • Umbilical, incisional hernias • Screening for stigmata of chronic liver disease (encephalopathy, ascites, jaundice, palmar erythema, etc.)
Musculoskeletal	• Osteoarthritis (Heberden's/Bouchard's nodes, weight-bearing joints) • Gout • Gait exam
Skin	• Candida, tinea, intertrigo, psoriasis, acanthosis nigricans, skin tags • Nutritional deficiencies (pallor of conjunctiva, atrophic glossitis, palmar crease rubor, neuropathy)[†] • Abdominal striae (violaceous striae wider than 1 cm)
Lower limbs	• Lymphedema (non-painful, pitting edema, typically arms/legs) • Lipedema (often painful fat deposition, non-pitting edema, typically in arms and legs with sparing of the hands and feet) • Venous insufficiency, ulcers, stasis, thrombophlebitis

Abbreviations: BMI, body mass index; WC, waist circumference

Notes:

[†] Aasheim, E.T., Aylwin, S.J., Radhakrishnan, S.T., Sood, A.S., Jovanovic, A., et al., Assessment of obesity beyond body mass index to determine benefit of treatment, Clin Obes 1(2-3) (2011) 77-84.

Investigations to assess obesity

In patients with obesity, early intervention is required to treat and prevent obesity-related complications. Diagnostic testing should be performed at initial assessment to identify obesity-related complications and the results can be used as a guide to initiate appropriate treatment (**Table** 2-7) [102]. The choice for diagnostic testing should be based on the presenting symptoms and obesity-related comorbidities of the patient (**Table** 2-8).

Table 2-7. Laboratory and diagnostic tests to consider in assessment of patients with obesity

Patient type	Suggested diagnostic tests
Consider for most patients	• Glycated hemoglobin (HbA1c) • Electrolytes, renal function tests (creatinine, eGFR) • Total cholesterol, HDL- and LDL-cholesterol, triglycerides, Non-HDL cholesterol • Alanine aminotransferase • Age-appropriate cancer screening
Consider only if clinically indicated	• Complete (full) blood count • Thyroid stimulating hormone (TSH) • Uric acid • Assessment of iron (TIBC, % saturation, serum ferritin, serum iron) • Vitamins B12 and D levels • Urinalysis • Urine for micro-albuminuria • Exclude Cushing syndrome; dexamethasone suppression test (DMST), midnight salivary cortisol, 24-hour urinary cortisol
Women with obesity and symptoms of polycystic ovary syndrome	• LH, FSH, total testosterone, DHEAS, prolactin and 17 hydroxyprogesterone levels

Abbreviations: DHEAS, dehydroepiandrosterone sulfate; eGFR, estimated glomerular filtration rate; FSH, follicle-stimulating hormone; HbA1c, hemoglobin A1c; LH, luteinizing hormone; TBIC, total iron-binding capacity.

2.5.3 Assessment for obesity-related diseases

Table 2-8 provides guidance for assessing obesity-related comorbidities of the patient.

Table 2-8. Summary of assessment for obesity-related comorbidities

Disease	Assessments
Type 2 diabetes mellitus (T2DM)	Glycated hemoglobin (HbA1c) and fasting glucose to screen for diabetes
Cardiovascular disease	Electrocardiogram (ECG), cardiac ultrasound and cardiac risk assessment Referral to cardiology if high cardiovascular risk, presence of cardiac symptoms or abnormal ECG or cardiac ultrasound.
Metabolic associated fatty liver disease	Liver function tests and platelets to calculate FIB-4 score (predictive of liver fibrosis Consider abdominal ultrasound fibro-scan if liver enzymes elevated, particularly if associated with hyperglycemia, specifically to detect fibrotic liver disease
Gastro-esophageal reflux disease	If presence of severe heartburn or acid reflux, consider referral for endoscopy

Disease	Assessments
Obstructive sleep apnea (OSA)	Screening questionnaire (e.g., STOP-BANG[*]) to identify those at risk for OSA Referral to sleep specialist if STOP-BANG score ≥ 3
Asthma	Underdiagnosed – wheezing or short of breath – refer to respiratory physician Undertreated – asthma plan review
Idiopathic intracranial hypertension	Headaches, women aged 20–50 at greatest risk. Assess for papilledema and visual disturbance. Refer to neurologist for further investigation.
Arthralgia	Usually from degenerative joint disease but consider rheumatoid arthritis as risk increased with obesity If neurological signs present, imaging is necessary
Lymphoedema	Optimal treatment is compression after ensuring peripheral circulation is normal; often misdiagnosed as cardiac failure, will worsen with diuretics Consider referral to occupational therapist for compression bandaging if very severe
Reproductive hormonal dysfunction	Central hypogonadism can also occur in females. However, polycystic ovary syndrome (PCOS) is more common; both can result in amenorrhea and reduced fertility. PCOS also has features of androgen excess
Disordered eating	Enquire about binge eating, purging or night eating Referral to dietitian or clinical psychologist with expertise in this area if suggestive symptoms
Depression	Screening questionnaire (e.g., K10 screening tool for anxiety and depression[§] or Patient Health Questionnaire-9 (PHQ-9)[†] Referral to clinical psychologist or psychiatrist if high risk identified.

Abbreviations: ECG, electrocardiogram; HbA1c, glycated hemoglobin; OSA, obstructive sleep apnea; PCOS, polycystic ovary syndrome; PHQ-9, Patient Health Questionnaire; T2DM: type 2 diabetes mellitus

Notes:

[*] Chung, F., Yang, Y., Brown, R., Liao, P., Alternative scoring models of STOP-bang questionnaire improve specificity to detect undiagnosed obstructive sleep apnea, J Clin Sleep Med 10(9) (2014) 951-8.

[†] Costantini, L., Pasquarella, C., Odone, A., Colucci, M.E., Costanza, A., et al., Screening for depression in primary care with Patient Health Questionnaire-9 (PHQ-9): A systematic review, J Affect Disord 279 (2021) 473-483.

[§] Kessler RC, Barker PR, Colpe LJ, Epstein JF, Gfroerer JC, Hiripi E, et al. Screening for serious mental illness in the general population. Arch Gen Psychiatry 60(2) (2003) 184-189.

2.6 The potential role of technology in obesity management in primary care

The use of electronic medical records (EMR) has allowed for more efficient storage and handling of patient information. This has revolutionized the management of primary care, including obesity care. Patient data stored in EMR, such as BMI, family history, and comorbidities, can be utilized to provide evidence-based guidelines and alerts that facilitate timely and accurate obesity diagnosis. Integrating EMR data with Clinical Decision Support Systems (CDSS) enables healthcare providers to identify patients at risk of obesity and intervene early.

Furthermore, technology-based assessment tools can facilitate the timely acquisition and evaluation of obesity-related factors. For example, digital questionnaires administered through electronic devices offer an efficient means of gathering information on weight status, dietary habits, physical activity levels, and comorbidities. This

can be enhanced through the use of advanced technology such as wearable devices. With wearable devices and mobile health applications, patients and healthcare providers can closely monitor obesity or obesity risk status. These devices also assist in tracking the effectiveness of dietary plans and lifestyle changes on patients' obesity or obesity risk status, enabling more responsive adjustments from both patients and their healthcare providers [119-121].

CHAPTER 3. Medical nutrition therapy in obesity management

Ms. Afra AlSammach and Ms. Rita Samuel

HIGHLIGHTS
Medical nutrition therapy integrates a comprehensive assessment and evaluation of the medical condition to ensure nutritional adequacy through a personalized tailored diet.
Holistic assessment is performed based on anthropometric measurements, biochemical analysis, clinical assessment (signs and symptoms), and dietary habits.
Nutrition interventions should encompass - Diet plans for balanced nutrition - Behavior modifications to eating habits - Caloric restriction and hunger and satiety cues

3.1 Introduction

Medical Nutrition Therapy (MNT) is a therapeutic approach that extends beyond basic dietary adjustments to prevent and treat medical conditions and their associated symptoms. MNT incorporates a comprehensive assessment and evaluation of the medical condition of the patient to ensure nutritional adequacy through a personalized tailored diet which is created and monitored by a professional Registered Dietitian (RD) [122]. The primary aim of MNT for people with overweight and obesity is to achieve and maintain a healthy weight, improve body composition by reducing body fat and preserving lean muscle mass, and decrease the health risks associated with obesity, such as diabetes, heart disease, and hypertension.

SMART (Specific, Measurable, Achievable, Relevant, Time-bound) goals are set realistically with the patient. They are regularly evaluated and modified by the RD to ensure they remain aligned with the health progress and motivations of the patient [123]. It includes:

- **Individualized care**: Every patient receives a personalized nutrition plan based on a thorough assessment of their medical history, dietary habits, lifestyle factors, and specific health needs [124].
- **Holistic approach**: MNT considers all aspects of an individual's health, not just their diet. It integrates the physical, medical, psychosocial, and behavioral elements to create a comprehensive treatment strategy [124].
- **Education**: Education is a key component of MNT, where patients (and sometimes their families) are not only informed about what to eat but also taught how to make healthy choices independently. The patient's involvement in their dietary plan is crucial in empowering and motivating them to commit to long-term dietary habit changes [125].

[Recommendation] The nutrition care process is a standardized process consisting of four steps for nutrition care developed by the Academy of Nutrition and Dietetics [122]. These are:

- Nutrition assessment
- Nutrition diagnosis

- Nutrition intervention
- Monitoring and evaluation

3.2 Nutrition assessment

The initial step in understanding the patient comprehensively is nutritional assessment. It is conducted by RDs and/or Registered Nutritionists to assess the individual from a holistic perspective using anthropometric measurements, biochemical analysis, clinical assessment (signs and symptoms), and dietary habits. In addition, medical history and psychological factors also play a crucial role in defining the nutrition status [126].

3.2.1 Anthropometric measurements

Anthropometric measurements, such as weight, height, BMI, WC, hip circumference, waist-to-hip ratio, and skinfold thickness [127], are a set of quantitative measurements used to assess the size and composition of the human body. These measurements are commonly used to evaluate an individual's health status and risk factors for certain diseases. Details of anthropometric measurements have been discussed in Chapter 2.

3.2.2 Biochemical analysis

Biochemical analysis is a crucial component of management in people with overweight and obesity, providing concrete data on the metabolic status of an individual and the underlying risk factors associated with obesity. It involves the examination of blood, urine, and other fluids to assess a wide range of biochemical markers, such as blood glucose levels, lipid profiles, protein levels, micronutrients (vitamins and minerals), and enzyme activities. Nutritional deficiencies or imbalances may not be evident from a dietary assessment alone; thus, biochemical analysis can better understand metabolic health and the effectiveness of dietary interventions [128].

3.2.3 Clinical assessment

Clinical assessment evaluates physical signs and symptoms that may indicate nutritional problems. It includes a physical examination of the skin, hair, nails, teeth, oral cavity, and overall body systems to check for signs of nutrient deficiencies or excesses. Clinical history is also reviewed to consider factors like past and present illnesses, medications and supplements, and family history, which can affect the overall nutritional status [122].

3.2.4 Dietary habits assessment

Dietary habit assessment involves collecting detailed information about an individual's dietary intake and habits to identify usual consumption patterns, preferences, and dietary restrictions. These assessments help to tailor nutritional interventions to promote healthier eating behaviors and weight management. Methods can include 24-hour dietary recalls, food frequency questionnaires (FFQ), and food diaries (**Table** 3-1). The goal is to assess dietary habits and relate them to current nutritional guidelines to determine any inadequacies or excesses [122].

Table 3-1. Methods for assessing dietary habits

Method	Purpose	Pros	Cons
24-Hour Recall	Evaluate an individual's intake over 24 hours	• Fast • Does not alter eating behavior	• Relies on memory • May not represent usual intake • Subject to underreporting
FFQ	Assesses usual dietary patterns over an extended period	• Covers a broader diet range • Can be analyzed for dietary patterns	• May be less accurate in quantifying intake • Requires literacy and motivation • Fixed food items list might miss locally consumed food
Food diaries or records	Provides detailed information on everything consumed over several days (might include time, place, emotion)	• Highly detailed data on intake and context • Allows portion size estimation	• Burden for individuals • Requires high commitment • Potential alteration of diet during recording

Abbreviations: FFQ, food frequency questionnaire

3.3 Nutrition diagnosis

It is the second step in medical nutrition therapy. It refers to the "PES statement", which stands for the problem, etiology, signs and symptoms [122]. It helps the registered dietitian to analyze the actual problem that needs to be resolved, it can be a clinical problem, intake problem or a behavioral problem.

- Problem: The specific diagnosis.
- Etiology: The reason behind the problem.
- Signs & symptoms: The justification of the problem, which can be withdrawn from the nutrition assessment.

3.4 Nutrition intervention

3.4.1 Dietary approach

The ultimate goal of the dietary approach in MNT is to achieve weight loss and foster healthier eating patterns that patients can maintain over the long term, thus improving quality of life and reducing the risks associated with obesity [122]. Multiple factors influence weight management in people living with obesity. The key components of weight management strategies include caloric restriction, manipulation of the macronutrient composition of food, artificial sweeteners and the time of meals [129].

3.4.2 Caloric restriction

Caloric restriction involves setting specific daily calorie limits to achieve quick weight loss, often ranging from 1,200 to 1,800 calories per day depending on the individual's baseline needs and weight loss goals.

Low-calorie diet: Obesity clinical guidelines recommend a calorie restriction of 500–750 calories/day from carbohydrates or fats to achieve a total consumption of 1,000–1,500 calories/day [130, 131].

- Very low-calorie diet (VLCD): It involves a total calorie intake of < 800 kcal a day. This diet is not recommended for routine weight management and should only be used in specific situations accompanied by medical supervision and monitoring [130, 131].
- Very low-calorie ketogenic diet (VLCKD): It is a form of VLCD associated with substantial weight loss in a short time [132]. The VLCKD consists of limiting the calorie intake to < 700–800 kcal/day in association with low carbohydrate intake (< 30–50 g/day) together with an adequate amount of daily protein intake of ideal body weight (0.8–1.2 g/kg/day). This diet should be followed for a limited period, to be followed by a gradual transition to a low- calorie diet [129].

3.4.3 Non-restrictive approaches

These approaches emphasize internal cues like hunger and satiety and prioritize food quality over quantity. They include mindful eating and Health at Every Size (HAES) and have shown benefits in improving psychological well-being and reducing disordered eating, though their effects on weight and cardiovascular health are mixed. HAES is a more sustainable solution, focusing on overall health rather than strict weight loss (Details in chapter 5).

3.4.4 Manipulation of macronutrient content

This strategy works by changing the macronutrient composition of iso-caloric diet for weight loss as well as keeping its metabolic benefits. The mechanism of action of this strategy depends on the principle that macronutrient change can affect the hormones, metabolic pathways, and gene expression, in addition to its action on the gut microbiome which together could affect fat storage in the body [133]. This manipulation strategy has resulted in the creation of a number of diets, for example:

- High-protein diet: It refers to a diet with protein intake of 30% of the total daily calories or 1–1.2 g/kg (ideal body weight) per day. The Atkins diet is an example of a high protein diet, and it is characterized by low carbohydrate (CHO) content (< 20 grams in first 2 weeks followed by < 50 grams in the weeks after), high fat and protein content with no restriction on the total caloric intake. High protein diets have been shown to increase the satiating effect and prevent weight regain [134]. However, some studies showed that the Atkins diet was also associated with an increase in total cholesterol and LDL-C in the first 3 months but these returned to normal within one year of treatment [135].
- Ketogenic diet: It is characterized by decreasing the CHO content and increasing the fat content with no change in the protein intake and no restriction in the total caloric intake. Although the diet was associated with significant weight loss [136-138], the effect on the lipid profile and hepatic steatosis which could be associated with an increased risk for cardiovascular diseases have been reported [139-142].
- Mediterranean diet: This diet focused on high intake of vegetables, fruits, nuts, whole grains, and olive oil (as a source of fat), with moderate intake of fish and poultry [143]. The Mediterranean diet was found to be a good strategy for long term weight maintenance [129].
- The Paleolithic (Paleo) diet: This diet is based on the foods that were available to our ancestors including meat, nuts, eggs, healthy oils, and fresh fruits and vegetables. The diet excludes cereal grains, legumes, dairy, and any processed products [144]. Studies show that this diet was associated with a decrease in

body weight in both the short and long term [145-148]. However, low adherence [71], poor palatability, and high costs in addition to deficiency of Vitamin D, calcium and iodine are the limitations of this diet [147, 149, 150].

- Low fat diet: It is a diet where the calories derived from fat ranges from less than or equal to 10% (very low) to less than or equal to 30% with 7-10% from saturated fat (moderate) [151]. However, there is no evidence that a diet with low fat contents is better than other dietary interventions [152].
- Low glycemic index (GI) diet: In this diet, high GI foods (e.g., white bread, cereals, potatoes, pasta, and noodles) are exchanged with medium or low GI food (e.g., vegetables, fruits, pulses, multigrain/whole-grain wheat or rye bread). This diet helps in weight management through increasing satiety and had been found to prevent coronary heart disease [153] and manage type 2 diabetes [154].

3.4.5 Manipulation of timing (intermittent fasting or Time Restricted Eating)

Intermittent calorie restriction has emerged as an alternative strategy for weight loss. Instead of daily calorie limits, intermittent fasting (IF) introduces a different approach by re-arranging eating and fasting periods. With its ability to control caloric intake, IF preserves food flexibility during mealtime windows. Several regimens of IF differ in length and frequency. The most widely used regimens are alternate-day fasting, periodic 5:2 fasting (i.e., fasting or consuming 900–1,000 calories for 2 days each week and 5 days of normal eating), and daily time-restricted feeding (fasting for 16–18 hours a day) [155]. This strategy was associated with improved insulin sensitivity and reduced blood pressure [156].. Even though IF can help with metabolic health and weight loss, its long-term sustainability and effects on adequate nutrition should be carefully evaluated. Combining aspects of intermittent fasting, non-restrictive methods, and calorie restriction may be a more flexible and successful strategy for managing obesity and better suited to the tastes and health goals of the individual [118, 157].

