Clinical Guidelines for Weight Management in New Zealand Children and Young People

The guideline represents a statement of best practice based on the available evidence and expert consensus (at the time of submission to the Ministry of Health). The guideline is not intended to replace the practitioner's judgement. In each case care decisions should consider the person's clinical state, age, and co-morbidities; the person's and their family/whānau's preferences; and the most recent evidence.

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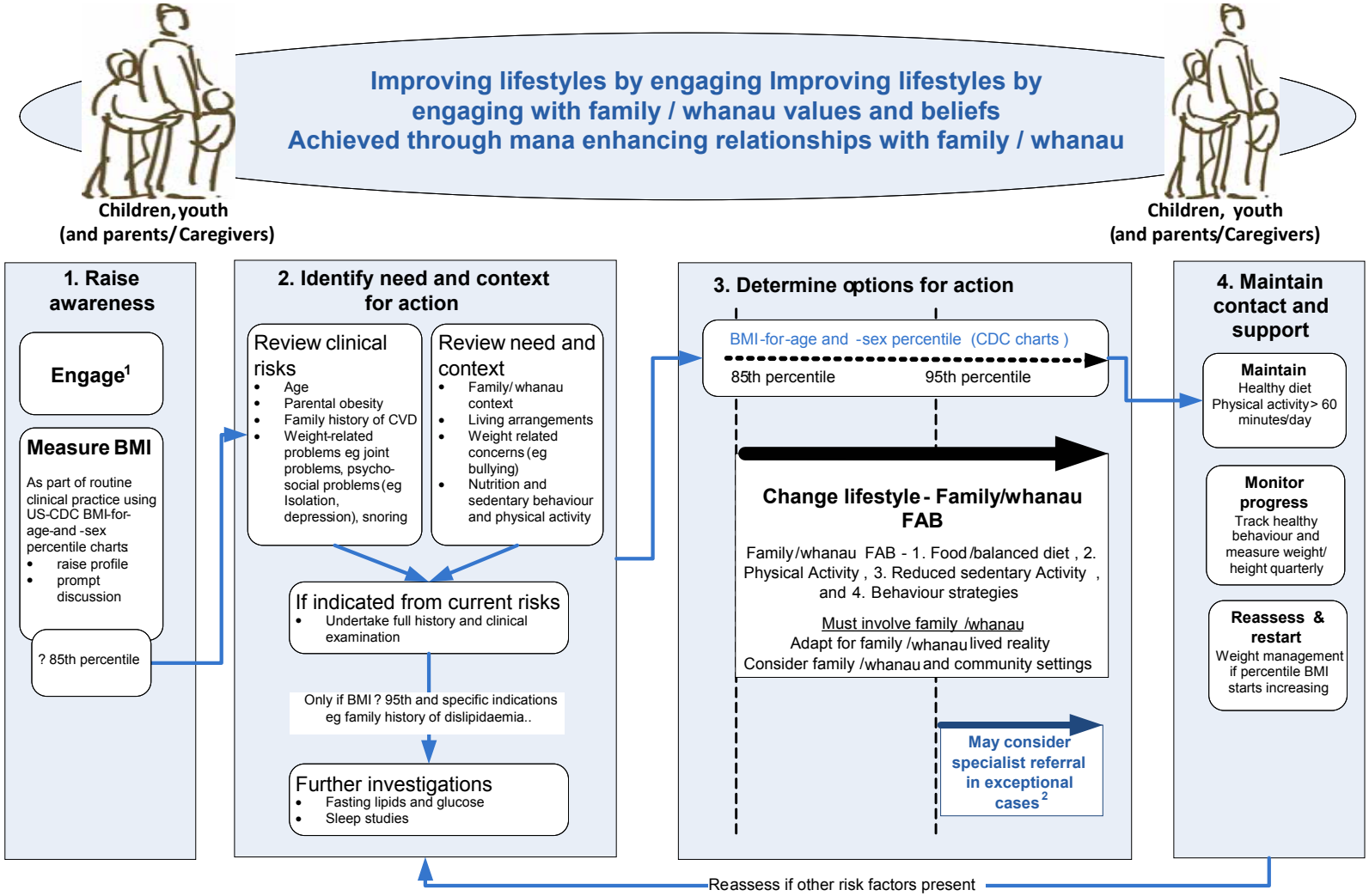
Contents

List of Tables

List of Figures

Algorithm and Key Messages



1 Primary health care, community health workers, schools, secondary care, through marae, via places of worship

2 When lifestyle interventions have failed and significant co -morbidities or risk factors exist

Note: BMI = body mass index; CVD = cardiovascular disease; US-CDC = United States Centers for Disease Control and Prevention.

Step 1: Engage and raise awareness

- Engage with child or young person and their family/whānau.
- Effect behavioural change by working with people's values, beliefs, and lived realities using mana-enhancing relationships.
- Measure height and weight as part of routine clinical practice to calculate body mass index (BMI).
- Use the United States Centers for Disease Control and Prevention BMI-for-age and -sex percentile charts to monitor BMI. For abdominal obesity, the waist circumference of a young person aged over 5 years should be about half the young person's height.
- Note that a child or young person with a BMI-for-age and -sex in the 85th percentile or higher is overweight and in the 95th percentile or higher is obese.