3.4.6 Artificial sweeteners

Artificial sweeteners can be classified as nutritive and non-nutritive sweeteners, according to their calories content. The nutritive sweeteners include monosaccharide polyols (xylitol, mannitol, and sorbitol) and disaccharide polyols (lactitol and maltitol). The non-nutritive sweeteners, include substances that have a sweeter taste without the calories [158], such as saccharin, sucralose, aspartame, advantame, acesulfame-potassium, and neotame as food additives approved by the Food and Drug Administration (FDA) [159]; and thaumatin, steviol glycosides (from *Stevia* plant leaves) and *Luo Han Guo* fruit extracts, referred to as "Generally Recognized as Safe" (GRAS) [160]. They work in controlling body weight through different mechanisms including alteration of gut microbiota, insulin secretory capacity, insulin resistance and reward system [161]. Meta-analysis of short-term randomized controlled trials showed that individuals consuming artificial sweeteners had lower BMI and body weight compared with those consuming free sugars. However, prospective cohort studies proposed the possibility of increased risk of long term consequences including obesity, cardiometabolic diseases and mortality [162].

All strategies highlighted the need for personalized treatment plans in management of people with overweight and obesity. Combining elements from different strategies may yield a more effective, adaptable approach to obesity management and emphasize individual preferences and health outcomes [118, 157].

Table 3-2 lists the key components of these weight management strategies.

Table 3-2. Key components of weight management strategies

Nutrition Intervention	Advantages	Disadvantages	Contraindications	Associated Weight Loss
Individualized MNT	Maintains healthy weight[*]	-	-	Sustainable long-term weight loss[*]
Caloric restriction	Quick weight loss[*]	Hard to maintain[*]	Can affect bone and muscle density[*]	Short term weight loss[*]
Non-restrictive approaches	Useful for people with eating disorders[*]	Different results related to cardiovascular health and weight loss	Long term commitment[†]	It differs based on the psychological condition[†]
Intermittent fasting	Improves metabolic health[§§]	Can affect adequate nutrition[§§]	Difficult to sustain[§]	Short term weight loss[§]
Artificial sweeteners	Lower sugar consumption and controls body weight[††]		Increased risk of side effects on health on the long term[**]	Weight management – short term weight loss[*]

[*] Brown J, Clarke C, Johnson Stoklossa C, Sievenpiper J. Canadian Adult Obesity Clinical Practice Guidelines: Medical Nutrition Therapy in Obesity Management. Available from: https://obesitycanada.ca/guidelines/nutrition. [September 2024].
[†] Abusnana, S., Fargaly, M., Alfardan, S.H., Al Hammadi, F.H., Bashier, A., et al., Clinical Practice Recommendations for the Management of Obesity in the United Arab Emirates, Obes Facts 11(5) (2018) 413 - 428.
[§] Association for the Study of Obesity on the Island of Ireland, Clinical practice guidelines for the management of obesity in adults in Ireland. , 2022. https://asoi.info/guidelines/. (Accessed 28 Aug 2024).
[**] M., R.-L., Montez J., Health effects of the use of non-sugar sweeteners: a systematic review and meta-analysis, Report No.: 9240046429. , World Health Organization, Geneva, 2022.
[††] Pang, M.D., Goossens, G.H., Blaak, E.E., The Impact of Artificial Sweeteners on Body Weight Control and Glucose Homeostasis, Front Nutr 7 (2020) 598340.
[§§] de Cabo, R., Mattson, M.P., Effects of Intermittent Fasting on Health, Aging, and Disease, N Engl J Med 381(26) (2019) 2541-2551.

3.4.7 Behavior modification strategies

MNT interventions necessitate behavior modifications for individuals living with obesity, focusing on altering eating habits such as the pace of eating, meal timing, and the context in which food is consumed, in addition to enhancing food planning activities like grocery shopping and meal preparation [163]. These behavior modifications include:

- **Modifying the eating pace**: Encourage eating slowly (20-30 min/meal) by setting down utensils between bites or chewing food thoroughly. This improves digestion, satiety, and satisfaction and reduces overeating [118].
- **Improving meal timing**: Establish a consistent eating schedule to regulate hunger and fullness signals (use hunger and satiety scale). Plan for regular and balanced meals and 1-2 snacks/day to avoid long periods of hunger [118].

- **Creating the environment for food consumption**: Promote mindful eating by creating a distraction-free eating environment. Avoid eating while working, watching TV, or using a mobile phone. Encourage the practice of mindfulness during meals to enhance awareness of the food's taste, texture, and aroma, fostering a more enjoyable eating experience [118, 123].
- **Shopping for groceries and meal preparation**: Educate patients (and/or their families) to plan their grocery shopping list based on weekly meal plans. Offer strategies for efficient meal preparation, such as preparing bulk meals at the start of the week [118].

3.5 Monitoring and evaluation

- **Monitoring**: Monitor the patient's progress throughout the management period. This involves regularly assessing various parameters, including dietary intake, nutritional status, anthropometric measurements, biochemical data, clinical indicators, and other relevant factors identified during the nutrition assessment.
- **Evaluation**: Assessing the outcomes of the nutrition intervention to determine its effectiveness in addressing the identified nutrition-related problems and achieving the desired goals. This may include evaluating changes in dietary habits, improvements in nutritional status, reductions in disease risk factors, enhancements in quality of life, or other relevant outcomes.

3.6 Tips for individuals living with obesity

[Recommendation] Clinicians may use the following tips to advise their patients who are living with obesity (**Figure** 3-1).

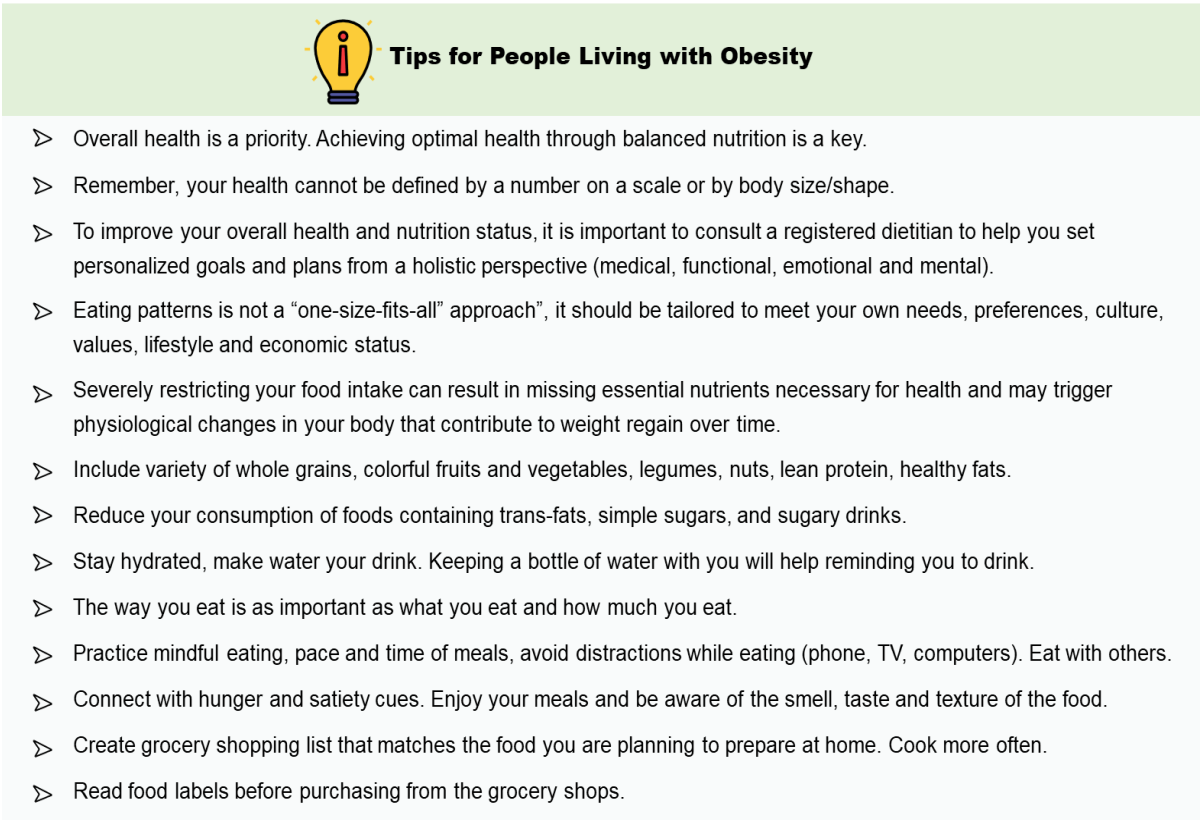

Figure 3-1. Tips for people living with obesity

3.7 Key messages for healthcare professionals

- Assess the health and nutrition status of the patient from a holistic perspective.
- Engage the individual in the goal setting and the intervention plan.
- Ensure a personalized patient-centered approach (medical conditions, preferences, values, culture, affordability, cooking skills).
- Create SMART goals with the patient.
- Prioritize overall health and well-being outcomes.
- Develop dietary strategies that emphasize sustainable behavioral changes.
- Emphasize nutrition education for the patient and his or her family.
- Educate the patient on reading food labels.
- Avoid judgment and blame.
- Set regular follow-up appointments to support the patient in maintaining weight loss.
- Monitor behavioral health, nutrition status, mental and emotional well-being, and other risk factors associated with obesity.
- Refer the patient to other healthcare professionals as needed.

CHAPTER 4. Physical activity in obesity management

Dr. Buthaina Bin Belaila and Dr Marwa Khalil

HIGHLIGHTS
Physical inactivity is a leading risk factor for mortality globally.
Pre-exercise screening: Use the General Practice Physical Activity Questionnaire (GPPAQ)
Identify patients with certain health conditions that may act as a contraindication for certain types of physical activity: Use the Physical Activity Readiness Questionnaire (PAR-Q and PAR-Q+)
Prescribed exercise should be individualized, taking into consideration the personal needs and interests: Apply the FITT (Frequency, Intensity, Time, Type) principle.
Exercise prescription for special populations: Use the Physical Activity Readiness Medical Examination (PARmed-X).
Technological devices offer an objective, measurable method to monitor physical activity.

4.1 Introduction

Physical inactivity is the fourth leading risk factor for mortality globally, after high blood pressure, tobacco use, and high blood glucose [127]. The prevalence of obesity and physical inactivity varies across socioeconomic levels and ethnicity, which leads to expanding health inequalities [164].

A meta-analysis on the effectiveness of physical activity for weight loss in individuals with obesity concluded that physical activity combined with proper diet resulted in an approximate weight loss of 1.95 kg after 12 months, compared to dieting alone [165]. Several large longitudinal studies have consistently observed that greater physical activity (or cardiorespiratory fitness) was associated with reductions in all-cause mortality, cardiovascular diseases, and metabolic diseases, such as type 2 diabetes [166, 167].

Exercise is a subcategory of physical activity, and is defined as “any planned, structured, repetitive, and intentional movement aimed at improving or maintaining physical fitness” [168]. It is important to have a specific exercise prescription [163] to achieve the desired aim of physical activity. The aim of an effective exercise prescription is to integrate physical activity seamlessly into a patient's daily life, making it an enduring routine.

4.2 Exercise prescription

Effective exercise prescription necessitates careful consideration of the patient’s health condition, fitness level, goals and personal preferences. Before starting a physical activity program, it is important to **screen, assess**, and **prescribe** the appropriate exercise regimen.

4.2.1 Pre-exercise screening

Taking a Physical Activity (PA) history is a very important step in planning a successful physical activity program. It is crucial to assess the patient's current level of PA, including the number of days per week the patient is engaged in moderate or vigorous PA and the duration (in minutes) of these activities.

[Recommendation] Clinicians in primary care may use the General Practice Physical Activity Questionnaire (GPPAQ) [169]. This tool categorizes patients as Active, Moderately Active, Moderately Inactive, and Inactive (**Table 4-1**). It is fundamental to evaluate the motivation of the patient to practice PA and identify potential barriers to participation.

Table 4-1. Patient categorization using the General Practice Physical Activity Questionnaire (GPPAQ)

			Occupation	
Physical exercise and / or cycling (hr/wk)	**Sedentary**	**Standing**	**Physical**	**Heavy Manual**
0 hour	Inactive	Moderately Inactive	Moderately Active	Active
Some but < 1 hour	Moderately Inactive	Moderately Active	Active	Active
1-2.9 hours	Moderately Active	Active	Active	Active
≥ 3 hours	Active	Active	Active	Active

4.2.2 Assess any contraindications

The Physical Activity Readiness Questionnaire (PAR-Q and PAR-Q+) [170] tools can identify certain health conditions that may contraindicate certain types of PA. If the patient answers NO to all the PAR-Q questions, they can be advised to practice independent low to moderate intensity physical activity (**Figure** 4-1).

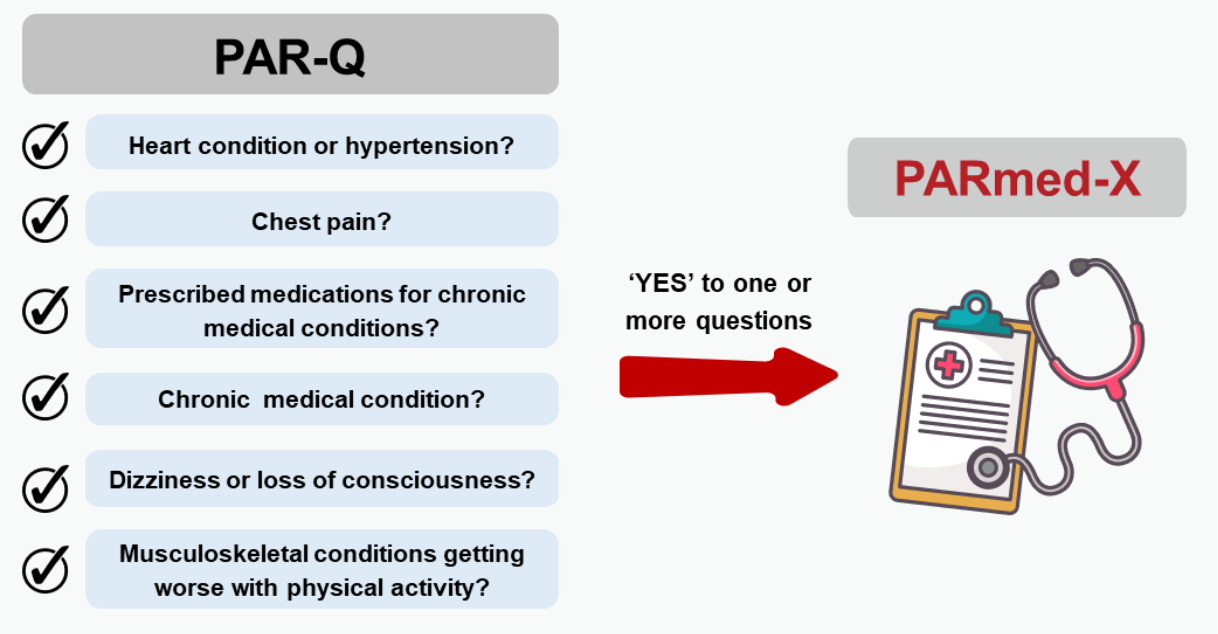

Figure 4-1. The Physical Activity Readiness Questionnaire (PAR-Q) for identifying PA contraindications

If the patient answers YES to any of the questions or is more than 69 years old, they should be evaluated by the Physical Activity Readiness Medical Examination (PARmed-X) [171] and accordingly categorized as having absolute contraindications, relative contraindications, or special prescriptive conditions for physical activity (**Figure** 4-2).

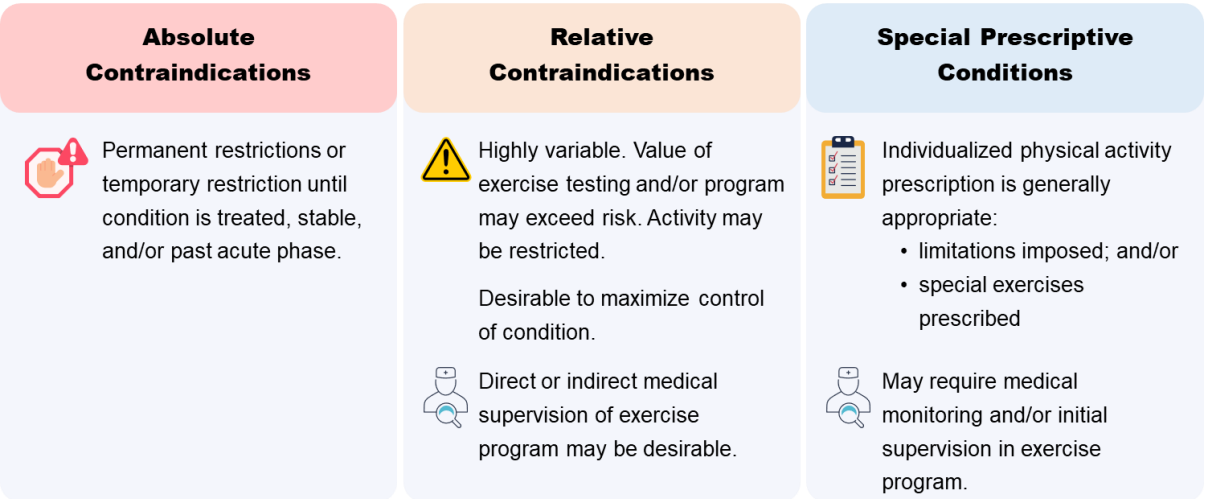

Figure 4-2. Contraindications and special conditions for physical activity prescription

4.2.3 Prescribe the exercise

An exercise prescription should be treated with the same importance as any other medical prescription. The following elements need to be considered in the prescription:

- The right type of exercise

- The benefits should outweigh any potential side effects
- The right amount and frequency

The exercise prescription plan should be individualized, considering each patient's needs and interests [172]. A typical exercise prescription should include the following parameters: (1) frequency, (2) intensity (3) timing and (4) type (FITT).

[Recommendation] The elements of the physical activity program based on FITT parameters are shown in **Figure** 4-3.