Step 2: Identify need and context for action

- Assess the child or young person's lived reality and clinical need. Consider their family/whānau, culture, work, community, beliefs, and values.
- Conduct a full history and clinical examination and advise the child or young person's family/whānau if the child or young person's BMI is in the 85th percentile or higher and there is evidence of a current health risk.
- Consider further investigations only where there are specific indications, such as the child or young person has a BMI in the 95th percentile or higher and a positive family history of dyslipidaemia or premature cardiovascular disease.
- Include in a full history:
  - precipitating events and actions taken
  - drugs that may contribute to weight gain
  - usual diet (including sugary drinks and fatty foods)
  - usual activity and sedentary activity
  - a family history of obesity or cardiovascular disease
  - a history of snoring
  - current consequences (physical and social) of overweight.
- Include in the clinical examination:
  - blood pressure
  - waist circumference
  - abnormal gait, flat feet, problems with hips or knees
  - presence of striae, intertrigo, or hepatomegaly
  - presence of acanthosis nigricans, which suggests insulin resistance
  - assessment for short stature, low height velocity or bruising/purple striae (suggests endocrine cause for weight gain)
  - an examination of the nose and throat if the child or young person snores.

Step 3: Determine options for action

Intervention approach

- Use comprehensive lifestyle approaches involving family/whānau and combining a healthy diet, increased physical activity, decreased sedentary activity, and behavioural strategies (this approach is known as the family/whānau FAB approach – **f**ood, **a**ctivity, **b**ehaviour).
- Monitor behavioural changes rather than weight.
- Aim to slow weight gain.
- Remember parents/caregivers may be better agents of change than the child.

Diet

- Suggest a healthy diet low in saturated fats, sugar, and salt, with a variety of foods, including wholegrain cereals, rice, and pasta, increased fruit and vegetable intake, and lean proteins.
- Encourage drinking of water and milk and avoidance of sugary drinks (eg, fizzy drinks, flavoured milk, fruit juice, sports drinks, and cordials).
- Encourage the reduction or avoidance of energy-dense takeaway foods and snacks (eg, snack bars, potato chips, cake, and ice cream).

Physical activity

- Encourage increase in child or young person's regular moderate-intensity or vigorous physical activity to at least 60 minutes per day (perhaps start with 5–10 minutes per day to build up to goal of at least 60 minutes).
- Encourage parents/caregivers to be active with children.
- Encourage decreasing the child or young person's screen time to two hours or less per day.
- Consider referring the child or young person to existing physical activity programmes (eg, the Green Prescription Active Families programme).
- Remember that children aged under 5 years are active in different ways to older children (see the Sport and Recreation New Zealand website, http://www.sparc.org.nz).

Pharmaceuticals

- Consider orlistat or sibutramine only when the child or young person's BMI is in the 95th percentile or higher and lifestyle change has not controlled their weight gain.
- Remember that orlistat is contraindicated in children aged under 12 years and sibutramine is contraindicated in people aged under 18 years.
- Ensure specialist services supervise the use of drugs.

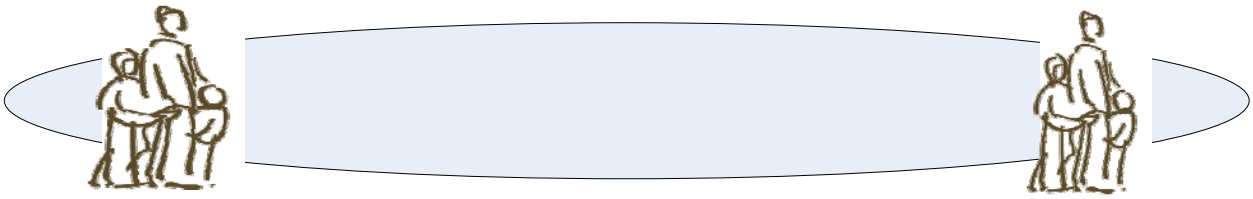
Surgery

- Consider bariatric surgery for young people only in exceptional circumstances, that is when:
  - the young person has attained physiological maturity
  - the young person has a BMI of 50 kg/m^2 or more or 40 kg/m^2 or more with other significant disease persisting, despite lifestyle interventions (with or without drugs)
  - the young person and their family/whānau have shown they can adhere to healthy dietary and physical activity habits
  - a psychological evaluation is likely to confirm the stability and competence of the family/whānau unit.

Step 4: Arrange ongoing contact and support (once goal weight reached)

- Focus on supporting healthy behaviours (with quarterly weight and height measurement for monitoring).

Improving equity of outcomes of children and young people



- Improving weight management outcomes for Māori, Pacific and South Asian populations is a priority for this guideline. Good practice that reflects the rights, needs, culture and context of priority populations can improve the uptake and impact of guideline-based interventions. This guideline emphasises the importance of involving family/whānau and achieving mana-enhancing relationships through a responsive health system at all stages of the algorithm. Mana-enhancing relationships are ones where there is genuine respect for the person with weight-related risks and a sense of collaboration to connect with those deeper values and beliefs to achieve behaviour change.
- Understand the values and beliefs of the family/whānau to support healthy lifestyles.
- The following good practice points may improve service responsiveness and outcomes for Māori, Pacific and South Asian people.
  - Develop mana-enhancing relationships that empower the family/whānau through respect, trust and mutual ownership by seeking to understand and acknowledge **their** "lived realities" including social determinants, cultural imperatives and socioeconomic circumstances.
  - Assess the clinical needs of the family/whānau.
  - Identify opportunities **with** the family/whānau to address their clinical needs **within** the context of their lived realities.