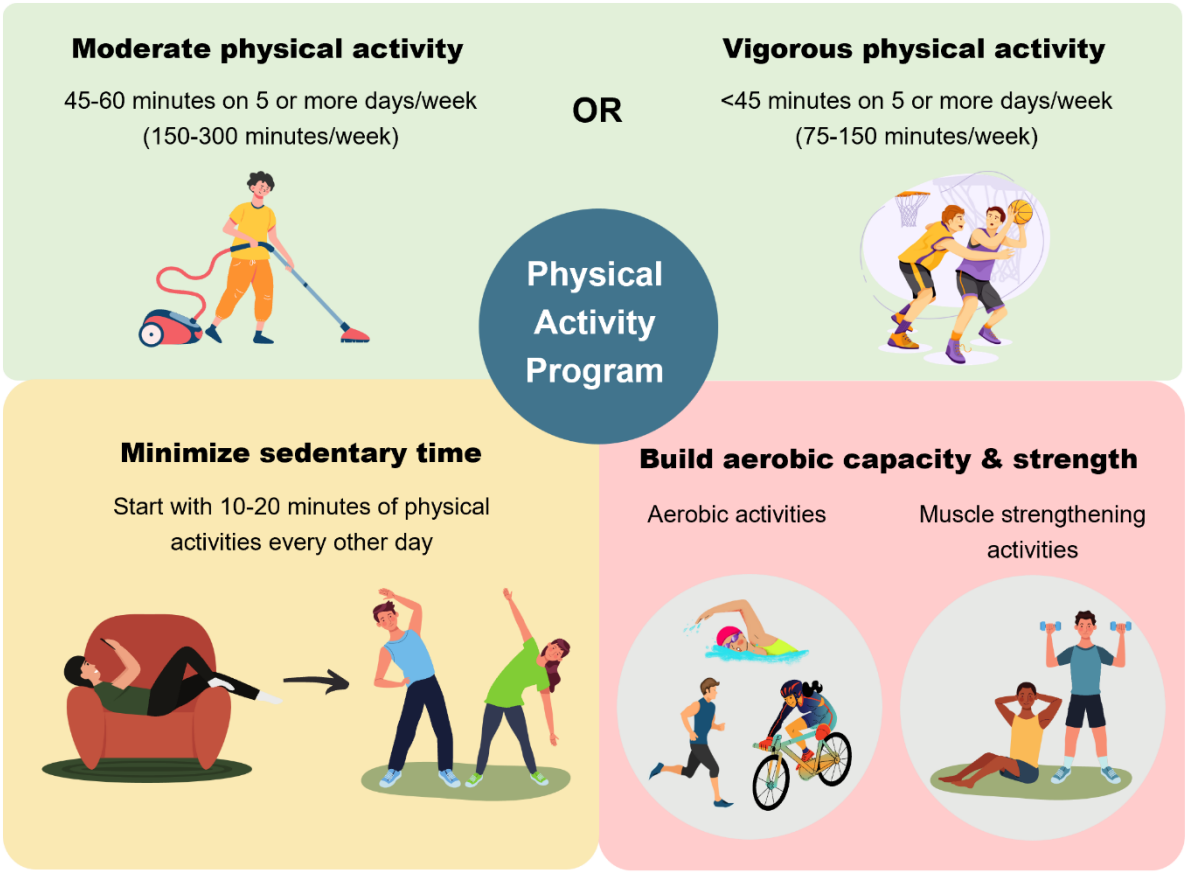

Figure 4-3. Elements of a physical activity program based on FITT parameters

Note: FITT* refers to Frequency, Intensity, Time, and Type of physical activity.

* Rooney, D., Gilmartin, E., Heron, N., Prescribing exercise and physical activity to treat and manage health conditions, Ulster Med J 92(1) (2023) 9-15.

Moderate PA: Is any activity that is performed at 3.0-5.9 times the intensity of rest, resulting in a HR that is 60-75% of the HRmax and the person should be able to talk but not sing.

Vigorous PA: Is any activity that is performed at more than 6 times the intensity of rest, resulting in a HR that 75-90% of the HRmax and the person should have difficulty talking more than a few single words in response to any questions.

Figure 4-4 shows the difference between aerobic activities and muscle strengthening activities.

Figure 4-4. Differences between aerobic activity and muscle strengthening activity

Abbreviation: BMI, body mass index.

Notes:

* Saris, W.H., Blair, S.N., van Baak, M.A., Eaton, S.B., Davies, P.S., et al., How much physical activity is enough to prevent unhealthy weight gain? Outcome of the IASO 1st Stock Conference and consensus statement, Obes Rev 4(2) (2003) 101-14.

† Public Health Agency Northern Ireland, Get wise to your health – Get Healthwise!, 2010. https://www.publichealth.hscni.net/news/get-wise-your-health-%E2%80%93-get-healthwise. Accessed 28 Aug 2024

‡ Biswas, A., Oh, P.I., Faulkner, G.E., Bajaj, R.R., Silver, M.A., et al., Sedentary time and its association with risk for disease incidence, mortality, and hospitalization in adults: a systematic review and meta-analysis, Ann Intern Med 162(2) (2015) 123-32.

These activities can be performed in one session or divided into several sessions lasting 10 minutes or more. Patients with obesity who have lost weight should practice 60 to 90 minutes of PA daily to avoid regaining weight [173, 174]. Sedentary patients should be advised to gradually increase their PA levels over several weeks. They can be advised to start with 10 to 20 minutes of PA every other day in the first two weeks to minimize muscle soreness and associated fatigue [173].

4.3 The potential role of technology

Technological devices such as fitness trackers and wearable devices offer an objective, measurable way to capture and monitor PA. Studies have suggested that their use could be associated with weight loss [175]. For example, the “10,000 steps per day” goal has been broadly promoted as a target for adults to increase PA. A study by Hultquist et al. showed that individuals advised to take 10,000 steps daily walked more than those advised to take a brisk walk for 30 minutes per day [176]. However, it may be difficult for sedentary individuals to reach the 10,000-step goal. It is often more effective to recommend starting with a lower target based on their baseline activity level and gradually increasing the number of steps by 2,000-3,000 steps/day until they reach the target [177].

4.4 Weight loss maintenance

Physical activity plays a crucial role in weight maintenance following weight loss, serving both physiological and psychological functions. Regular exercise helps to counteract metabolic adaptations that often occur after weight loss such as decreased energy expenditure, by increasing muscle mass and improving metabolic rate [178]. Additionally, regular physical activity can enhance mood and reduce stress, which are important factors in preventing weight regain [179]. Researchers suggested that individuals who incorporate at least 150 minutes of moderate-intensity aerobic exercises per week, combined with strength training, were more successful in maintaining their weight loss [180]. Furthermore, incorporating physical activity into the daily routine can improve adherence to weight maintenance strategies, making it a vital component of the obesity continuous care model.

CHAPTER 5. Psychological and behavioral interventions in obesity management

Dr. Iffat Elbarazi, Dr. Nadirah Ghenimi, Dr. Asma Aljaberi and Ms Rita Samuel

HIGHLIGHTS
Psychological assessment to identify barriers, triggers, and psychological elements that influence eating behaviors.
Psychological and behavioral interventions include - Cognitive-behavioral therapy - Mindfulness-based intervention
Addressing weight bias, stigma, and discrimination in healthcare is essential to fostering a supportive, inclusive environment for individuals with obesity.

5.1 Introduction

Obesity, as a chronic disease, demands a multifaceted approach that includes blending physical and psychological strategies [181]. Although medical nutrition therapy and exercise are essential components, lasting weight management requires an equally robust emphasis on psychological interventions. Obesity should be approached as a lifelong chronic disease with a high rate of relapse when treatment is discontinued. This necessitates long-term patient education, regular follow-up visits, and self-monitoring to ensure adherence and sustained weight management. The cultural context in the UAE, where food is pivotal in social interactions, alongside societal stigma and familial pressures, heightens this need [182].

5.2 Psychological assessment

A rigorous psychological assessment forms the bedrock of effective weight management. It identifies barriers, triggers, and psychological elements that influence eating behaviors, especially in a culturally rich context like the UAE. Given the chronic nature of obesity, ongoing psychological evaluations are crucial to address recurrent barriers to adherence to treatment and prevent relapses in weight management goals. While some individuals achieve weight loss goals with minimal psychological support, others necessitate more intense interventions, particularly when conditions like dysthymic disorder, major depressive disorder, binge eating disorder, or history of child/sexual abuse are present [181, 183-190]. Such evaluations can be facilitated through specialized questionnaires or scales such as the Patient Health Questionnaire-9 (PHQ-9) for depression [191, 192], Dutch Eating Behavior Questionnaire (DEBQ) for eating behavior [193], and Yale Food Addiction Scale (YFAS) 2.0 for food addiction [191].

5.3 Psychological and behavioral interventions

Psychological and behavioral interventions include cognitive-behavioral therapy (CBT) and mindfulness-based interventions [102, 194-199].

5.3.1 Cognitive-behavioral therapy

Cognitive-behavioral therapy (CBT) is a multifaceted intervention aimed at transforming negative thoughts and behavior patterns that are related to weight and obesity. Its components include self-monitoring, stimulus control, reinforcement, and relaxation techniques. For long-term success in managing obesity as a chronic condition, CBT must be integrated with continuous follow-up, focusing on relapse prevention and sustained behavior change. Self-monitoring and reinforcement should be applied regularly to ensure adherence to weight management goals over time. Depending on the patient's needs, CBT can be integrated into the routine dietary management delivered by various healthcare professionals and adjusted for individual or group settings.

- **CBT in solo practice**: CBT can be performed stand alone or in complement with other treatments, focusing on elements like emotional eating, body image concerns, and sedentary behavior.
- **CBT in a multidisciplinary approach**: In a multidisciplinary approach, CBT is performed with dietary counseling, exercise regimens, and medical management. A holistic team collaborates to offer a well-rounded strategy for obesity management. The therapy's objective remains consistent: identifying and altering negative thought patterns contributing to obesity.

5.3.2 Mindfulness-based intervention

This intervention focuses on intuitive eating by developing an awareness and acceptance of food and weight, fostering a healthier relationship with both. Intuitive eating is a holistic, compassionate, non-diet approach that focuses on cultivating and empowering individuals to develop healthier relationships with their bodies and food [200]. It encourages them to honor their internal hunger cues, fullness, and satisfaction in the eating experience, rather than relying on external rules (counting calories or portion controls) for weight loss. (**Figure** 5-1) Intuitive eating consists of 10 core principles and applying them will ultimately lead to improved physical and mental well-being [201, 202]. Moreover, studies showed that intuitive eaters have lower levels of disordered eating behaviors and higher levels of body satisfaction and self-esteem [203].

Figure 5-1 Principles of intuitive eating

The 10 Principles of Intuitive Eating [200] are:

- **Principle 1: Reject the diet mentality**. Diet culture perpetuates the belief that certain body shapes and sizes equate to health and promotes the idea that external rules and restrictions for weight loss are necessary for health. This mentality fosters a negative relationship with food, creates body dissatisfaction, and contributes to disordered eating behaviors. By rejecting this mindset, the focus will be on achieving overall wellbeing in a holistic manner rather than fixating on achieving a specific number on the scale.
- **Principle 2: Honor your hunger**. Intuitive eating emphasizes on acknowledging the body's natural signals for nourishment. It involves being attuned to physical cues (stomach growling, low energy levels, or difficulty concentrating) and responding by providing adequate and satisfying nutrition. This can help avoid the feeling of deprivation and prevent overeating that may occur if hunger is suppressed.
- **Principle 3: Make peace with food**. This means that there is an unconditional permission to consume food without guilt, shame, or judgment. Intuitive eating challenges the notion of labeling food as "good" or "bad" by allowing the enjoyment of food. Moreover, it fosters a sense of curiosity around food choices and supports the development of a healthy sustainable flexible approach to the eating experience.
- **Principle 4: Challenge the food police**. The food police represents an inner critic that judges food choices and creates feelings of guilt or shame. Those feelings may arise upon eating forbidden or restricted food dictated by diet rules. Intuitive eating supports the development of a non-judgmental attitude toward food selection and grows a positive relationship with food.

- **Principle 5: Respect your fullness**. This principle involves being mindful of the body's signals of fullness and stop eating when comfortably satisfied. Promoting mindful eating practices is part of intuitive eating as it encourages savoring every bite and paying attention to the body's response. This step helps develop a greater awareness to the fullness cues.
- **Principle 6: Discover the satisfaction factor**. Intuitive eating empowers individuals to discover the satisfaction factor. Knowing that food is not only about nourishment, but also pleasure, enjoyment, cultural and social experience of sharing meals with others. Encouraging the engagement of senses by noticing flavors, textures, and aromas of food can enhance the satisfaction factor of the eating experience and promote a healthier relationship with food.
- **Principle 7: Honor your feelings without using food**. Recognizing the connection between emotions and eating behavior is crucial to detect emotional eating. Food can indeed provide temporary comfort, while intuitive eating empowers individuals to explore alternative strategies and mechanisms to cope with emotions. This practice helps nurture the emotional well-being without turning to food.
- **Principle 8: Respect your body**. Fostering acceptance and appreciation of the diversity in shapes and sizes of the natural body and supports the idea of health and worth is not determined by a specific number on the scale. Prioritizing positive affirmation and challenging social beauty standards helps create positive body image based on self-acceptance and self-compassion.
- **Principle 9: Exercise and feel the difference**. Intuitive eating highlights shifting the focus from rigid exercise routines to embracing physical activities in ways that bring joy and vitality. Exploring various forms of movement and resonate with one's interests and preferences, can build a healthier and more sustainable relationship with exercise.
- **Principle 10: Honor your health with gentle nutrition**. Intuitive eating promotes making food choices that honor both physical and emotional well-being. It involves cultivating a balanced approach to nutrition, where individuals aim to nourish their bodies with a variety of foods that provide essential nutrients while also savoring the pleasures of eating.

5.4 Models for behavioral and psychological intervention

A number of models are available to describe perception and behavior change to enable behavioral and psychological interventions, and these can be applied to address obesity [204-210]. These models are outlined in **Table** 5-1.

Table 5-1 Models for behavioral and psychological intervention

Health Belief Model	Transtheoretical Model (Stages of Change)	5 As Model
This model discerns the perceptions influencing obesity management, breaking down elements like perceived susceptibility, severity, benefits, barriers, and cues to action. Understanding these elements facilitates the design of interventions that resonate with individuals.	This model delineates behavior change into stages (from pre-contemplation to maintenance). By understanding an individual's stage, healthcare providers can tailor interventions, enhancing the chances of long-term success.	This model provides a structured approach for clinicians addressing obesity.
• **Perceived Susceptibility**: Highlighting personal risks of obesity, such as chronic diseases e.g., diabetes, motivates action. • **Perceived Severity**: Using visuals or statistics to emphasize serious consequences of obesity, e.g., health deterioration. • **Perceived Benefits**: Advocating the advantages of weight management, e.g., enhanced self-esteem • **Perceived Barriers**: Recognizing and mitigating challenges, e.g., can make weight management more feasible. Example: suggesting affordable nutritious foods. • **Cues to Action**: Varied cues, from personal experiences to media campaigns, can instigate positive changes.	• **Precontemplation**: Yet to recognize the need to manage weight. Interventions can emphasize health risks of obesity and benefits of a healthier lifestyle, utilize visual aids or personal stories to highlight urgency. Use motivational interviewing techniques. • **Contemplation**: Aware of need but display hesitance. Guide them to appreciate advantages of weight management, address fears or misconceptions, and present real-life success stories to inspire motivation. • **Preparation**: Ready to initiate action. Support by setting achievable goals, providing resources like diet and exercise plans, and connecting them with support groups/buddies. • **Action**: Continuous motivation, e.g., regular check-ins, celebrating milestones, addressing, and learning from setbacks, and readjusting plan, is crucial. • **Maintenance**: Ensure long-term adherence, e.g., offering advanced exercise routines, sharing recipes for healthy meals, addressing emotional challenges, community support and home-based visits.	• **Ask:** Obtain patient's consent to discuss weight and assess readiness for change. • **Advise:** Provide information on health benefits of weight management and associated risks of obesity. • **Assess:** Determine the patient's motivation and suitability for weight management interventions. • **Assist:** Design a weight management plan tailored to the patient's preferences, including dietary, physical, and possible medical interventions. • **Arrange:** Schedule regular follow-ups for progress monitoring and support.

[Recommendation] The recommendations for psychological and behavioral interventions at primary care are shown in **Table** 5-2 [194].

Table 5-2 Recommendations for effective psychological and behavioral interventions in weight management and health improvement

Recommendation	Description	Evidence level and grade
Multicomponent psychological interventions	Combine behavior modification, cognitive therapy, and values-based strategies for weight loss, health, and quality of life. Ensure adherence, confidence, and intrinsic motivation.	Level 1a, Grade A
Longitudinal care & messaging	Offer consistent support and messages to build confidence, and motivation, set achievable goals, self-monitor behaviors, problem-solve, and employ adaptive thinking.	Level 1A, Grade A
Education on success metrics	Obtain the patient's permission to inform them that success is based on health, function, and quality of life rather than weight loss alone.	Level 1a, Grade A
Follow-up sessions	Hold regular sessions that reiterate key messages, ensuring they align with repetition and relevance to enhance self-efficacy and intrinsic motivation.	Level 1a, Grade A

Notes:

Evidence Level 1a - evidence from meta-analysis of randomized controlled trials. Grade A - directly based on Level 1 evidence*

* Wharton, S., Lau, D.C.W., Vallis, M., Sharma, A.M., Biertho, L., et al., Obesity in adults: a clinical practice guideline, Canadian Medical Association Journal 192(31) (2020) E875-E891.

5.5 Weight bias, stigma, and discrimination

A number of strategies can be adopted to address weight bias, stigma, and discrimination of individuals with obesity. These include:

5.5.1 Reducing weight bias in obesity management

Weight bias, encompassing negative attitudes, beliefs, and judgments, towards individuals with obesity manifests in explicit, implicit, and internalized forms [182]. Explicit bias entails overt negative attitudes such as labeling such individuals as lazy or lacking willpower, while implicit bias operates unconsciously, influencing perceptions and behaviors.

5.5.2 Addressing weight bias, stigma, and discrimination in healthcare settings

Healthcare professionals must confront weight bias, stigma, and discrimination earnestly to ensure equitable care provision [102]. Key strategies include:

- **Self-awareness**: Health professionals must recognize and confront their own biases through self-reflection and tools like the Implicit Association Test [211].
- **Acknowledgment and education**: Acknowledge the pervasiveness of weight bias among healthcare providers and educate them on its impact on patient care.

- **Patient assessment**: Sensitively assess patients for internalized weight bias, integrating questioning into motivational interviewing techniques.

5.5.3 Combatting bias: implement interventions to reduce bias

- Present factual information on the multifactorial nature of obesity, including genetic and environmental influences.
- Foster positive interactions between healthcare providers and patients living with obesity to cultivate empathy.
- Utilize empathic obesity experts as role models for healthcare professionals.
- Encourage repeated exposure to patients with obesity to promote long-term attitudinal changes.