- Identify **with** the family/whānau options for action that are realistic and **aligned** to their lived realities.
- Maintain contact and support **with** the family/whānau in a way that is consistent with their lived realities.

Abbreviations

AGREE	Appraisal of Guidelines for Research and Evaluation
BMI	body mass index
DHB	District Health Board
GRADE	Grading of Recommendations, Assessment Development and Evaluation
HDL	high density lipoprotein
Kcal	kilocalorie
Kg	kilogram
Kg/m^2	kilogram per square metre (unit of BMI)
KJ	kilojoule
LDL	low density lipoprotein
mg	milligram
MJ	millijoule
mmHg	millimetres mercury (unit of blood pressure)
mmol/L	millimols per litre
n	number
NICE	National Institute for Health and Clinical Excellence
p	probability (usually p-value)
RCT	randomised controlled trial
SMD	standardised mean difference
WHO	World Health Organization
WMD	weighted mean difference
95%CI	95% confidence interval
%EWL	percentage excess weight loss

About these Guidelines

Aim of these guidelines

The aim of this guideline is to provide evidence-based guidance for the management of overweight and obesity in children and young people. It is expected that this guideline will be used principally in primary care and community-based initiatives.

Primary prevention of overweight and obesity, although vitally important, is outside the contracted scope of this guideline.

This guideline stands alongside a clinical guideline developed for weight management in adults.

Need for a guideline

The prevalence of overweight and obesity remained stable in New Zealand children (aged up to 14 years) from the Child Nutrition Survey in 2002 (Ministry of Health 2003) to the New Zealand Health Survey in 2006/07 (Ministry of Health 2008a). The prevalence of overweight was about one in five children and young people, with similar rates in boys and girls. The prevalence of obesity was about one in 10 children and young people, with similar rates in boys and girls.

Overweight and obesity disproportionately affects Māori children and young people, even after standardisation for age. Twenty-five percent of Māori children and young people were overweight in 2006/07 compared with 20% of all children and young people. Thirteen percent of Māori children and young people were obese in 2006/07 compared with 8% of all children and young people. A larger proportion of Māori girls than Māori boys were overweight or obese.

Overweight and obesity also disproportionately affects Pacific children and young people in New Zealand. Thirty-one percent of Pacific children and young people were overweight in 2006/07 compared with 20% of all children and young people. Twenty-six percent of Pacific children and young people were obese compared with 8% of all children and young people.

Māori and Pacific children and young people are considered priority populations for this guideline. Although Māori and Pacific people represented about 23% and 11% of the New Zealand population aged 14 years or under in 2006 (Statistics New Zealand), they represent about 28% respectively of all the children and young people who are obese. For this reason, Māori and Pacific children and young people are a significant focus of this guideline.

The prevalence of overweight and obesity was also reported for Asian people in the 2006/07 New Zealand Health Survey (Ministry of Health 2008a). However, the term 'Asian' includes a wide variety of ethnic groups, including population groups originating from South Asia, South-east Asia, and East Asia (Rasanathan et al 2006). The diversity of these groups suggests the term 'Asian' is unhelpful when discussing health profiles, because it disguises health disparities between the different groups (Workshop Organising Team 2005). Therefore, we have chosen to use the term 'population groups' (eg, South Asia population groups) in this guideline.

The combined group of South Asian population groups is a priority population group for the purposes of this guideline. This guideline uses the term 'South Asian' to refer to population groups originating from India (including Fijian Indians), Pakistan, Bangladesh, Sri Lanka, Nepal, Afghanistan, Bhutan, and the Maldives. The prevalence of overweight and obesity in South Asian children and young people has not been reported in the New Zealand Health Survey (Ministry of Health 2004, Ministry of Health 2008a) or Children's Nutrition Survey (Ministry of Health 2003).

Overweight and obesity in childhood and adolescence is an important health issue because it increases the risk of obesity in adulthood (Singh et al 2008b). Childhood overweight and obesity also may increase early mortality in adulthood from endocrine, nutritional, and metabolic diseases and circulatory system disease (Bjorge et al 2008). Overweight and obesity in children and young people have also been associated with increased prevalence of cardiovascular risk factors, (Freedman et al 2007), impaired glucose tolerance, and type 2 diabetes (Sinha et al 2002), as well as other co-morbidities such as non-alcoholic fatty liver disease, gallstones, obstructive sleep apnoea, and musculoskeletal disorders (August et al 2008).

How to use this guideline

Each section in this guideline is structured in the following way.

- An overview of the evidence.
- One or more graded recommendations that are, wherever appropriate, congruent with the recommendations or guidance of other organisations, such as Sport and Recreation New Zealand.
- Good practice points that provide additional guidance, reflecting the expert opinion of the Guideline Technical Advisory Group and are backed up by testing, augmented literature reviews, and consultation with Māori, Pacific, and South Asian population groups.
- A more detailed narrative that summarises the evidence tables.
- A description of evidence that might provide useful information about the priority population groups.
- Evidence statements that summarise the evidence and give a quality assessment of the evidence.

How to interpret the recommendations

The evidence was assessed using the Grading of Recommendations, Assessment Development and Evaluation (GRADE) system (Guyatt et al 2008b), a system for developing guideline recommendations that incorporate the values of the Guideline Technical Advisory Group – the GTAG (Swiglo et al 2008). The recommendations were graded as **strong** or **weak**. The strength of the recommendation reflects the confidence the Guideline Technical Advisory Group has that patients receiving the recommended intervention will be better off than they would be if they did not receive that intervention and that the desirable effects of the recommended intervention outweigh the undesirable effects (Swiglo et al 2008). If, in the Guideline Technical Advisory Group's view, the trade-off was sufficiently clear that most practitioners and/or patients would choose the recommended intervention, then the recommendation was graded as strong. The recommendation was graded as weak when the trade-off was less clear and it was considered likely that the practitioner and/or patient might not choose the recommended intervention) (Guyatt et al 2008a). See Appendix 1 for further discussion of this grading system.

Guideline implementation and training

Implementation of the guideline and the training needs of guideline users have been considered as part of full implementation planning. They will align with the overall roll-out and implementation of *New Zealand Cardiovascular Guidelines Handbook* (New Zealand Guidelines Group 2009) and the upcoming revised diabetes guidelines.

Treaty of Waitangi and Māori Development

The Government recognises the Treaty of Waitangi as the founding document of New Zealand. The Government envisages all New Zealanders moving forward together with a shared commitment to the future. Since the late 1980s, Māori have become a strong, vibrant force in our society, buoyed by the renaissance of Māori culture and language. However, too many are being left behind. The Government is committed to ensuring all Māori enjoy a brighter, more prosperous future. To do this, the Government is nurturing strong families/whānau and communities. In particular, the Government is seeking significant outcomes in whānau ora by eliminating poverty, advocating for social justice, and advancing Māori social, cultural, economic, and community development in the best interests of the nation.

Policy Statement – He Korowai Oranga: The Māori Health Strategy

He Korowai Oranga: The Māori Health Strategy (Ministry of Health 2002) provides a framework for improving Māori health and, in particular, for informing weight management in Māori children and young people. At the heart of He Korowai Oranga is the goal of whānau ora: realising Māori potential. The four key pathways to achieve whānau ora are:

- whānau, hapū, iwi, and community development
- Māori participation in the health and disability sector (eg, supporting effective Māori health providers and a highly skilled Māori workforce)
- effective health and disability services
- working across sectors to address the broader determinants of health (eg, social development, education, and housing).

Translating the Treaty of Waitangi, Māori Development, and He Korowai Oranga into a pragmatic framework for weight management for Māori

To contribute to the pragmatic implementation of the Treaty of Waitangi and Māori development, while working within the parameters of He Korowai Oranga: The Māori Health Strategy, three strategic actions for Māori have been identified in the area of weight management in Māori children and young people.

- Accelerate the development of a culturally competent sector that understands the lived realities of Māori and the importance of mana-enhancing relationships.
- Ensure effective health services for Māori are provided by both non-Māori-led and Māori-led providers.
- Promote the ongoing development of Māori-led providers and the Māori workforce.

Evidence of need in Māori

Obesity is disproportionately prevalent in Māori children and young people compared with the combined New Zealand European and Other group (Ministry of Health 2008c). About 13% of Māori aged 5–14 years were obese in the New Zealand Health Survey 2006/07 compared with about 8% of the total population aged 5–14 years.

Limited evidence base for Māori

We found no direct evidence of the effectiveness of weight management interventions with Māori children and young people. We also found no randomised controlled trials of weight-loss interventions with Māori children and young people.

Making the guideline work for Māori

The lack of evidence pertinent to Māori in the area of weight-loss interventions required us to make other efforts to identify appropriate responses, so an augmented review was commissioned from Dr Cindy Kiro (Kiro 2009).

The goal of the recommendations and good practice points in this guideline is to contribute to the pragmatic implementation of the Treaty of Waitangi and Māori development and to support the weight management sector to respond to the unmet need for effective interventions for Māori. Given the desire to ensure the guideline works for Māori despite the limited evidence base, detailed good practice points and advice on solutions are integrated into the remainder of the document. More detailed information on processes and frameworks are in Appendices 1 and 2.

Making the guideline work for Pacific population groups

Evidence of need in Pacific population groups

Obesity is disproportionately prevalent in Pacific children and young people compared with the combined New Zealand European and Other group (Ministry of Health 2008c). About 26% of Pacific 5–14 years were obese in the New Zealand Health Survey 2006/07 compared with about 8% of the total population aged 5–14 years. From 2002 to 2006/07, the prevalence of overweight increased from 28% to 33% in boys and the prevalence of obesity in girls increased slightly from 27% to 29%.

Limited evidence based for Pacific populations

No direct evidence on the effectiveness of weight management interventions with Pacific populations was found. We also found no randomised controlled trials of interventions for weight loss with Pacific children and young people were found.

The lack of evidence pertinent to Pacific population groups required further effort to identify appropriate responses for these priority populations. Therefore, an augmented review was commissioned from Dr Jemaima Tiatia for Pacific population groups (Tiatia 2009).

Making the guideline work for South Asian population groups

Evidence of need in South Asian population groups

The 2006/07 New Zealand Health Survey found the prevalence of overweight among Asian 5–14 year olds was lower than that of the combined New Zealand European and Other group of 5–14 year olds; the prevalence of obesity was similar between the two groups (Ministry of Health 2008c). However, no data have been published on the prevalence of overweight and obesity in South Asian children and young people in New Zealand.