5.5.4 Reduce stigma in healthcare settings

By implementing strategies to reduce stigma, healthcare settings can create a supportive and inclusive environment for individuals with obesity, promoting improved health outcomes and patient experiences. These strategies [102] include:

- **Attitude improvement**: Enhance healthcare provider attitudes towards individuals with obesity to mitigate negative influences on care delivery.
- **Environment optimization**: Modify clinic environments or procedures to foster acceptance and comfort for patients with obesity.
- **Empowerment**: Equip patients with strategies to navigate stigmatizing situations and access high-quality healthcare.
- **Internalized bias addressal**: Integrate coping strategies into behavioral interventions, aligning with the principles of cognitive-behavioral therapy and/or acceptance and commitment therapy.

5.6 Maintenance and follow-up in obesity management

Obesity, being a chronic condition, requires continuous maintenance and long-term follow-up care. Regular follow-up appointments are crucial for addressing patient adherence to prevent relapse and adjusting the intervention as needed. In line with similar principles applied to the management of chronic diseases like type 2 diabetes mellitus and cardiovascular disease, follow-up care for obesity should include ongoing patient education, self-monitoring, and the use of behavioral strategies to maintain health improvements over the long term.

CHAPTER 6. Pharmacological management of obesity

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HIGHLIGHTS
Pharmacotherapy can be used as an adjunct to lifestyle interventions.
Pharmacotherapy is indicated for individuals with a BMI ≥30 kg/m^2, or those with a BMI ≥27 kg/m^2 and diagnosed with comorbidities.
Each pharmacotherapeutic agent has distinct characteristics and health impacts.
Weight management pharmacotherapy impacts several obesity-related comorbidities.

6.1 Introduction

The fundamental treatment for obesity is lifestyle intervention, which includes a combination of nutrition, physical activity, and behavior therapies. However, effects of lifestyle intervention therapies are not always satisfactory in all cases, and pharmacotherapy is often used for patients in conjunction with lifestyle interventions.

6.2 Pharmacological treatment of obesity

The criteria required for regulatory approval for a pharmacotherapeutic agent as in weight management are [212]:

- It has been used in a clinical trial for a minimum of one year
- It has demonstrated a minimum of 5% weight loss in at least 35% of patients
- It improved obesity-associated comorbidities

[Recommendation] Pharmacotherapy, as an adjunct to lifestyle intervention, is indicated for individuals with a BMI ≥30 kg/m^2, or those with a BMI ≥27 kg/m^2 and diagnosed with comorbidities such as hypertension, dyslipidemia, T2DM, or sleep apnea [213].

[Recommendation] The goals to consider when using pharmacotherapy for obesity management as an adjunct to lifestyle intervention are shown in **Table** 6-1.

Table 6-1. Goals of pharmacotherapy for management of obesity

Goals of therapy	When considering a drug	Individualized goals
• Weight loss • Weight maintenance • Cravings control • Quality of life improvement	• Efficacy, adverse side effects, safety, and tolerability • Cost as well as mode (oral versus subcutaneous) and frequency of administration and impact on Obesity related co-morbidities*	• Adequacy of dosing, challenges in adherence, barriers to health-behavior change. • There is significant heterogeneity in the response to any pharmacotherapeutic agent.

* Pedersen SD, Manjoo P, Wharton S. Canadian Adult Obesity Clinical Practice Guidelines: Pharmacotherapy for Obesity Management. Available from: https://obesitycanada.ca/guidelines/pharmacotherapy. Accessed 5/3/2025.

6.3 Characteristics and health impact of pharmacotherapeutic agents

Pharmacotherapeutic agents that have been approved for the management of obesity include:

- Orlistat
- Naltrexone/bupropion
- Phentermine/Topiramate
- Liraglutide
- Semaglutide
- Tirzepatide

Table 6-2 summarizes the main characteristics, effect on weight reduction and health impact of these pharmacotherapeutic agents [212, 214, 215].

Table 6-2. Main characteristics and health impact of pharmacotherapeutic agents for obesity

	Orlistat	**Liraglutide**	**Naltrexone/Bupropion**		**Semaglutide**	**Tirzepatide**
Group	Semisynthetic derivative of lipstatin	Human glucagon-like peptide 1 (GLP-1) analog	Opioid receptor antagonist	Dopamine and norepinephrine reuptake inhibitor	Human glucagon-like peptide 1 (GLP-1) analog	Dual GIP and GLP-1 receptor agonist
Mode of action	A potent and selective inhibitor of pancreatic lipase, thereby inhibiting the breakdown of dietary triglycerides into absorbable free fatty acids	Acts centrally on the pro-opiomelanocortin (POMC) or cart neurons to improve satiation and satiety and reduce hunger, delays gastric emptying.	Disrupts the auto-inhibitory effect of β-endorphin on the pro-opiomelanocortin cells by blocking the μ-opioid receptors	Induces satiety centrally by enhancing production and release of (α-msh) and β-endorphin in arcuate nucleus of the hypothalamus	Acts centrally on the pro-opiomelanocortin (POMC) or cart neurons to improve satiation and satiety and reduce hunger, reduce craving & delays gastric emptying.	It acts on GLP & GIP to reduce body weight & body fat mass ,regulate appetite ,work on satiety ,decrease hunger & reduce food craving
Route of administration	Oral	Subcutaneous injection	Oral		Subcutaneous injection	Subcutaneous injection
Dose/ frequency	120 mg three times daily (taken during or up to one hour after meals orally	0.6 mg daily starting dose, with up-titration by 0.6 mg each week until the 3.0 mg maintenance dose is achieved	8mg daily up-titrated by 8mg weekly for a maintenance dose of 32mg/day	90mg daily up-titrated by 90mg weekly for a maintenance dose of 360mg/day	Starting dose is 0.25 mg weekly, with up-titration every four weeks to 0.5 mg weekly, 1 mg weekly, 1.7 mg weekly and then to the maximum dose of 2.4 mg weekly.	Starting dose is 2.5 mg weekly, with up-titration every four weeks to 5 mg weekly, 7.5mg weekly, 10 mg weekly, 12.5 mg weekly and then to the maximum dose of 15 mg weekly.
% weight loss vs placebo at 1 year	10.2% vs 6.1% At 1 year	8.6% vs 2.6% At 1 year	6.1% vs 1.3% At 1 year		16..9% vs 2.4% At 68 weeks†	- 22.5% vs 2.4% At 72 weeks
Weight loss over longer term vs placebo *	-5.8 kg at 4 years	-6.1 % at 3 years	Not studied		-15.2% at 104 weeks‡	- 25.3% at 88 weeks
% of patients achieving						
≥5% weight loss at 1 year	54 % (vs.33% in placebo)	63.2 % (vs 27.1% in placebo)	48% (vs 16% in placebo)		At 68 weeks, semaglutide 2.4 mg: 86.4% (vs 31.5% in placebo)	At 72 weeks, Tirzepatide 15 mg: 96.3% (vs 27.9% in placebo)
≥10 % weight loss at 1 year	26% (vs.14 % in placebo)	33.1 % (vs 10.6 % in placebo)	25% (vs 7% in placebo)		At 68 weeks, semaglutide 2.4 mg:	At 72 weeks, Tirzepatide 15 mg:

	Orlistat	**Liraglutide**	**Naltrexone/Bupropion**	**Semaglutide**	**Tirzepatide**
≥15% weight loss at 1 year	Not studied	14.4% (vs 3.5 % with placebo)	13.5 % (vs 2.4% with placebo)	69.1 % (vs 12% in placebo) At 68 weeks, semaglutide 2.4 mg: 50.5% (vs 4.9% with placebo)	90.1% (vs 13.5% in placebo) At 72 weeks, Tirzepatide 15 mg: 78.2% (vs 6% in placebo)
≥20% weight loss at 1 year	Not studied	Not studied	Not studied	At 68 weeks, semaglutide 2.4 mg: 32% (vs 1.7% in placebo)	At 72 weeks, Tirzepatide 15 mg:62.9%(vs 1.3% in placebo)
Effect on maintenance of previous lifestyle induced weight loss	2.4 kg less weight regain vs placebo over 3 years	-6.0% additional placebo-subtracted weight loss at 1 year	Not studied	Not studied	Not studied
Cost	$$	$$$$	$$$	$$$$	$$$$
Contraindications	-cholestasis -chronic malabsorption syndrome -pregnancy, attempting conception, breastfeeding	-personal or family history of medullary thyroid cancer -personal history of MEN2 syndrome -pregnancy, attempting conception, breastfeeding	-uncontrolled hypertension -any opioid use -history of or risk factors of seizure -abrupt discontinuation of alcohol -concomitant administration of MOI -severe hepatic impairment -end-stage renal failure -pregnancy, attempting conception, breastfeeding	-personal or family history of MTC -personal of family history of MEN2 syndrome -pregnancy, attempting conception, breastfeeding	-personal or family history of MTC -personal of family history of MEN2 syndrome - gallbladder disease or diabetic retinopathy - pregnancy, attempting conception, breastfeeding
Common side effects	Loose, oily stools, flatus	Nausea, constipation, diarrhea, vomiting	Nausea, constipation, headache, dry mouth, dizziness, diarrhea	Nausea, diarrhea, constipation, vomiting	Nausea or vomiting, diarrhea, and stomach pain

	Orlistat	**Liraglutide**	**Naltrexone/Bupropion**	**Semaglutide**	**Tirzepatide**
Uncommon side effects	Liver failure, Nephrolithiasis, acute kidney injury	Cholelithiasis, pancreatitis	Seizure, worsening of depression	Cholelithiasis, pancreatitis	Severe hypoglycemia, acute pancreatitis, cholelithiasis, and cholecystitis
Medication interaction	Fat soluble vitamins, levothyroxine, cyclosporine, oral anti-coagulant, anti-convulsant	May affect absorption of medication due to slowing of gastric emptying	selective serotonin reuptake inhibitors, beta blockers, anti-psychotic agents, type 1C anti-arrhythmic agents and many tricyclic anti-depressants, tamoxifen, ticlopidine, clopidogrel, ritonavir, lopinavir, efavirenz, carbamazepine, phenobarbital, phenytoin, levodopa, amantadine	May affect absorption of medications due to possible showing of gastric emptying	insulin, sulfonylureas, and glinides(hypoglycemia), birth control pills (reduced absorption)

Abbreviations: BP, blood pressure; MTC, medullary thyroid carcinoma; GIP, gastric inhibitory polypeptide; GLP-1, glucagon-like peptide-1

Notes: * Placebo-subtracted value.

† Wilding JPH, Batterham RL, Calanna S, Davies M, Van Gaal LF, Lingvay I, McGowan BM, Rosenstock J, Tran MTD, Wadden TA, Wharton S, Yokote K, Zeuthen N, Kushner RF; STEP 1 Study Group. Once-Weekly Semaglutide in Adults with Overweight or Obesity. N Engl J Med. 2021 Mar 18;384(11):989-1002. doi: 10.1056/NEJMoa2032183. Epub 2021 Feb 10. PMID: 33567185.

‡ Garvey, W.T., Batterham, R.L., Bhatta, M. et al. Two-year effects of semaglutide in adults with overweight or obesity: the STEP 5 trial. Nat Med 28, 2083–2091 (2022). https://doi.org/10.1038/s41591-022-02026-4

6.4 Impact of weight management pharmacotherapy on obesity-related diseases.

Pharmacotherapeutic agents also have effects on physiological function parameters and obesity-related diseases. These effects are summarized in **Table** 6-3 [212].

Table 6-3. Impact of weight management pharmacotherapy on obesity-related diseases

	Orlistat	Liraglutide	Naltrexone/Bupropion	Semaglutide	Tirzepatide
Physiological function					
Prediabetes	37.3% reduction in risk of developing T2DM over 4 years	79% reduction in the risk of developing T2DM over 3 years	Not studied	81% of patients reverted back to normoglycemia at 52 weeks with Semaglutide 2.4mg (vs 14% placebo)‡	93.3% of patients reverted to normoglycemia at 176 weeks with Tirzepatide 15mg (vs 58.9% placebo)§
BP at 1 year*	-1.7 mm Hg SBP -0.71 mm Hg DBP	-2.87 mm Hg SBP -0.73 mm Hg DBP	Not significantly different	-6.16 mm Hg SBP -4.8 mm Hg DBP**	-7.2 mm Hg SBP -2.83 mm Hg DBP††
Lipids at 1 year*,†	LDL - 8.7mg/dl HDL +1.1mg/dl	LDL -2.91 mg/dl	LDL -4.2 mg/dl HDL +2.2 mg/dl	-3 mg/dl total cholesterol -3mg/dl LDL +5 mg/dl HDL -22 mg/dl Triglycerides**	-4.8mg/dl Total Cholesterol -5.8mg/dl LDL +8 mg/dl HDL -24.8 mg/dl Triglycerides††
HR at 1 year*	No change	+2.4 BPM	+1.1 BPM	+4.2 BPM	+2.1 to 5.4 BPM
HbA1C in patients with diabetes at 1 year*	-0.4%	-1.0%	-0.5%	-1.6%‡‡	-2.08%§§
Physical function /QoL	Not studied	SF-36-significant improvement IWQOL-significant improvement	IWQOL-improvement	SF36-significant Improvement IWQOL-significant improvement	SF36- greater improvement IWQOL: greater improvement
CoEQ (cravings)	Not studied	Not studied	Improvements in craving control, positive mood, craving for sweet & savory food	Improvements in craving control, positive mood, craving for sweet & savory food	Greater reduction in appetite and reduced food cravings for all types of food vs placebo

	Orlistat	Liraglutide	Naltrexone/Bupropion	Semaglutide	Tirzepatide
Obesity-related diseases					
MACE	Not studied	Cardiovascular safety demonstrated in people with type 2 DM but not studied in obesity trials	Not studied	Cardiovascular benefit. demonstrated 20% Relative risk reduction in 3-point MACE (major adverse cardiovascular events)***	On going
MASH	No change	Resolution of MASH & improvement in steatosis (39% with lira 3mg vs 9% with placebo)	Not studied	Resolution of MASH (59% with semaglutide 0.4 mg daily vs. 17% with placebo	Resolution of MASH 62% vs 10% in the placebo group with Tirzepatide 15mg resolution of MASH & no worsening of fibrosis†††
PCOS	Not studied	Not sufficiently studied	Not studied	Not studied	Not studied
OA	Not studied	No benefit	Not studied	Significant reduction in body weight and pain related knee OA vs placebo‡‡‡	Ongoing
OSA*	Not studied	Reduce AHI by 6/hour	Not studied	Not studied	Tirzepatide reduced body weight, and improved sleep related outcomes§§§

Abbreviations: AHI, apnea-hypopnea index; BP, blood pressure; CoEQ, Control of Eating Questionnaire; HDL, high density lipoprotein; HR, heart rate; IWQOL, Impact of Weight on Quality of Life; MACE, major adverse cardiovascular event; LDL, low density lipoprotein; MASH, Metabolic dysfunction-associated steatohepatitis; OA, osteoarthritis; OSA, obstructive sleep apnea; PCOS, polycystic ovary syndrome; QoL, quality of life; SBP, systolic blood pressure; T2DM, Type 2 diabetes mellitus.

Notes:

* Placebo-subtracted value.

† Only statistically significant changes in lipid parameters are listed.

‡ McGowan, B. M., Bruun, J. M., Capehorn, M., Pedersen, S. D., Pietiläinen, K. H., Muniraju, H. A. K., Quiroga, M., Varbo, A., Lau, D. C. W., & STEP 10 Study Group. Efficacy and safety of once-weekly semaglutide 2·4 mg versus placebo in people with obesity and prediabetes (STEP 10): a randomized, double-blind, placebo-controlled, multicentre phase 3 trial. Lancet Diabetes Endocrinol. 2024;12(9):631-642. doi:10.1016/S2213-8587(24)00182-7.

§Jastreboff AM, le Roux CW, Stefanski A, Aronne LJ, Halpern B, Wharton S, Wilding JPH, Perreault L, Zhang S, Battula R, Bunck MC, Ahmad NN, Jouravskaya I; SURMOUNT-1 Investigators. Tirzepatide for Obesity Treatment and Diabetes Prevention. N Engl J Med. 2025 Mar 6;392(10):958-971. Doi: 10.1056/NEJMoa2410819.

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6.4.1 Type 2 diabetes mellitus

The available evidence supports actions that control the body weight of a person can halt the progression to Type 2 diabetes mellitus (T2DM). The Xenical in the Prevention of Diabetes in Obese Subjects (XENDOS) trial showed that orlistat and lifestyle changes together led to a larger reduction in the incidence of T2DM over a 4-year period when compared to lifestyle changes alone [216]. The cumulative incidence of diabetes was 6.2% in the orlistat (and lifestyle changes) group versus 9.0% in the placebo (lifestyle changes only) group. According to another study by Jacob et al [217], patients with T2DM and overweight or obesity, orlistat 120 mg appears to enhance glycemic control more than would be predicted by weight loss alone. Improved insulin sensitivity, slower and less complete digestion of dietary fat, decreased postprandial plasma non-esterified fatty acids, decreased visceral adipose tissue, and stimulation of glucagon-like peptide-1 secretion in the lower small intestine were some of the hypothesized mechanisms causing this effect [217]. Similarly, in the SCALE trial, T2DM manifested in more patients in the placebo group than in the liraglutide group with a reduction in the use of glucose-lowering agents including insulin and meaningful reductions in HbA1c [218].

Patients receiving naltrexone/bupropion had a better improvement in HbA1c compared with placebo and were more likely to achieve a HbA1c below 7%, according to the Contrave Obesity Research Diabetes (COR) and the COR-II trials [217, 219]. Semaglutide 2.4 mg once a week significantly and more effectively reduced body weight in comparison to placebo during the Semaglutide Treatment Effect in People with Obesity (STEP) 2 trial and reduced the need for concurrent diabetes medication in 28.6% of the patients [220]. Tirzepatide, a dual gastric inhibitory polypeptide (GIP)/glucagon-like peptide 1 (GLP-1) agonist, was shown in SURPASS trials in participants with type 2 diabetes to be superior to comparators [215, 221-226].

6.4.2 Hypertension, lipids, and cardiovascular disease

In a systematic review and network meta-analysis, approved weight-loss medications only have marginally positive effects on the cardiometabolic risk profile [227]. Though effects on the lipid profile by some of these medications were statistically significant, they were of unclear clinical significance [227].