Limited evidence based for South Asian populations

There is an absence of direct evidence on the effectiveness of weight management interventions with South Asian children and young people. No randomised controlled trials of interventions for weight loss with South Asian children and young people were found.

The lack of evidence pertinent to South Asian population groups required further effort to identify appropriate responses for these priority populations. Therefore a detailed review of the guidelines was undertaken with Ruth De Souza for South Asian population groups.

Improving the health of Māori, Pacific, and South Asian populations

The starting point for the development of this guideline and associated implementation and training considerations was He Korowai Oranga: The Māori Health Strategy. The goal of the guideline for the priority populations is to help realise whānau ora: supporting the whānau/family and communities to make healthy lifestyle choices that enhance the health and wellbeing of the whānau. Whānau ora requires health services to be co-ordinated around the needs and realities of whānau. Services also need to incorporate cultural views, beliefs, and practices, and be guided by Māori, Pacific, and other models of health.

For the overweight and obesity guidelines to be responsive and relevant to the priority populations, they must be implemented in a way that meets the social and cultural realities of family/whānau and communities, for example, income levels and geographic location (eg, rural areas can influence health outcomes for the priority populations). The provider's cultural competence is integral to understanding these lived realities. Cultural competence requires practitioners "to provide patient-centred care by adjusting their [own and organisational] attitudes and behaviours to the needs and desires of different patients, including accounting for the impact of emotional, cultural, social, and psychological issues on the main biomedical ailment" (American Medical Association 1999 p154). Cultural competence, therefore, requires practitioners to move beyond simply developing their awareness to acting to overcome the barriers to whānau ora.

The starting point for achieving whānau ora lies with the quality of the relationship between the provider and the family/whānau. The relationship must be one that enhances trust, respect, and mutual ownership of the goals. For the purposes of this guideline, we have defined such relationships as 'mana-enhancing relationships'. Mana-enhancing relationships are interactions where there is mutual respect and a sense of collaboration to connect with the deeper values and beliefs of the person and their family/whānau to change behaviour. Such relationships acknowledge and work with people's lived realities – the cultural, social, and socioeconomic context – to empower change. Through the platform of mana-enhancing relationships and lived realities, the more technical aspects of the guideline can be implemented. The good practice points below may assist providers to realise this vision.

Good practice points for providers

- Develop proactively your cultural competence to facilitate effective communication.
- Develop your relationship with the young person before doing anything else to ensure you can empathise with the person's cultural, social, and socioeconomic circumstances.
- Develop your relationship by:
  - assessing factors such as cultural engagement, the role of the young person's family/whānau (immediate and extended) and wider community, and the family/whānau employment situation, living circumstances, health literacy, values, and beliefs
  - recognising that differences in views of health and wellbeing may mean you need to work alongside other providers (eg, marae-based workers or church ministers) to improve health outcomes.
- Work with the young person to understand their needs within their context (ie, within their lived reality) by:
  - identifying the young person's needs and establishing realistic goals
  - assessing and helping the young person to overcome the barriers (eg, costs) to meeting goals
  - working with the young person's family/whānau, not just with the individual person
  - exploring the meaning of food and opportunities for adapting the person's diet by considering:
  - the types of food available in different contexts (eg, on marae or at church)
  - foods of cultural significance and their seasonal availability
  - exploring physical activity options and opportunities for adapting traditional and customary activities (eg, hunting) for exercise and physical activity
  - considering group-based activities and other activities the young person enjoys
  - being aware of and referring to local community options for people interested in weight loss (eg, marae-based, healthy hapū programmes, and church-based or local community group options).
  - being sensitive to the young person's communication needs and providing resource material and information in the young person's and the family/whānau's preferred language, if possible.

Measurement and Classification of Overweight and Obesity

The prevalence of overweight and obesity in Māori and Pacific children and young people is higher than in the total population of children and young people. Overweight and obesity are associated with future risk of cardiovascular disease, diabetes, and some cancers in adults. Being overweight in childhood and adolescence increases the risk of adult overweight and obesity. Being overweight in childhood and adolescence has also been associated with increased prevalence of cardiovascular risk factors, including elevated triglycerides and insulin, high low-density lipoprotein (LDL) cholesterol, low high-density lipoprotein (HDL) cholesterol, and increased blood pressure.

Body mass index (BMI) is a simple measure that can be used to identify overweight and obese children and young people. BMI is weight in kilograms divided by height in metres squared, but body composition changes with normal growth in children and youth, so age- and sex-specific thresholds are required to correctly identify overweight and obesity. The United States Centres for Disease Control and Prevention (US-CDC) publishes downloadable charts for assessing for overweight and obesity. Other growth charts include the UK1990 and the World Health Organization (WHO) growth charts.

Recommendation

Use the US-CDC BMI-for-age and -sex percentile charts to assess children and young people for overweight and obesity. Children and young people with a BMI-for-age and -sex in the 85–94th percentiles are overweight and in the 95th percentile or higher are obese.

Good practice points

- Download the US-CDC charts from the CDC's website (http://www.cdc.gov/GrowthCharts) and use them to track a child or young person's progress.
- In children and young people aged over five years, a rule of thumb for identifying abdominal obesity is waist circumference should be half or less than the child or young person's height in over-five-year olds. Measure a child or young person's waist circumference (at the midpoint between the lowest rib and iliac crest). Consider using waist circumference as well as BMI to measure progress.

Body mass index

Rationale for using BMI to measure adiposity

Direct measures of the extent a person's fat tissue, or adiposity, are not practical in most health care settings. Therefore, indirect measures are most commonly used. Indirect measures of adiposity include BMI, waist circumference, waist-to-hip ratio, and waist-to-height ratio. Literature is emerging on the use of waist circumference and waist-to-height ratio (Ortega et al 2008, Maffeis et al 2007), but BMI is the most widely used, practical, and convenient measure of general adiposity, and is recommended in guidelines internationally (National Institute for Health and Clinical Excellence 2006, Lau et al 2006). BMI in children and adolescents is associated with other measures of body fatness (Katzmarzk et al 2007), but in children and young people body composition and simple anthropometric indicators change dramatically with normal growth and maturation (Lau et al 2006), so age- and sex-specific approaches to classification are required.

There is a relative lack of high-quality studies looking at the association between different obesity measures and morbidity in children and young people (National Institute for Health and Clinical Excellence 2006) Children have less obesity-related disease than adults in the short term. However, in a US study increased BMI in children and young people was associated with increases in cardiovascular risk factors (elevated triglycerides and insulin, high LDL cholesterol, low HDL cholesterol, and increased blood pressure) (Freedman et al 2007). In this study, 19% of those aged 5–17 years with a BMI in the 85–94th percentiles, 39% of those with a BMI in the 95th or higher percentiles, and 59% of those with a BMI in the 99th or higher percentile had two or more cardiovascular risk factors.

Overweight in childhood also appears to increase risk of obesity in adulthood. In a separate cohort in the US study (Freedman et al 2007), 84% of people with a childhood BMI in the 95–98th percentiles were obese in adulthood compared with 5% of people with a childhood BMI in less than the 50th percentile. In another study, the odds ratio of being obese in young adulthood (21–29 years) increased from 1.3 when the child had a BMI in higher than the 85th percentile at ages 1–2 to 17.5 when the child had a BMI in higher than the 85th percentile at ages 15–17 (Whitaker et al 1997).

Childhood overweight may also be associated with long-term adult mortality risk. A Norwegian cohort of 227,000 adolescents aged 14–19 years had their body weight surveyed between 1963 and 1975 (Bjorge et al 2008). The cohort was divided into four percentile groups, using the US-CDC percentile charts. The two highest groups (75th–84th percentiles and above the 85th percentile) had significantly higher rates of death from endocrine, nutritional, and metabolic diseases and circulatory system disease compared with the reference groups. Adolescent overweight and obesity was linked with increased mortality from these diseases in middle age.

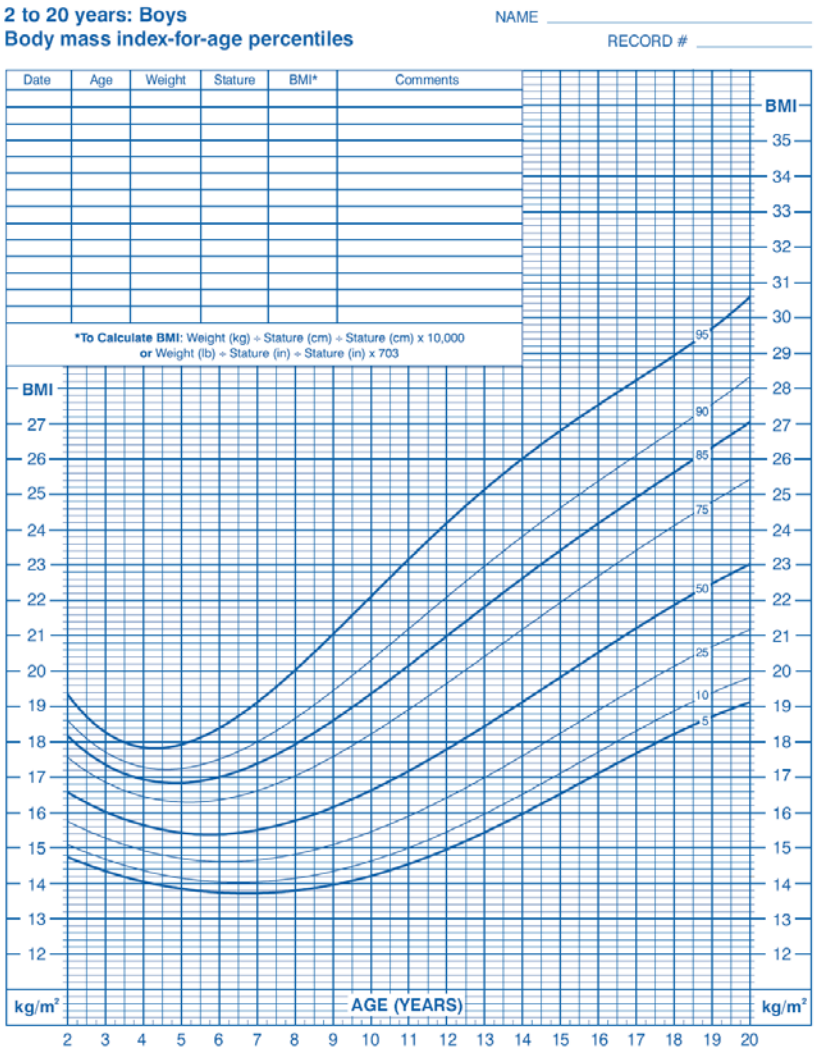
Approaches to identifying overweight and obesity with BMI

Identifying children and adolescents who are overweight and obese is more difficult than identifying overweight and obese adults. Body composition changes with normal growth and maturation, so age- and sex-specific thresholds are required (Katzmarzk et al 2007, Dansinger et al 2007). Two main BMI-based approaches are used to classify children and young people as overweight and obese: the distributional approach and the anchored approach.