In the LEADER study, it was found that liraglutide cut the rates of the first occurrence of cardiovascular death, nonfatal myocardial infarction, or nonfatal stroke in patients with T2DM compared to placebo [228]. Naltrexone-bupropion therapy had no significant impact on major adverse cardiovascular events (MACE), according to the LIGHT study and a meta-analysis that included 12 RCTs [229, 230]. When compared to placebo, semaglutide demonstrated its ability to reduce cardiovascular events in patients with T2DM and existing cardiovascular disease or those who are at high risk for developing it [220]. Similarly, studies on Tirzepatide was show to lower both systolic and diastolic BP [221-226].

6.4.3 Metabolic dysfunction associated steatohepatitis (MASH) & Metabolic associated fatty liver disease (MAFLD)

In a study by Harrison et al. [231], it was observed that orlistat combined with caloric restriction in patients who were overweight and afflicted by Metabolic dysfunction associated steatohepatitis (MASH) improved insulin resistance and steatosis, and that patients who lost 9% or more of their body weight also experienced improved

hepatic histologic changes. In the LEAN trial, liraglutide caused MASH to histologically resolve independently of weight loss [232]. Similarly, a phase 2 trial involving individuals with MASH revealed that semaglutide therapy resulted in a noticeably larger proportion of patients experiencing MASH resolution than placebo [233]. In a limited trial, liraglutide 1.8 mg daily was found to cause weight loss as well as decreased visceral fat, liver fat content, and Metabolic associated fatty liver disease (MAFLD) when compared to a placebo, throughout the course of 26 weeks of treatment [234]. Similarly, resolution of MASH & no worsening of fibrosis was observed by Tirzepatide 15 mg vs placebo (62% vs 10%) [235].

6.4.4 Polycystic ovary syndrome

A meta-analysis of six studies on women with polycystic ovary syndrome (PCOS) indicated that their WC, weight, and BMI were all considerably lower than their peers [236]. Exenatide and metformin combination drug was found to be more effective in regulating the menstrual cycle and reducing BMI, hyperandrogenism, and IR when used in combination for 24 weeks than either drug alone in patients with obesity and PCOS [237].

6.4.5 Obstructive sleep apnea

Liraglutide 3.0 mg was typically well tolerated and generated considerably higher decreases in apnea-hypopnea index (AHI), body weight, systolic blood pressure (SBP), and HbA1c than placebo in patients with obesity and moderate/severe obstructive sleep apnea (OSA), according to the SCALE Sleep Apnea Randomized Clinical Trial [238]. The outcomes show that losing weight enhances OSA-related parameters. Tirzepatide has shown reduction in body weight and reduced the AHI, body weight, hypoxic burden, hsCRP concentration, and systolic blood pressure and improved sleep-related patient-reported outcomes according to the SURMOUNT OSA study [239].

6.4.6 Osteoarthritis

A study by Gudbergsen, et al. [240] found that liraglutide did not lessen knee pain compared to placebo. The lack of benefit in this study was likely attributable to insufficient magnitude of weight loss. A weight loss target of 10% of body weight is recommended for symptomatic and functional improvement among patients with overweight or obesity and osteoarthritis of weight-bearing joints. In the STEP 9 study, once- weekly semaglutide in persons with obesity and knee osteoarthritis, semaglutide resulted in significantly greater reductions in body weight and pain related to knee osteoarthritis than placebo [241].

6.4.7 Chronic kidney disease

No dose adjustment is required for semaglutide and liraglutide in patients with mild or moderate renal impairment. Liraglutide and semaglutide are not recommended for use in patients with severe renal impairment (eGFR <30 mL/min/1.73m^2) including patients with end-stage renal disease [242, 243]. Similarly, for tirzepatide, no dose adjustment is required for patients with renal impairment including end stage renal disease (ESRD). Experience with the use of tirzepatide in patients with severe renal impairment and ESRD is limited. Caution should be exercised when treating these patients with tirzepatide [244].

The maximum recommended daily maintenance dose for naltrexone/bupropion is one tablet (8 mg/90 mg) BID in patients with moderate or severe renal impairment [238]. Orlistat has low systemic absorption and thus dosage adjustment in renal insufficiency cases is not required.

Liraglutide for the treatment of T2DM has shown renal benefits in patients with T2DM with chronic renal disease including decreased rates of albuminuria development and progression compared with placebo (236), Semaglutide for the treatment of obesity has shown similar kidney benefits and delays progression of nephropathy in the SELECT trial as a secondary endpoint [245]. Tirzepatide also showed renal benefits in patients with excess body weight and type 2 diabetes based on a post-hoc analysis [246]. These trends are positive signs for the future of patients living with obesity and chronic kidney disease while on treatment with GLP1-RAs.

6.4.8 Gastroesophageal reflux disease

Gastroesophageal reflux disease (GERD) can occur with the use of GLP-1 receptor agonists and/or GIP/GLP1 receptor agonists such as liraglutide, semaglutide and trizepatide or in an existing case of GERD, they can worsen the condition. However, this adverse effect is often mild to moderate in severity and usually transient [247]. There were no specific studies that explored pharmacotherapy for managing obesity in the GERD subpopulation.

6.4.9 Mental health

Obesity and mental health have a complicated relationship, with each creating therapeutic challenges for the other. Liraglutide and semaglutide had no negative impact on neuro-psychiatric parameters [248-250]. However, anti-depressant safety precautions including screening for suicidal behavior and ideation should be considered when administering naltrexone/bupropion to patients [251]. A systematic review and meta-analysis of metformin in the prevention and treatment of antipsychotic-induced weight gain confirmed that metformin is effective in treating antipsychotic-induced weight gain in patients with schizophrenia or schizoaffective disorder [252].

6.4.10 Craving and control of eating

An integrated analysis of four RCTs evaluating naltrexone/bupropion for food craving revealed that early improvements in craving control, followed by reduced cravings for sweet foods throughout the 56-week trial, were more pronounced in subjects receiving naltrexone/bupropion [253]. According to the results from the Control of Eating Questionnaire (COEQ) trial, semaglutide 2.4 mg once a week improved eating control and decreased cravings in a trial which included 72 patients over a 20-week period [254]. Overall, the study observed improved control overeating, less food cravings, less hunger, and consequently, less energy intake for semaglutide 2.4 mg compared with placebo [254]. Similar results were noted in tirzepatide [255].

6.4.11 Quality of life

Liraglutide 3.0 mg and tirzepatide 2.4 mg, together with diet and exercise, is associated with long-term improvements in health-related Quality of Life (HRQoL) for patients with obesity or overweight comorbidity compared with placebo [256, 257]. In the COR trial, naltrexone/bupropion also demonstrated significant improvement in quality of life as shown by the scores on the Impact of Weight on Quality of Life-Lite (IWQOL-

Lite) assessment tool compared with placebo in several key areas [258]. Semaglutide-treated patients in the STEP 1 trial were more likely to achieve clinically meaningful improvements from baseline to week 68 in physical function, psychosocial and total scores compared with placebo [247].

6.5 New available therapy in UAE

Phentermine/Topiramate is an appetite suppressant and enhances satiety [259]. It is orally administered. The initiation dose is 3.75mg/23mg daily and maintenance dose is 7.5 mg/46 mg up to 15 mg/92 mg daily. Titration is done at 12 weeks intervals. It is contraindicated in pregnancy, glaucoma, hyperthyroidism, taken with monoamine oxidase inhibitors (MAOI) or within 14 days of stopping MAOI, and hypersensitivity to the drug components. Common side effects include paresthesia, dizziness, dysgeusia, insomnia, constipation, and dry mouth.

6.6 Weight maintenance

Pharmacological treatment can be an effective tool for weight maintenance following initial weight loss, particularly for persons with obesity who struggle to sustain lifestyle changes alone. This treatment can enhance the effects of behavioral strategies by providing additional support in managing hunger and food cravings thus improving adherence to dietary and exercise recommendations [260]. Importantly, pharmacological interventions are most effective when combined with a comprehensive weight management program that includes lifestyle modifications and regular follow-up with healthcare professionals as part of the obesity continuous care model [261]. As with any treatment, monitoring for its side effects and assessing individual responses are crucial for optimizing outcomes and ensuring long-term success in weight maintenance.

CHAPTER 7. Bariatric surgery

Dr. Abdulwahed Mohamed AlWahedi

HIGHLIGHTS
Bariatric surgery includes procedures that reduce stomach size or reroute the intestines to promote weight loss.
Types of bariatric surgery: Sleeve gastrectomy, One Anastomosis Gastric Bypass (OAFB), Roux-en-Y gastric bypass, Biliopancreatic Diversion with Duodenal Switch (BPD-DS), Single Anastomosis Duodenal-Ileal bypass with Sleeve (SADI-S), and laparoscopic adjustable gastric banding.
Each type of bariatric surgery has advantages and disadvantages.
Surgical risks include bleeding, infection, procedure-specific complications, and some post-surgery complications that may require emergency referrals.
Post-surgery care includes dietary changes, lifelong nutritional supplementation, regular follow-up, and monitoring for complications and nutritional deficiencies.

7.1 Introduction

Bariatric surgery, or weight loss surgery, consists of a variety of surgical procedures performed to manage obesity and associated co-morbidities. These procedures are performed either by reducing the size and capacity of the stomach (restrictive procedure) or by resecting and re-routing the small intestines to a small gastric pouch (malabsorptive procedure).

Patients may be referred for surgery due to primary obesity, revision surgery for weight regain after bariatric surgery, and for post-surgical complications. **Figure** 7-1 describes the process flow for bariatric surgery.

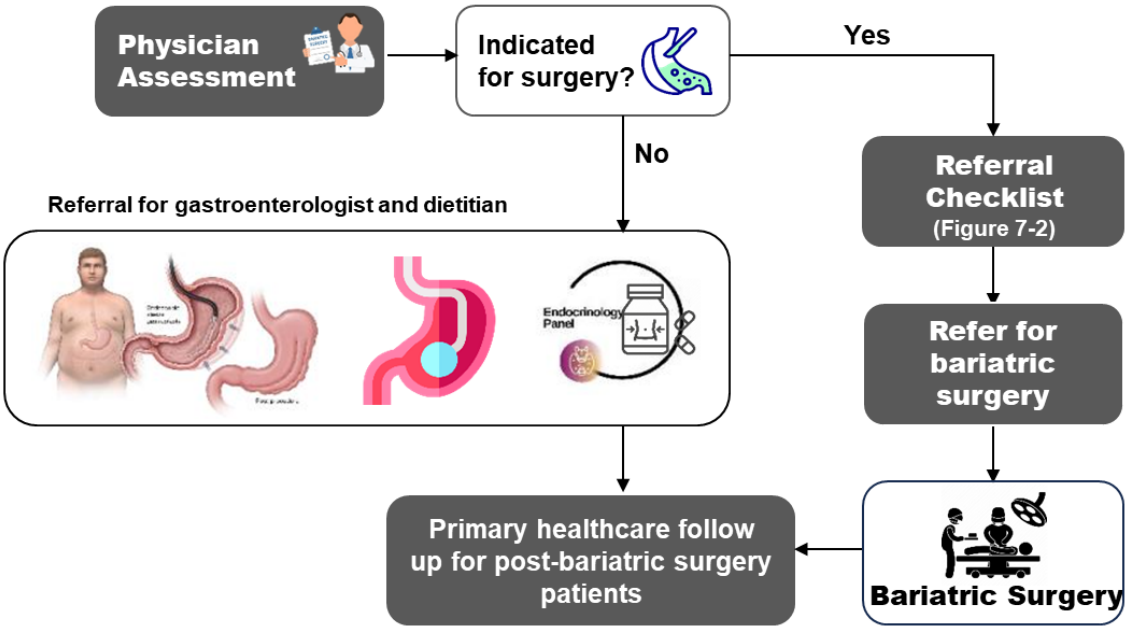


Figure 7-1. Process flow for bariatric surgery

7.2 Indications and referral checklist

7.2.1 Indications for bariatric surgery

[Recommendation] A physician assessment should be performed to determine if the patient is indicated for surgery.

The criteria for bariatric surgery for patients with primary obesity, revision surgery for weight regain after bariatric surgery, and post-surgery complications are presented in **Figure** 7-2 [262].

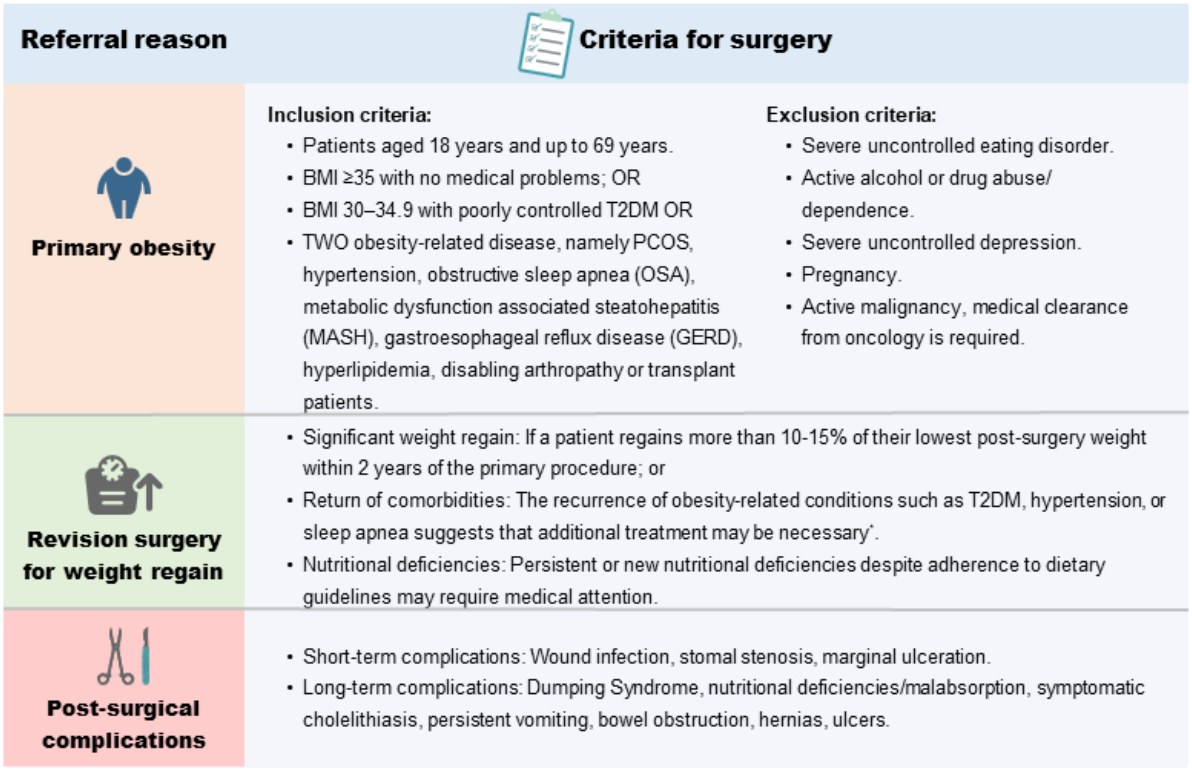


Figure 7-2. Criteria for bariatric surgery

Note:

* Schauer, P.R., Bhatt, D.L., Kirwan, J.P., Wolski, K., Brethauer, S.A., et al., Bariatric surgery versus intensive medical therapy for diabetes--3-year outcomes, N Engl J Med 370(21) (2014) 2002-13.

7.2.2 Referral checklist

If the patient is indicated for surgery, **Figure** 7-3 describes a list of medical history and investigations to be verified prior to referral for bariatric surgery.

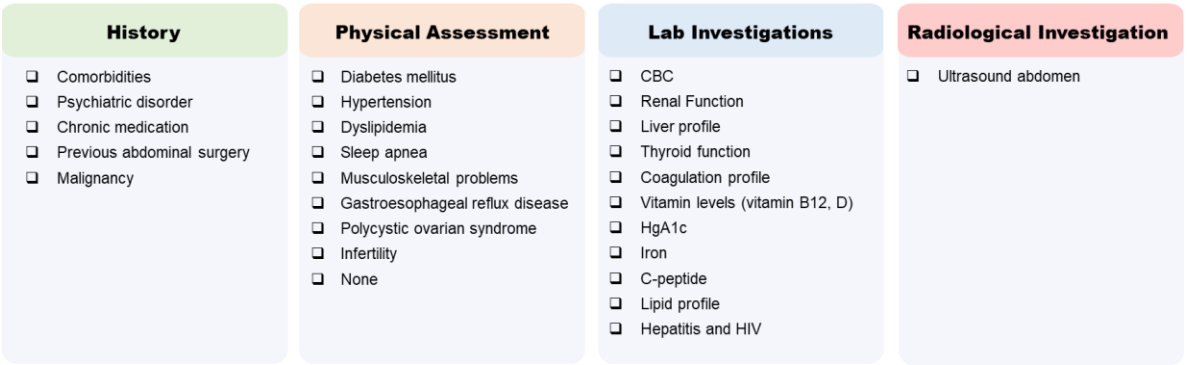
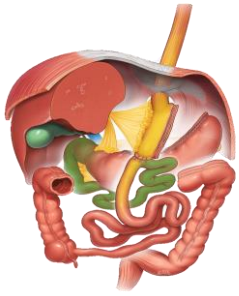


Figure 7-3. Medical history and investigations to be verified prior to referral for bariatric surgery

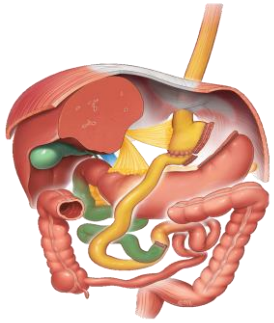
7.3 Types and mechanisms of bariatric procedures

The types of bariatric procedures are shown in **Figure** 7-4 [263].

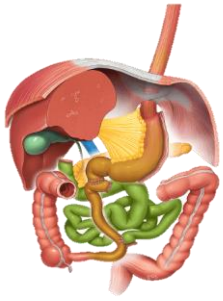
A. Sleeve Gastrectomy: This is the most common procedure. In sleeve gastrectomy, a significant portion of the stomach is removed, leaving a smaller, tubular-shaped stomach. Most studies have demonstrated that the laparoscopic sleeve gastrectomy (LSG) is effective for weight loss and results in improvement and even resolution of co-morbidities like T2DM, quite similar to Roux-en-Y gastric bypass, but with less morbidity, and mortality[*,†]



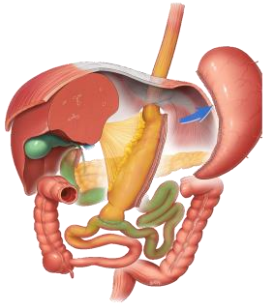
B. One Anastomosis Gastric Bypass (OAFB): This procedure has gained proponents throughout the world, particularly increasing in the past years in Europe and Asia[‡]. Several studies have demonstrated that it is a safe, rapid, and effective bariatric operation[§,¶]. The operation consists of two components: first, a long and narrow restrictive lesser-curvature gastric pouch; and second, a 150 to 200 cm jejunal bypass with an antecolic gastro-jejunostomy (GJ) anastomosis, which leads to significant fat malabsorption.



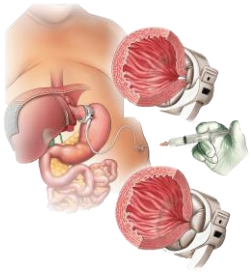
C. Roux-en-Y Gastric Bypass: The procedure involves staple dividing the stomach into two chambers. The upper chamber receives food and is very small, holding about 30 cc. The lower chamber is “bypassed” and does not receive food. The small intestine is divided, and one end is connected (“anastomosed”) to the pouch. A second connection (“anastomosis”) is made to connect the disconnected stomach and duodenum to the small bowel. This connection enables the digestive fluids to meet the ingested food to enable nutrient breakdown and absorption. The distance between the two connections can vary by surgeon preference but is generally 50 to 150 cm.



D. Biliopancreatic Diversion (BPD) with Duodenal Switch:
Three main components into the Duodenal Switch:
Vertical gastrectomy with excision of the greater curvature to significantly reduce gastric volume capacity and provide restriction (a sleeve gastrectomy).
Division of the duodenum between the pyloric valve and the sphincter of Oddi, preserving the normal function of the pylorus and gastric emptying, to avoid dumping syndrome.
Bypassing the proximal small bowel results in decreased absorption of nutrients, promoting weight loss. Deriving from experience with BPD, the BPD-Duodenal Switch maintains a longer common channel to reduce the risk of vitamin and protein deficiencies.



E. Single Anastomosis Duodenal-Ileal bypass with Sleeve (SADI-S):
SADI-S is a very effective procedure for weight loss and resolution of co-morbidities associated with obesity, like type 2 diabetes, dyslipidemia, Obstructive Sleep Apnea (OSA), etc.[#] SADI-S has shown good results as primary and as revisional procedure after failed previous operations as well. A large bougie (54 French) intragastric bougie is introduced, and the sleeve gastrectomy is completed, then the duodenum is divided with a 60-mm purple/blue linear stapler and the ileocecal junction is identified. 250-300 cm are measured proximally along the ileum. At this point, the loop of bowel is lifted in an ante-colic fashion to the duodenal stump.



F. Laparoscopic Adjustable Gastric Banding: It involves placing an adjustable band around the upper stomach to induce satiety. The band stoma size can be adjusted by filling the band with sterile saline, which is injected through a port placed under the skin. Long-term adjustments and aftercare are needed to achieve and maintain good outcomes.

Figure 7-4. Types of bariatric surgery

Notes:

[*] Schauer, P.R., Bhatt, D.L., Kirwan, J.P., Wolski, K., Brethauer, S.A., et al., Bariatric surgery versus intensive medical therapy for diabetes--3-year outcomes, N Engl J Med 370(21) (2014) 2002-13.
[†] Hutter, M.M., Schirmer, B.D., Jones, D.B., Ko, C.Y., Cohen, M.E., et al., First report from the American College of Surgeons Bariatric Surgery Center Network: laparoscopic sleeve gastrectomy has morbidity and effectiveness positioned between the band and the bypass, Ann Surg 254(3) (2011) 410-20; discussion 420-2.
[‡] Georgiadou, D., Sergentanis, T.N., Nixon, A., Diamantis, T., Tsigris, C., et al., Efficacy and safety of laparoscopic mini gastric bypass. A systematic review, Surg Obes Relat Dis 10(5) (2014) 984-91.
[§] Parikh, M., Eisenberg, D., Johnson, J., El-Chaar, M., American Society for Metabolic and Bariatric Surgery review of the literature on one-anastomosis gastric bypass, Surg Obes Relat Dis 14(8) (2018) 1088-1092.
[¶] Aleman, R., Lo Menzo, E., Szomstein, S., Rosenthal, R.J., Efficiency and risks of one-anastomosis gastric bypass, Ann Transl Med 8(Suppl 1) (2020) S7.
[#] Vilallonga, R., Nedelcu, A., Cirera de Tudela, A., Palermo, M., Pérez-Aguirre, E., et al., Single Anastomosis Duodeno-ileal Bypass As a Revisional Procedure Following Sleeve Gastrectomy: Review of the Literature, J Laparoendosc Adv Surg Tech A (2021).

7.3.1 Mechanisms of action

Bariatric surgery procedures can be classified into 3 categories based on the mechanisms of action [264]:

- **Restrictive procedure:** These procedures, sleeve gastrectomy being the most common, limit the amount of food the stomach can hold. They do not interfere with the normal absorption (digestion) of food and nutrients in the intestines. The primary mechanism of these surgeries is to create a sense of fullness after consuming a small amount of food, thus reducing the overall calorie intake.
- **Malabsorptive procedure:** Malabsorptive procedures alter the digestive process, resulting in food being poorly digested and not fully absorbed in the small intestine. These procedures involve rerouting, or bypassing, a substantial portion of the small intestine. This reduces the amount of food, and especially

the number of calories and nutrients, your body absorbs, leading to weight loss. Malabsorptive procedures include Roux-en Y and Mini Gastric bypass.

- **Combined procedure:** These procedures employ both restrictive and malabsorptive mechanisms. They limit the amount of food the stomach can hold, and the amount of nutrients absorbed by the intestines. The gastric bypass, OAGB or ROUX, procedures are used to resize the stomach into a small pouch to restrict food intake. The small intestine is then cut and attached to this pouch, bypassing a portion of the small intestine and thereby reducing the absorption of calories and nutrients.

7.4 Complications

Possible post-surgical complications include bleeding, infection, pneumonia, stenosis/narrowing, leak, ulcers, chronic vomiting, malnutrition, vitamin deficiency, chronic diarrhea, hair loss, deep vein thrombosis, pulmonary emulsion, chronic abdominal pain, and bowel obstruction. A number of these complications which are indicated for referral for surgery are listed in **Figure** 7-5**.**

7.5 Primary healthcare management

7.5.1 Complications requiring emergency referral

Figure 7-5 shows the post-surgery complications requiring emergency or urgent referral, based on the severity of the patient's symptoms [265]. Patients exhibiting symptoms highlighted in red should be treated as emergency cases and those in yellow as urgent cases.

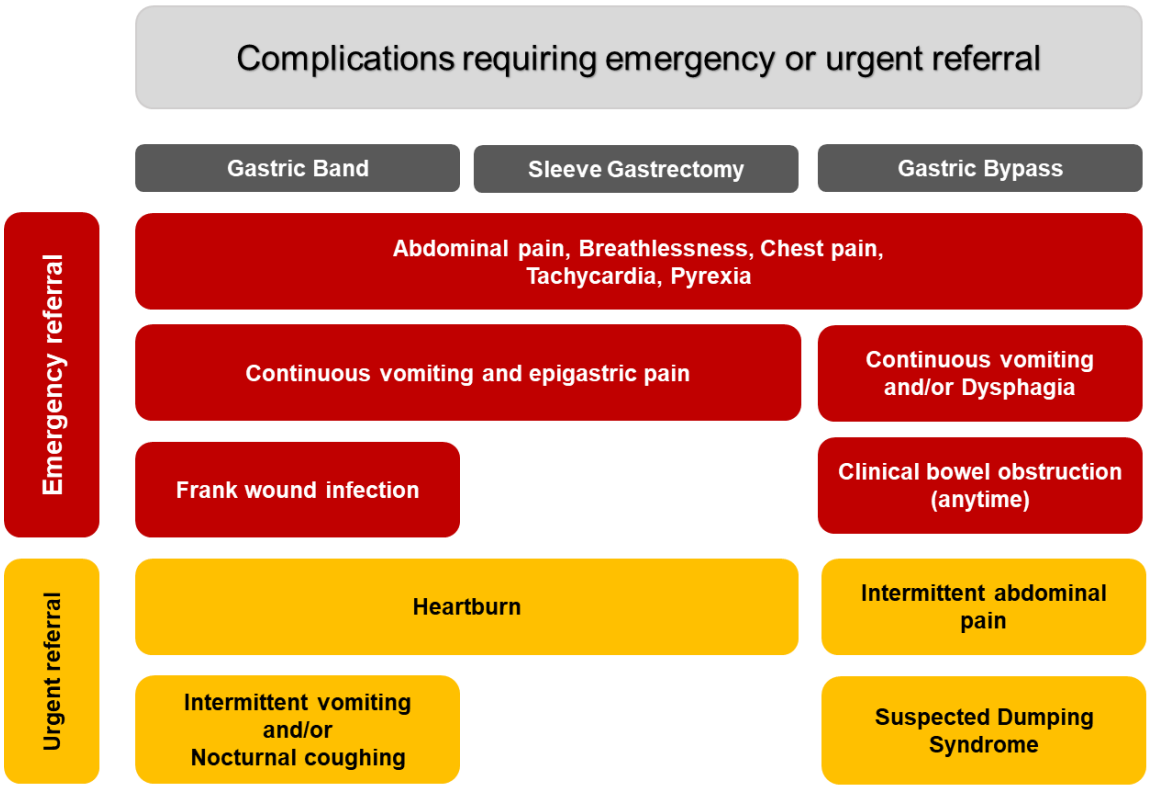


Figure 7-5. Bariatric surgery complications requiring emergency or urgent referral

Notes:

Emergency referral is required for symptoms in red and urgent referral is required for symptoms in yellow*.

* NHS-Cornwall and Isles of Scilly, Bariatric surgery follow up. https://rms.cornwall.nhs.uk/primary_care_clinical_referral_criteria/primary_care_clinical_referral_criteria/obesity/bariatric_surgery_followup. Accessed 29 Aug 2024.

Table 7-1 shows a comparison of the characteristics of the types of bariatric surgeries.

Table 7-1. Comparison of different types of surgery

	Adjustable gastric banding (AGB)	**Sleeve Gastrectomy (SG)**	**Roux-en Y Gastric Bypass (RYGB)**	**Mini (one anastomosis) gastric Bypass- (MGB)**	**Biliopancreatic Diversion with Duodenal Switch (BPD-DS)**
Prevalence of use	Decreasing in prevalence, 3% of bariatric surgeries performed	Most common bariatric surgery performed worldwide	Second most common procedure performed	Third most common performed procedure	- Relatively uncommon due to its complexity - Should be restricted to patients with very severe obesity (BMI >50)
Procedure	Adjustable silicone band creates a 30-40ml gastric pouch	- Longitudinal gastrectomy - 75-100 ml gastric pouch	- 15-30ml gastric pouch - 150cm alimentary limb bypass excluded stomach and duodenum - biliopancreatic limb (200cm)	Long narrow gastric pouch and one anastomosis	Combines sleeve gastrectomy and post pyloric RYGB
Effectiveness in weight loss	High rate of weight regains	More effective than AGB	Effective	Comparable to RYGB	Very effective
Complications	- Slippage of band - Re-operation	- Staple line leak - Mid-gastric stricture - GERD	- Dumping syndrome - Marginal ulcers - Internal Hernia - Bowel obstruction	- Bile reflux - Later complications of failure to lose weight and narrowing of anastomosis	Long term nutritional complications

7.5.2 Nutritional supplementation

All bariatric procedures affect nutritional intake, and some procedures may affect the absorption of macronutrients and/or micronutrients. **Table** 7-2 summarizes the impact of different bariatric procedures on the nutrition of patients.

Table 7-2. Primary healthcare guidance for post-bariatric patients

Surgical procedure	Impact on nutrition
Gastric band	No impact on absorption
	Over-tight gastric band affects nutritional quality of diet including protein and iron
Sleeve gastrectomy	May be some impact on absorption including iron and vitamin B12
Gastric bypass	Impact on absorption of iron, vitamin B12, calcium and vitamin D
	Long limb bypasses may affect absorption of protein, fat, vitamin A and trace elements in addition.

After surgery, patients will be required to stay on lifelong nutritional supplements (**Table** 7-3) and have lifelong annual monitoring of their nutritional status (**Table** 7-4).

Table 7-3. Post-operative nutritional supplementation (routine)

	Surgical procedure	
	Sleeve gastrectomy	**Gastric bypass**
Ursodiol	For 6 months	For 1 year
Omega-3	For 6 months	For 1 year
Multivitamin and minerals	Yes	Yes
Iron	Monitor ferritin levels	Monitor ferritin levels
Folate	As part of multivitamin and mineral supplement	As part of multivitamin and mineral supplement
Vitamin B12*	Yes	Yes
Calcium and vitamin D	Yes	Yes
Zinc and copper	As part of multivitamin and mineral supplement	As part of multivitamin and mineral supplement

Note: *As an alternative to vitamin B12 injections, oral cyanocobalamin 1mg once daily can be prescribed.

Table 7-4. Annual blood tests following bariatric surgery.

Blood tests	Surgical procedure	
	Sleeve gastrectomy	Gastric bypass
Liver function tests	Yes	Yes
Full blood count	Yes	Yes
Ferritin	Yes	Yes
Folate	Yes	Yes
Vitamin B12	Yes[*]	Yes[*]
Calcium	Yes	Yes
Vitamin D	Yes	Yes
Parathyroid hormone	Yes	Yes
Vitamin A	No	Possibly[†]
Zinc, copper	Possibly[‡]	Yes[‡]
Selenium	No[‡§]	No[‡§]

Notes:

[*] International Federation for Surgery of Obesity & Metabolic Disorders (IFSO), Bariatric Surgery. https://www.ifso.com/bariatric-surgery/. (Accessed 2 Sep 2024).

[†] Schauer, P.R., Bhatt, D.L., Kirwan, J.P., Wolski, K., Brethauer, S.A., et al., Bariatric surgery versus intensive medical therapy for diabetes--3-year outcomes, N Engl J Med 370(21) (2014) 2002-13.

[‡] Hutter, M.M., Schirmer, B.D., Jones, D.B., Ko, C.Y., Cohen, M.E., et al., First report from the American College of Surgeons Bariatric Surgery Center Network: laparoscopic sleeve gastrectomy has morbidity and effectiveness positioned between the band and the bypass, Ann Surg 254(3) (2011) 410-20; discussion 420-2.

[§] O'Kane, M., Parretti, H. M., Pinkney, J., Welbourn, R., Hughes, C. A., Mok, J., et al. British Obesity and Metabolic Surgery Society Guidelines on perioperative and postoperative biochemical monitoring and micronutrient replacement for patients undergoing bariatric surgery-2020 update. Obesity reviews: an official journal of the International Association for the Study of Obesity (2020) 21(11) e13087.

[Recommendation] The recommended post-surgery follow-up schedule are:

- Annual endoscopy referral for bariatric patients to examine stomach pouch and anastomotic site
- Plastic surgery referral 1.5 years after bariatric surgery
- Pregnancy counseling 1 year after sleeve gastrectomy and 2 years after gastric bypass
- Patient to be referred if there are signs of organ impairment, hypoalbuminemia, or constant heartburn

7.6 Weight maintenance after bariatric surgery

Weight maintenance after bariatric surgery is a critical aspect of the long-term success of the procedure, as many patients who experienced significant weight loss initially may struggle to sustain it over time. Following surgery, patients must adopt lifelong dietary and lifestyle changes to maximize the benefits of the surgery. This includes adhering to a balanced diet rich in protein, regular physical activity, and ongoing monitoring of weight and health markers [266]. Behavioral support, such as counselling or participation in support groups, plays a vital role in helping patients navigate the psychological and emotional challenges that can accompany post-surgical life [267]. Additionally, routine follow-up appointments with healthcare providers are essential for addressing any nutritional deficiencies and adjusting their dietary plans as needed. Overall, a comprehensive approach that combines medical, nutritional, and psychological support is key to achieving lasting weight maintenance after surgery.

CHAPTER 8. Management of obesity in special populations

Dr. Nadirah Ghenimi, Dr. Carine Platat

HIGHLIGHTS
Women of reproductive age - Women with obesity face heightened risks for various maternal, obstetrical, and fetal complications during pregnancy. - Multiple factors influence gestational weight gain. - A combined behavioral intervention and pharmacotherapy is the most effective approach for weight management.
Obesity in pregnancy after bariatric surgery - Screening and supplementation in pregnancy are important.
People of determination - There is a high prevalence of overweight, obesity and underweight among individuals with intellectual disability. - Limited clinical evidence exists regarding weight management for individuals with intellectual disability. - A comprehensive approach targeting dietary habits and physical activity should be adopted. Families, along with a medical team including a physician, a dietitian, a behavioral specialist/psychologist with expertise in intellectual disability, are key components of the overall weight management strategy. - Special consideration should be given to cognitive rigidity and sensory sensibility of individuals with intellectual disability.

8.1 Introduction

Obesity in certain specific populations needs particular attention. These populations include: (i) women of reproductive age; (ii) women who are pregnant who have previously undergone bariatric surgery; and (iii) people of determination.

8.2 Weight management for women at reproductive age

The pre-conception period is an important time for women to address their health status, especially those with obesity who are considering pregnancy. Women with a BMI of ≥30 kg/m^2 have a higher risk of infertility, congenital malformations, and adverse pregnancy outcomes such as hypertensive disorders, gestational diabetes, Caesarean delivery, and pre-term birth [268-272]. Routine BMI and waist circumference assessment should be integrated into preventive health check-ups at key life stages, including gynecological visits, contraception counseling, and preconception care.

Weight management before pregnancy can help mitigate these risks. It is recommended that women have a pre-conception consultation with their healthcare provider to discuss individualized health risks during pregnancy and make informed decisions. Healthcare providers should receive training to address weight-related stigma, ensuring respectful and patient-centered counseling that integrates psychological support when needed.

8.2.1 Maternal and fetal complications associated with obesity in pregnancy

During pregnancy (antenatal period), women with obesity face heightened risks for various maternal, obstetrical, and fetal complications. These are outlined in **Table** 8-1. Close fetal growth monitoring is essential, particularly in the third trimester, to detect risks of macrosomia or fetal growth restriction.