The distributional approach uses percentile cut points on BMI-for-age and -sex charts. The US-CDC charts are an example of the distributional approach (Figure 1), as are the United Kingdom (UK) 1990 growth charts (Preece et al 1996) and WHO growth charts. The US-CDC charts use the 85th percentile for age and sex as a threshold for overweight and the 95th percentile for age and sex as a threshold for obesity. Thus, a child placed in the 85–94th percentiles would be classified as at risk of being overweight and a child placed in the 95th percentile or higher would be at risk of being obese. The UK 1990 charts use the 91st and 98th percentiles as thresholds for overweight and obese. The US-CDC charts are recommended in the Canadian, Australian and US Endocrine Society guidelines (National Health & Medical Research Council 2003, Lau et al 2006, August et al 2008), but the National Institute for Health and Clinical Excellence (NICE) guideline recommends the UK 1990 charts (National Institute for Health and Clinical Excellence 2006). WHO has developed growth charts for the group aged 0–5 years and may develop growth charts for other age groups.

The anchored approach was developed from cross-sections of children and young people from Brazil, the United Kingdom, Hong Kong, the Netherlands, Singapore, and the US for use in epidemiological research (Cole et al 2000). The approach projected the age- and sex-specific BMIs backwards from the percentile BMIs at age 18 that corresponded to a BMI of 25 kg/m^2 or 30 kg/m^2, the adult thresholds for overweight and obesity. The approach produces age- and sex-specific BMI thresholds for overweight and obesity (Table 1), and has been endorsed by the International Obesity Task Force.

Figure 1: Growth chart, body mass index-for-age for males aged 2–20 years



Source: United States Centers for Disease Control, National Center for Chronic Disease Prevention and Health Promotion, http://www.cdc.gov/GrowthCharts (accessed 19 August 2008).

Both the distributional and anchored approaches classify a child or young person as overweight or obese on the basis of an arbitrary choice of BMI being above a certain percentile or thresholds for health risk in adults, rather than being directly tied to known medical or health risk in children and young people (Katzmarzk et al 2007, Neovius et al 2004).

An advantage of a distributional approach (such as the US-CDC charts) compared with an anchored approach (such as that of the International Obesity Task Force), is that the distributional approach enables clinicians to track changes. The distributional approach also has low misclassification rates of children and young people who are not overweight. A systematic review of studies comparing BMI indices to a gold standard measure of body fat (eg, dual-energy X-ray absorptiometry) found five studies with an average specificity of 94% (Westwood et al 2007). Thus, BMI indices correctly categorised on average more than 9 out of 10 children who were not overweight. However, the distributional approach was less successful at accurately identifying children who were overweight, with sensitivity ranging from 17% to 94%.

No practice guideline has recommended using the anchored approach to identify children and youth who are overweight and obese. The anchored approach is probably more suited to population monitoring and epidemiological research (Neovius et al 2004).

Table 1: International cut-off points for overweight and obesity for boys and girls (aged 2–18 years) using body mass index

Age (years)	Overweight (kg/m^2)		Obese (kg/m^2)	
	Boys	Girls	Boys	Girls
2.0	18.41	18.02	20.09	19.81
2.5	18.13	17.76	19.80	19.55
3.0	17.89	17.56	19.57	19.36
3.5	17.69	17.40	19.39	19.23
4.0	17.55	17.28	19.29	19.15
4.5	17.47	17.19	19.26	19.12
5.0	17.42	17.15	19.30	19.17
5.5	17.45	17.20	19.47	19.34
6.0	17.55	17.34	19.78	19.65
6.5	17.71	17.53	20.23	20.08
7.0	17.92	17.75	20.63	20.51
7.5	18.16	18.03	21.09	21.01
8.0	18.44	18.35	21.60	21.57
8.5	18.76	18.69	22.17	22.18
9.0	19.10	19.07	22.77	22.81
9.5	19.46	19.45	23.29	23.46
10.0	19.84	19.86	24.00	24.11
10.5	20.20	20.29	24.57	24.77
11.0	20.55	20.74	25.10	25.42
11.5	20.89	21.20	25.58	26.05
12.0	21.22	21.68	26.02	26.67
12.5	21.56	22.14	26.43	27.24
13.0	21.91	22.58	26.84	27.76
13.5	22.27	22.98	27.25	28.20
14.0	22.62	23.34	27.63	28.57
14.5	22.96	23.66	27.98	28.87
15.0	23.29	23.94	28.30	29.11
15.5	23.60	24.17	28.60	29.29
16.0	23.90	24.37	28.88	29.43
16.5	24.19	24.54	29.14	29.56
17.0	24.46	24.70	29.41	9.69
17.5	24.73	24.85	29.70	29.84
18.0	25.00	25.00	30.00	30.00

Source: Cole et al (2000).