Table 8-1. Maternal and fetal complications associated with obesity in pregnancy

Period	Complications
Preconception	Hypertension, renal dysfunction, T2DM, infertility, in-vitro fertilization failure.
Pregnancy	Pre-existing conditions (chronic hypertension, renal disease, T2DM), miscarriage, gestational diabetes, gestational hypertension, pre-eclampsia, venous thromboembolism, labor complications, Caesarean section, depression, premature birth.
Immediately postpartum	Post-partum hemorrhage, venous thromboembolism, delayed onset of breastfeeding, shortened duration of breastfeeding.
Persistent postpartum	Weight gain or persistent obesity, hyperlipidemia, T2DM, ischemic heart disease, hypertension, stroke.
Fetal/neonatal	Macrosomia, large for gestational age, stillbirth, congenital malformation, shoulder dystocia, neonatal hypoglycemia.

Abbreviations: T2DM, type 2 diabetes mellitus

8.2.2 Gestational weight gain

Gestational weight gain may be influenced by many factors, including depression, health behavior, knowledge and expectations, socioeconomic status, maternal age, number of previous pregnancies (parity), and ethnicity. For women with obesity, managing weight during pregnancy can be particularly challenge. Prenatal healthcare providers can offer valuable guidance and support to these women regarding weight management. **Table** 8-2 shows the expected gestational weight gain during pregnancy. Tools like the 5As of Healthy Pregnancy Weight Gain or trackers weight gain [273] can assist primary care providers in discussing healthy weight gain with their patients as per the recommendations in **Table** 8-2 [274]. Due to the sensitivity of the topic, some healthcare providers may hesitate to discuss weight gain with their patients. However, understanding and discussing the experiences of the woman and the factors influencing her weight during pregnancy can strengthen the patient-provider relationship. Regular discussions with women regarding gestational weight gain should be conducted in a non-judgmental manner, taking into account cultural and psychosocial influences on dietary and physical activity habits.

Table 8-2. Expected gestational weight gain during pregnancy.

Pre-pregnancy BMI	**Total weight gain**	**Rates of weight gain* 2nd and 3rd trimester**
Category	**Range in kg**	**Mean (range) in kg/week**
Underweight (<18.5 kg/m^2)	12.5 – 18	0.51 (0.44 – 0.58)
Normal weight (18.5 – 24.9 kg/m^2)	11.5 – 16	0.42 (0.35 – 0.50)
Overweight (25.0 – 29.9 kg/m^2)	7 – 11.5	0.28 (0.23 – 0.33)
Obesity (≥30.0 kg/m^2)	5 – 9	0.22 (0.17 – 0.27)

8.2.3 Clinical strategies for weight management

Clinical strategies for weight management in women [274-279] include: Clinical strategies for weight management in women [274-279] include:

- **Combined behavioral intervention:** Studies suggest that a combination of behavioral interventions focusing on both nutrition and physical activity can effectively reduce gestational weight gain in women with obesity who are planning to conceive.
- **Pharmacotherapy:** The use of medications for weight management during pregnancy is generally discouraged due to unknown effects on the fetus. Women planning for pregnancy are advised to discontinue these medications to safeguard the developing fetus.

A combined approach that integrates both behavioral interventions and pharmacotherapy has been proven to be most effective. Moreover, managing comorbidities such as gestational diabetes and sleep apnea is essential. A multidisciplinary team including an obstetrician, dietitian, and behavioral health specialist should be involved in the weight management plan for women with obesity to provide individualized support.

8.2.4 Postpartum weight management

The postpartum period, which begins immediately after childbirth and may extend beyond a year, particularly in breastfeeding mothers, presents unique challenges in weight management. The weight gained during pregnancy is a major contributor to postpartum weight retention, which can be influenced by pre-pregnancy weight, sleep patterns, mental health, and educational levels.

- **Breastfeeding:** Women with obesity may need additional support to establish and maintain breastfeeding, which can include tailored counseling and addressing any challenges faced [280, 281].
- **Nutrition and lifestyle:** Nutritional counseling should be individualized, considering factors such as culture, personal preferences, and any underlying medical conditions. Encouraging physical activities such as walking or swimming can help women achieve postpartum weight loss goals. In some cases, medication or even surgical options may be considered, but these should be approached with caution due to potential risks.
- **Monitoring:** Women who have undergone bariatric surgery should be closely monitored for nutrient deficiencies and potential complications during the postpartum period. Additionally, monitoring for postpartum depression is essential, as it can contribute to weight gain. A combination of hormonal changes, postpartum lifestyle changes, and challenges like low self-esteem can increase the risk of postpartum depression.

The aim of postpartum weight management is to promote healthy outcomes and minimize obesity-related health complications. The ideal management plan should be personalized, considering the individual's unique needs and health status. A comprehensive approach encompassing physical activity, nutritional counseling, and breastfeeding support can help women achieve their postpartum weight goals. Long-term management with regular follow-up can ensure adherence to lifestyle changes and minimize the likelihood of regaining weight. A

dedicated postpartum follow-up visit (6 months to 1 year after childbirth) should be encouraged to monitor weight, mental health, and cardiovascular risk factors.

[Recommendation] The recommendations for weight management interventions to support women during their reproductive years are summarized in **Table** 8-3 [272, 281].

Table 8-3. Recommendations for weight management interventions for women of reproductive age

Topic	Recommendation	Evidence level* and grade†
General advice	Discuss weight management targets which are specific to reproductive years. Provide extra support due to lower initiation and continuation rates.	Level 3 Grade C; Level 4, Grade D
Combined behavioral change interventions	Offer behavior change interventions (nutrition and physical activity) during pre-conception, pregnancy, and postpartum.	Level 3, Grade C; Level 2a, Grade B; Level 1a, Grade A
Nutrition counseling alone	Encourage and support pregnant women to consume foods consistent with a healthy dietary pattern.	Level 3, Grade C
Physical activity counseling alone	Encourage and support pregnant women without contraindications to exercise to engage in at least 150 minutes/week of moderate-intensity physical activity.	Level 3, Grade C
Pharmacotherapy	Do not prescribe metformin for managing gestational weight gain. No weight management medications during pregnancy or breastfeeding.	Level 1b Grade A; Level 4, Grade D
Breastfeeding	Offer additional breastfeeding support to women with obesity due to decreased rates of initiation and continuation.	Level 3, Grade C

Notes:

* Evidence level (category of evidence)‡: Level 1a: Evidence from meta-analysis of randomized controlled trials (RCTs); Level 1b: Evidence from at least 1 RCT; Level 2a: Evidence from at least 1 controlled study without randomization; Level 3: Evidence from nonexperimental descriptive studies, such as comparative studies, correlation studies and case–control studies; Level 4: Evidence from expert committee reports or opinions or clinical experience of respected authorities, or both.

† Grade (strength of recommendation)‡: Grade A: Directly based on level 1 evidence; Grade B: Directly based on level 2 evidence or extrapolated recommendation from category 1 evidence; Grade C: Directly based on level 3 evidence or extrapolated recommendation from level 1 or 2 evidence; Grade D: Directly based on level 4 evidence or extrapolated recommendation from level 1, 2 or 3 evidence.

‡ Piccinini-Vallis H., A.K., Bell R, Pereira L, Nerenberg K., Canadian Adult Obesity Clinical Practice Guidelines: Weight Management Over the Reproductive Years for Adult Women Living with Obesity. 2020. https://obesitycanada.ca/guidelines/reproductive.

8.3 Pregnancy post-bariatric surgery

This section offers guidance on managing pregnancies in women who have previously undergone bariatric surgery and are either planning conception or are already pregnant. While bariatric surgery is an effective treatment for obesity, it can influence the nutritional status of a woman and may affect her pregnancy outcomes. Hence, she may need specialized obstetric care during pregnancy and postpartum. Monitoring potential complications like gestational diabetes, hypertension, and others becomes pivotal and good perinatal management is crucial [282, 283].

8.3.1 Planning pregnancy post-bariatric surgery

Post-surgery, women should undergo preconception counseling to discuss potential nutrient deficiencies, the need for supplements, and weight management during pregnancy. Pregnancy is discouraged within the first 12-18 months following the surgery corresponding to the weight stabilization phase [284, 285]. Women of reproductive age undergoing the procedure should be provided with effective contraception. Given that estrogen absorption is altered post-surgery, oral contraceptive pills are not recommended for women undergoing the Roux-en-Y gastric bypass or the biliopancreatic diversion/duodenal switch. Alternative contraception methods such as estrogen implants or levonorgestrel-releasing intrauterine devices (IUDs) are preferred. Gastric banding and sleeve gastrectomy do not have definitive contraindications against oral contraceptive pills [282, 284-290]. Oral contraceptives are less effective in women who have undergone Roux-en-Y gastric bypass, and long-acting reversible contraceptive methods should be preferred.

Research has shown that post-bariatric surgery pregnancies have reduced risks of gestational diabetes, hypertensive disorders, and macrosomia, compared to their counterparts with obesity who have not undergone surgery [291-294]. However, there's an elevated risk of delivering small gestational-age babies, hence it is important to ensure adequate nutritional intake and weight gain to support healthy fetal growth [291-294].

8.3.2 Preconception

Initiate a daily multivitamin supplementation with 0.4 to 1.0 mg of folic acid three months prior to conception, continuing until the 12^{th} week of pregnancy. Subsequently, transition to a multivitamin containing 0.4-1.0 mg of folic acid through pregnancy and postpartum. During the first trimester, avoid retinol-based vitamin A supplements to avoid teratogenic effects and opt for supplements with beta-carotene instead [282, 284-290].

8.3.3 Nutritional monitoring

Pregnant post-bariatric surgery women require meticulous weight gain and nutritional monitoring by a specialized multidisciplinary team comprising endocrinologists, gynecologists, dietitians, etc. Regular laboratory tests during each trimester are essential to assessing their complete blood count (CBC), ferritin, albumin, vitamins B12 and D levels, calcium, parathyroid hormone, and folate level. In addition, monitor zinc, copper, and vitamin A levels for women who have had malabsorptive surgery; and vitamins E and K levels for women who had a duodenal switch procedure. If the woman is experiencing severe vomiting, immediate B1 supplementation is advised alongside close monitoring of B1 levels. A Registered Dietitian can guide her dietary needs, ensuring weight gain following

the Institute of Medicine (IOM) recommendations and ensure an optimal protein intake of 60g daily [286, 287, 295].

[**Recommendation**] The recommended nutritional screening and supplementation in pregnancy after bariatric surgery is given in **Table** 8-4 [286, 289].

Table 8-4. Recommendations for screening and supplementation in pregnancy after bariatric surgery

Category	Tests/Supplements	Frequency
Laboratory screening (every trimester)	CBC, albumin, prealbumin, 25(OH)D, PTH, calcium, phosphorus, ferritin, folate, Vitamin B12, Vitamin A, PT, magnesium, zinc	Every trimester
	Vitamin B1	If persistent vomiting occurs.
Daily vitamin supplementation	Multivitamin (10 mg zinc, 1 mg copper, <5000 IU Vitamin A as β-carotene*)	Throughout pregnancy
	Folic acid	0.4 mg/day up to 12 weeks

Abbreviations: 25(OH)D, 25-hydroxyvitamin D; CBC, complete blood count; PTH, parathyroid hormone injection; PT, Prothrombin Time.

*To avoid teratogenic effects.

Notes:

In cases of any deficiency, recheck correction one month after treatment adjustment. Use reference values for plasma concentrations of vitamins and trace elements during pregnancy†.

Severe complications, including internal hernias and gastric perforations, may arise during pregnancy or postpartum. If a post-operative pregnant woman reports abdominal pain or persistent vomiting, these complications must be considered. If warranted, CT scans should be interpreted by experienced bariatric surgeons or radiologists.

† Ciangura, C., Coupaye, M., Deruelle, P., Gascoin, G., Calabrese, D., et al., Clinical Practice Guidelines for Childbearing Female Candidates for Bariatric Surgery, Pregnancy, and Post-partum Management After Bariatric Surgery, Obes Surg 29(11) (2019) 3722-3734.

8.3.4 Tests for gestational diabetes

For patients who have undergone malabsorptive surgery, alternatives to the typical 75g glucose solution (administered between 24-28 weeks) should be considered due to potential for intolerance and dumping syndrome. One alternative is home glucose monitoring (fasting and two-hour postprandial blood sugar) for approximately one week during the 24-28 weeks of gestation [296].

8.3.5 Postpartum

Breastfeeding is encouraged for post-surgery women [297]. Continuing vitamin supplementation is imperative to prevent nutritional deficiencies in infants breastfed by a mother who has undergone a Roux-en-Y gastric bypass. Long-term follow-up during the postpartum period should include regular assessments of nutritional health to prevent both maternal and infant complications. Postpartum follow-up should include a structured assessment of cardiovascular risk and metabolic health, given the long-term implications of obesity.

8.4 Weight management guidelines for people of determination

8.4.1 Terminology

- **People of determination:** This terminology refers to individuals with temporary or permanent, full or partial deficiency or infirmity in their physical, sensory, mental, communication, educational or psychological abilities, to an extent that limits their ability to perform tasks as individuals without special needs (adapted from the UAE Federal Law No.9 of 2006 [298]).
- **Intellectual disability:** This term is used when there are limitations in a person's ability to learn at an expected level and function in daily life.
- **Autism spectrum disorder (ASD):** ASD is a neurological and developmental disorder that affects interaction with others, communication, learning, and behavior [299]. Autism is described as a "developmental disorder" as its symptoms generally appear in the first 2 years of life. However, autism can also be diagnosed at any age.
- **Down syndrome (DS):** A genetic condition caused by an extra chromosome 21 in some or all cells of the body. DS is marked by growth, developmental, and learning delays that vary from mild to severe [300].

8.4.2 People of determination in the UAE population

According to the World Bank, approximately one billion people worldwide live with disabilities, representing 15% of the global population in 2011 [301]. A 2018 United Nations Economics and Social Commission for Western Asia (ESCWA) report on people of determination in the Arab region indicates that prevalence rates in Arab countries ranges between 0.19 per cent and 5 per cent [302]. Worryingly, 1 in 10 children aged between 0 and 17 years worldwide, including 20.9 million children in the Middle East and North Africa region, are people of determination, according to a 2022 report by UNICEF [303]. Despite the global and regional prevalence data, there is no official count of people of determination in the UAE. The UAE government has thus decided to designate people of determination as a priority. The UAE was among the first countries to ratify the International Convention on People with Disabilities issued by the United Nations in 2008. People of determination now have a dedicated identity card, and the UAE aims to offer an accessible environment and to guarantee their right to education. Article 11 of its Federal Law No.29 of 2006 states that any citizen with disabilities shall have the right to access health and support services at the expense of the State [298].

In the UAE, neurodevelopmental disorders such as ASD, intellectual disability, and specific learning disorders are among the most common disabilities among people of determination. Statistics showed that ASD and DS are diagnosed at higher rates compared with global averages, affecting approximately 1 in 146 births and 1 in 319 births respectively [304, 305]. Our guideline focuses on individuals with intellectual disabilities, especially those with ASD and DS.

8.4.3 Health specificities and challenges of individuals with intellectual disabilities

ASD and DS rarely occur as isolated conditions; they are frequently associated with psychiatric, neurological, or somatic co-morbidities. Addressing these co-morbid conditions is crucial, as they can significantly impact the quality of life of affected individuals. The most prevalent comorbid diagnoses include sleep disorders, anxiety,

depression, attention deficit hyperactivity disorder (ADHD), eating disorders, auto- or hetero-aggression, and self-harm [306, 307]. As many as 95% of individuals with autism have at least one comorbid psychiatric diagnoses [307]. A longitudinal cohort study reported that a individuals diagnosed with autism have a 2-fold higher mortality risk through young adulthood, for which may be mediated through shared neurologic (e.g., epilepsy) and mental/behavioral disorders [308]. Epilepsy is also prevalent in ASD, with up to 60% of individuals exhibiting epileptiform activity in EEG studies [307]. For adults with DS, there is high incidence of comorbid conditions such as dementia, Alzheimer's disease, and behavioral problems [306, 307]. As many as 95% of individuals with autism have at least one comorbid psychiatric diagnoses [307]. A longitudinal cohort study reported that a individuals diagnosed with autism have a 2-fold higher mortality risk through young adulthood, for which may be mediated through shared neurologic (e.g., epilepsy) and mental/behavioral disorders [308]. Epilepsy is also prevalent in ASD, with up to 60% of individuals exhibiting epileptiform activity in electroencephalogram (EEG) studies [307]. For adults with DS, there is high incidence of comorbid conditions such as dementia, Alzheimer's disease, and behavioral problems [309]. These psychiatric and neurodegenerative conditions necessitates a nuanced approach to treatment and underscores the importance of recognizing co-occurring psychiatric disorders for effective management [307].

Physical health issues are also more prevalent among individuals with intellectual disabilities. Research has shown a greater prevalence of diabetes compared with age- and gender-matched controls, pointing toward a need for focused diabetes screening and preventive care for this population [310]. In addition, cardiovascular disease, obesity, hypothyroidism, osteoporosis, vision and hearing impairment, and motor coordination difficulties are frequently observed. The ability to communicate in individuals with intellectual disabilities is often impaired with speech and language disorders, especially in young persons.

Gastrointestinal disorders are also common in individuals with intellectual disabilities. These include chronic constipation, chronic diarrhea, gastroesophageal reflux and/or disease, nausea and/or vomiting, flatulence, chronic bloating, abdominal discomfort, ulcers, colitis, inflammatory bowel disease, food intolerance, and/or failure to thrive. Celiac disease was more frequently observed in adults with DS [311].

Several categories of inborn errors of metabolism have been detected in some patients, including mitochondrial disorders, disorders of creatine metabolism, selected amino acid disorders, disorders of folate or B12 metabolism, and selected lysosomal storage disorders [312, 313]. Hypothyroidism is also a common complication in adults with DS [311]. A summary of the most common co-morbidities is provided in [312, 313]. Hypothyroidism is also a common complication in adults with DS [311]. A summary of the most common co-morbidities is provided in **Table** 8-5.

Table 8-5 Summary of the most common co-morbidities in individuals with intellectual disabilities

Co-morbidity group	Most common comorbidities
Psychiatric/mental health	Depression
	Anxiety
	Behavior problems
	Attention Deficit Hyperactivity Disorder
Neurological disorders	Epilepsy, seizure
	Alzheimer's disease*
Physical issues	Motor coordination difficulties†
Sleep disorders	
Musculo-skeletal disorders	Osteoporosis*
	Arthritis*
Endocrine/metabolism disorders	Diabetes
	Obesity
	Hypothyroidism
	Cardiovascular diseases
Sensory impairments	Hearing and vision loss
Communication disorders	Speech and language disorders†
Nutritional and gastrointestinal issues	Celiac disease
	Other gastrointestinal disorders (constipation, inflammatory bowel disease)
	Eating disorders

Notes:

* More frequent in adults

† More frequent among children and adolescents

Integrated care strategies that consider both the mental and physical health are essential when addressing the intricate needs of individuals with intellectual disabilities.

8.4.4 Obesity and weight management for people with intellectual disability

Obesity is one of the most commonly observed health complications among adults with ASD and DS [308, 311, 313, 314]. Recent meta-analysis and research review indicated that the prevalence of obesity, overweight and underweight among individuals with ASD was 1.8%, 19.8% and 6.4%, respectively, [308] and that the prevalence of obesity and overweight among individuals with DS ranged from 38% to more than 70% [314].

To date, no clinical guidelines have been published for weight management in adults with intellectual disabilities. The gaps in clinical knowledge may compromise clinical decision-making and management of these medically complex individuals. The existing gaps in clinical knowledge highlight the need for comprehensive, evidence-based guidance to inform practice.

Individuals with intellectual disabilities face significant challenges in maintaining weight loss, often due to a combination of behavioral, cognitive, and environmental factors. Structured follow-up care is essential in preventing weight regain in these individuals. This care includes regular monitoring, reinforcement of healthy

behaviors, goal-setting, and involvement of caregivers who play a crucial role in facilitating and maintaining their healthy lifestyle choices [315, 316]. In addition, the development of culturally-tailored and individualized programs which are adapted to the cognitive needs of these individuals should be prioritized [315, 317]. Although the evidence is limited, the implementation of multi-component interventions with dietary restriction playing a key role, appears to be the most effective way to promote and maintain weight loss for individuals with intellectual disability compared to programs based on education, diet or physical activity alone [318]. In the context of the UAE and Gulf Cooperation Council (GCC) countries, efforts to integrate these strategies with cultural and familial considerations are also being explored.

[Recommendation] Based on available clinical knowledge, several points of attention can be identified for weight and obesity management in people with intellectual disability (**Table** 8-6).

Table 8-6 Recommendations for obesity and weight management for people with intellectual disability

Category	Points of attention	Recommendation
Weight	Weight status should be regularly monitored, at least annually with a medical specialist, followed by regular tracking at home.	Regular home tracking and annual review weight status with specialist.
Use of antipsychotic drugs	Antipsychotic drugs have been found to be widely used in individuals with intellectual disability. Weight gain has been identified as a major side-effect. Individuals taking antipsychotic drug should be monitored by a dietitian.	Monitor weight gain and involve a dietitian if on antipsychotic medication.
Eating habits	Cognitive rigidity and sensory sensitivity can contribute to disordered eating patterns. They are particularly frequent among individuals with ASD. These traits can be managed and should be incorporated as a key component in the weight management strategy for individuals with intellectual disability. The combined intervention of a dietitian and a psychologist may help to design a customized plan/strategy that recognizes these traits in order to improve their eating habits. The lack of tools to estimate the energy needs must be emphasized here. Energy needs are often overestimated. Individuals with intellectual disability are characterized by atypical eating behavior. They usually tend to prefer energy dense food and develop picky eating with a high food selectivity.	Address cognitive rigidity and sensory sensitivity with a customized diet and behavioral plan; and ensure careful energy need estimation.

Category	Points of attention	Recommendation
Behavioral strategy for weight management	Current studies on behavioral strategies for weight management are of low quality, which limits their applicability [319]. Support from a behavioral specialist/psychologist with expertise in intellectual disability is recommended when developing an individualized plan for weight management.	Tailor weight management programs with support from a behavioral specialist, involving family and focusing on dietary habits, physical activity, and reducing inactivity.
Co-morbidities	Comprehensive assessment of all possible comorbidities, including diet-related complications (e.g., gastroesophageal reflux, chronic bloating, abdominal discomfort, and food intolerance) that are frequently reported in individuals with intellectual disability.	Perform comprehensive assessment of diet-related complications and monitor dietary habits and physical activity.
Monitoring	Dietary and physical activity/inactivity habits should be assessed, and progress should be monitored.	

The weight management plan for individuals with intellectual disability should aim to improve dietary habits, increase physical activity, and reduce physical inactivity through behavior modification techniques. Programs should be tailored and involve the family. An example is a set of general recommendations developed in the UK to support people with learning disabilities in managing their weight [320]. They highlighted the importance of raising the awareness of the families regarding the risk of weight gain as well as the role of family carers and health professionals. Challenges related to the adoption of health eating habits and the practice of physical activity were identified. Tools and practical tips are also provided. Additional evidence on obesity and weight management in children and young people with autism can be found in Sanders, et al.[321].

Weight management recommendations which are available for youth with DS [322] could also be used to develop recommendations for adults. Some of the relevant recommendations are:

- Youth with DS should be screened routinely for overweight and obesity.
- Clinicians and families should be aware of health conditions and risk factors that are common in DS and may impact the development of obesity.
- Clinicians should screen for feeding difficulties in all youth with DS.
- Clinicians should include assessments of dietary intake and physical activity at every visit.
- Clinicians and families should set appropriate recommendations for dietary intake. No adapted/validated equation to estimate energy needs. Macronutrients needs seem to be similar to the general population
- Clinicians and families should set appropriate recommendations for physical activity
- Clinicians should provide multi-component behavioral weight management treatment programs specific to the needs of youth with DS and with overweight or obesity.
- Families should work to promote healthy eating and increased physical activity at home and school.

8.4.5 Tips for the people of determination and their families:

- Promote a healthy eating environment. Limit the availability and consumption of products with added sugars, processed food while encouraging the consumption of fruits and vegetables.
- Create family cooking opportunities.
- Encourage a progressive exposure to new food or flavors.
- Support the practice of regular physical activity.

CHAPTER 9. Health literacy for obesity management

Dr. Iffat ElBarazi, Dr Marwa Khalil

HIGHLIGHTS
Health literacy (HL) is a foundational element that underpins effective clinical practice and patient engagement.
HL helps patients make informed decisions, engage in preventive care, and adhere to medication, leading to effective disease management and follow-up care. Improving HL can reduce health disparities and improve healthcare access.
Written and visual materials, diagrams, and models should be used to empower decision making and improve patient HL.

9.1 Introduction

In the realm of modern healthcare, the battle against obesity stands as one of the most formidable challenges of our time. As the prevalence of obesity continues to rise globally, clinicians, researchers, and policymakers are increasingly recognizing the multifaceted nature of this public health crisis. Amidst the complexities of obesity management, health literacy (HL) exists as a foundational element that underpins effective clinical practice and patient engagement.

Health literacy, often regarded as the cornerstone of informed decision-making and optimal healthcare outcomes, holds particular significance in the context of obesity management. Maintaining good health necessitates possessing the skills and abilities to comprehend and act upon information [323]. These collective abilities were initially termed “health literacy” in 1974 [324]. According to the WHO, HL is defined as “the cognitive and social skills that determine an individual's motivation and capacity to access, comprehend, and utilize information in ways that promote and sustain good health” [325]. The most widely accepted definition of HL is “the extent to which individuals have the capability to obtain, process, and comprehend fundamental health information and services required to make appropriate health decisions” [326]. These collective abilities were initially termed “health literacy” in 1974 [324]. According to the WHO, HL is defined as “the cognitive and social skills that determine an individual's motivation and capacity to access, comprehend, and utilize information in ways that promote and sustain good health” [325]. The most widely accepted definition of HL is “the extent to which individuals have the capability to obtain, process, and comprehend fundamental health information and services required to make appropriate health decisions” [326].

This chapter delves into the pivotal role that HL plays within the clinical guidelines for obesity management. It will highlight the profound impact of health literacy on the understanding, engagement, and empowerment of patients. Additionally, it emphasizes the crucial role of healthcare providers in health communication and providing patient-centered care, while shedding light on the transformative potential HL holds within the realm of clinical guidelines.

9.2 Role of health literacy in improving patient outcomes

HL is significant in clinical settings. It has been shown that HL plays a role in improving decision-making, medication adherence, and reducing complications through proper management, safety precautions, and better communication. The self-efficacy theory posits that individuals with higher self-efficacy are more likely to set achievable goals for behavior change [327], and are more likely to persist in their efforts, seek support when needed, and adapt their strategies to overcome barriers [328]. **Figure** 9-1 shows the positive impact of having good HL.

Figure 9-1. Positive impacts of good health literacy

Specifically for the patient with obesity, by being health-literate, the individual is more likely to:

- Make healthier food choices, control portion sizes, and select foods that contribute to weight management and overall well-being [329].
- Follow recommended exercise routines and participate in physical activities that promote well-being [330].
- Adhere to recommendations from healthcare providers about weight management strategies, dietary changes, and exercise routines.
- Have better abilities to navigate the healthcare system to access obesity prevention and treatment services. This includes scheduling regular check-ups, seeking referrals to nutritionists or dietitians.
- Have access to credible sources of information regarding healthy eating, physical activity, and weight management, is less likely to be swayed by misinformation or fad diets and is more likely to follow evidence-based recommendations [331].

9.3 Health literacy strategies

9.3.1 Assessment of organizational health literacy

Organizations are encouraged to assess their level of health literacy using different tools, such as the Health Literate Health Care Organization [332] or the Health Literacy Environment of Hospitals and Health Centers (HLE2) [331, 333].

9.3.2 Training staff in health literacy and creating a welcoming environment

Organizations should provide training to healthcare providers on HL best practices. They should also create a welcoming environment for all patients throughout all the steps starting from the registration till reaching the examination room and meeting the physician.

9.3.3 Improving methods of communication

Organizations should ensure that they use clear oral, written, and digital methods of communication. **Figure** 9-2 describes some best practices in digital health literacy.

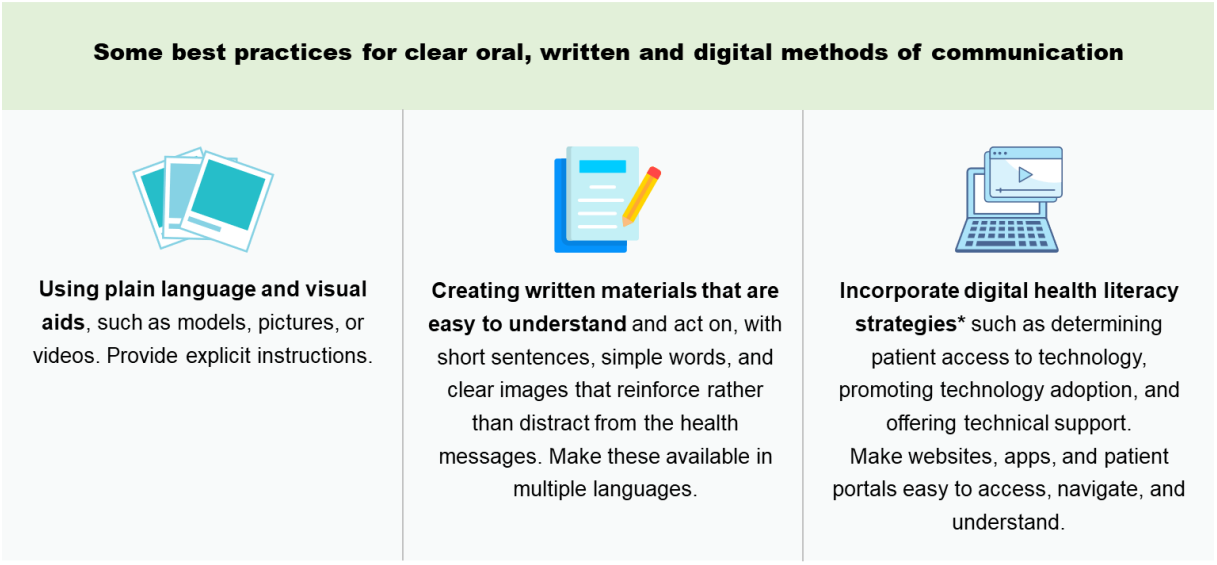


Figure 9-2. Best practices in health literacy

Note: * Conard, S., Best practices in digital health literacy, Int J Cardiol 292 (2019) 277-279.

9.4 Contents of health literacy materials

HL universal precautions involve assuming that all patients may have difficulty understanding healthcare instructions. Thus, when implementing universal precautions for HL, organizations design healthcare materials—such as instructions, patient education, and handouts— with the assumption that everyone may face challenges in comprehending health information and accessing healthcare services. Healthcare systems should therefore implement universal precautions that assume everyone is at risk of limited HL [334]. HL materials and resources need to be designed at an appropriate reading level and include plain language explanations. Written, visual materials, diagrams, and models should be used to empower decision making and improve the HL of the patient. **Figure** 9-3 shows a suggested list of topics for HL materials relating to obesity for all health entities.

[Recommendation] All healthcare entities are encouraged to have health literacy materials related to the topics in obesity (**Figure** 9-3).

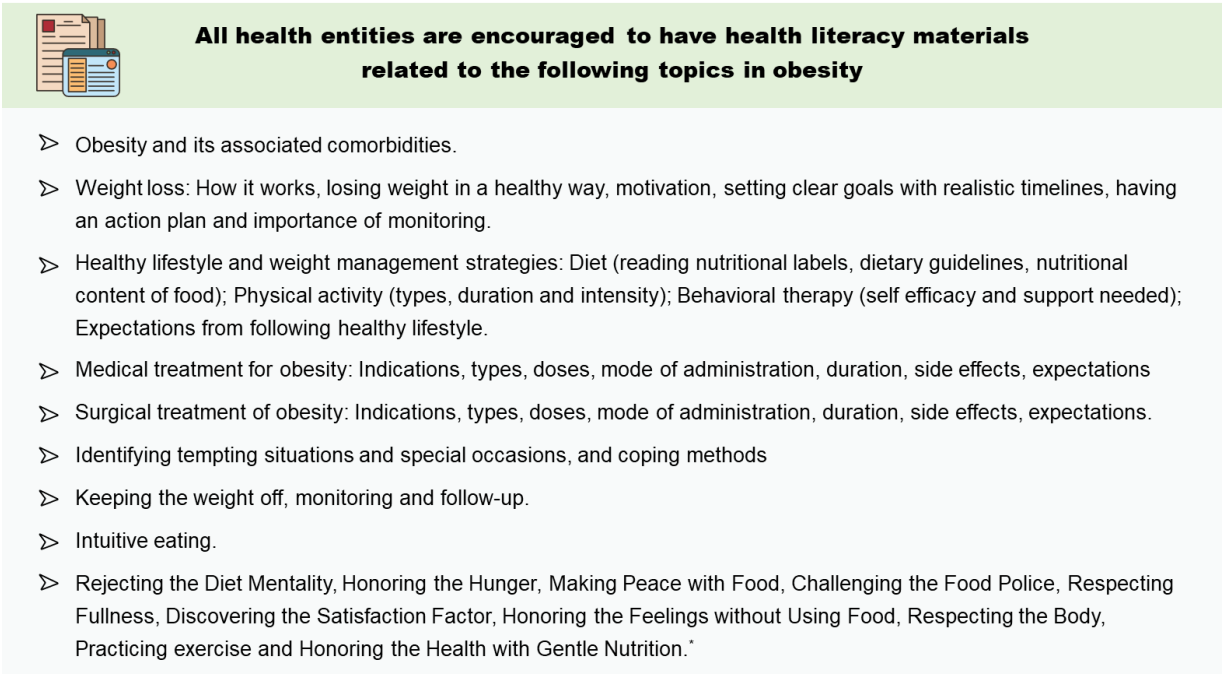


Figure 9-3. List of topics for HL materials relating to obesity

9.5 Health literacy and weight maintenance

HL plays a crucial role in weight maintenance as it empowers individuals to make informed decisions about their health and lifestyle. Those with high HL are better equipped to understand nutritional information, interpret health-related messages, and navigate the complexities of weight management [330]. This understanding enables them to adopt healthier eating habits, engage in regular physical activity, and adhere to weight maintenance strategies effectively. Additionally, improved HL facilitates communication with healthcare providers, allowing individuals to seek appropriate guidance and support tailored to their needs [335].

APPENDICES

Chapter 2

STOP-BANG Screening questionnaire for OSA

http://www.stopbang.ca/osa/screening.php

K10 screening tool for anxiety and depression

https://www.worksafe.qld.gov.au/__data/assets/pdf_file/0010/22240/kessler-psychological-distress-scale-k101.pdf

Patient Health Questionnaire-9 (PHQ-9)

https://med.stanford.edu/fastlab/research/imapp/msrs/_jcr_content/main/accordion/accordion_content3/download_256324296/file.res/PHQ9%20id%20date%2008.03.pdf

https://www2.gov.bc.ca/assets/gov/health/practitioner-pro/bc-guidelines/depression_patient_health_questionnaire.pdf

Chapter 4

General Practice Physical Activity Questionnaire (GPPAQ)

https://assets.publishing.service.gov.uk/media/5a7b530140f0b6464693564f/GPPAQ_-_pdf_version.pdf

Physical Activity Readiness Questionnaire (PAR-Q and PAR-Q+)

www.hse.ie/eng/about/who/healthwellbeing/our-priority-programmes/heal/heal-docs/physical-activity-readiness-questionnaire.pdf

https://eparmedx.com/wp-content/uploads/2022/12/ParQ-Plus-Jan-2023-Image-File.pdf

Physical Activity Readiness Medical Examination (PARmed-X)

https://www.chp.gov.hk/archive/epp/files/PARmed-X.pdf

Chapter 5

Dutch Eating Behavior Questionnaire (DEBQ)

Van Strien, T., Frijters, J. E., Bergers, G., & Defares, P. B. (1986). The Dutch Eating Behavior Questionnaire (DEBQ) for assessment of restrained, emotional, and external eating behavior. *International Journal of Eating Disorders, 5*, 295–315. https://doi.org/10.1002/1098-108X(198602)5:2<295::AID-EAT2260050209>3.0.CO;2-T

Yale Food Assessment Scale (YFAS) 2.0

https://sites.lsa.umich.edu/fastlab/yale-food-addiction-scale/

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