Waist circumference

Rationale for using waist circumference to measure adiposity

Waist circumference is a good predictor of other measures of adiposity and risk of heart disease (Katzmarzk et al 2007), because it takes into account body fat distribution. However, international guidelines have not recommended using waist circumference because data are lacking on the added value of waist circumference when combined with BMI in children (Katzmarzk et al 2007) and because there is no consensus on the use of waist circumference as an alternative to BMI (National Institute for Health and Clinical Excellence 2006).

In New Zealand, the value of waist circumference has been assessed against dual-energy X-ray absorptiometry in a cohort of 580 children and young people aged 3–19 years (Taylor et al 2000). The 80th percentile of waist circumference was found to be more sensitive and specific than waist-to-hip ratio for identifying central body fatness, but was not compared with BMI. Sensitivity and specificity in boys was 87% and 92%, and in girls was 89% and 94%. However, these values are derived from a cohort that included only New Zealand European children, so the findings may not apply to Māori, Pacific, or South Asian children.

Evidence for Māori, Pacific, and South Asian population groups

Using the International Obesity Task Force thresholds, the 2006/07 New Zealand Health Survey found the mean BMI of 5–14-year-olds had not changed since the 2002 National Children's Nutrition Survey (Ministry of Health 2008c). Mean BMI was 19.2 in 2002 and 19.1 in 2006/07. The only published data on adolescents aged over 14 years are the 1997 National Nutrition Survey data on 15–18-year-olds. The prevalence of overweight and obesity in children and young people has remained constant in the total population (Table 2).

Table 2: Age-standardised prevalence of overweight and obesity in children and young people (5–14 years)

Population (5–14 years)	2002		2006/07	
	Overweight	Obese	Overweight	Obese
Total	19.8	9.0	20.1	8.4
Boys	18.0	8.1	20.1	8.1
Girls	21.7	10.0	20.1	8.7
Māori	24.4	14.4	24.6	12.7
Boys	19.1	14.3	23.7	12.0
Girls	29.8	14.4	25.6	13.4
Pacific	32.7	27.3	31.0	26.2
Boys	28.3	27.5	33.6	23.7
Girls	37.0	27.2	28.3	28.9

Source: Child Nutrition Survey 2002 (Ministry of Health 2003); New Zealand Health Survey 2006/07 (Ministry of Health 2008a).

In Māori children and young people, the prevalence of overweight remained stable from 2002 to 2006/07 and the prevalence of obesity decreased slightly. The pattern is similar for boys and girls with respect to obesity in the same period, but overweight increased in Māori boys and decreased in Māori girls.

In Pacific children and young people, the prevalence of overweight and obesity combined decreased from 2002 to 2006/07. However, in the same period, the prevalence of overweight increased in boys and obesity decreased. Girls experienced the opposite, with the prevalence of overweight in girls decreasing and obesity increasing slightly.

The prevalence of obesity was greater in higher deprivation neighbourhoods than in lower deprivation neighbourhoods in 2006/2007: prevalence increased from 5.5% of children living in New Zealand Index of Deprivation quintile 1 neighbourhoods (low deprivation) to 15.1% of children living in quintile 5 neighbourhoods (high deprivation). The pattern was similar with the prevalence of overweight: 15% of children in low deprivation neighbourhoods were overweight compared with 26.3% of children living in high deprivation neighbourhoods.

The prevalence of overweight and obesity in South Asian children and young people was not reported in the New Zealand Health Survey (Ministry of Health 2004, Ministry of Health 2008c), the National Children's Nutrition Survey (Ministry of Health 2003), or the Asian Health Chart 2006 (Ministry of Health 2006).

The main issues revealed by the inequalities analysis are the higher prevalence of obesity in Pacific and Māori children and young people than in the total population of children and young people, and the higher prevalence in areas of high deprivation compared with areas of low deprivation. A further issue is the absence of published data on the prevalence of overweight and obesity among South Asian children and young people.

Assessment

The likelihood that childhood overweight and obesity will persist into adulthood increases with the age of the child. The presence of parental obesity also increases the risk that childhood overweight and obesity will persist. Initial assessment should determine current health risks (age, parental obesity, family history of cardiovascular disease, and history of weight-related problems such as joint problems, psychosocial problems, and snoring) before considering a full history and clinical examination.

Most children and young people who are overweight (ie, with a BMI in the 85–94th percentiles) or obese (BMI ≥ 95th percentile) do not require further investigation, but should simply begin weight management after a clinical assessment. Some children and young people may require further investigations for co-morbidities (Table 3); the likelihood of treatment being initiated may be a useful filter to determine whether further investigations are required.

Recommendations

Children or young people with a BMI in the 85th percentile or higher **and** who have current health risks should have a full history and clinical examination. Unless otherwise indicated by features of the history and examination, adiposity should be noted and weight management strategies advised.

Consider further investigations **only when** there are specific indications, such as the child or young person has a BMI in the 95th percentile or higher and a positive family history of dyslipidemia or premature cardiovascular disease (premature disease would be onset in men aged 55 years or under and in women aged 65 years or under).

Good practice points

- Develop proactively your cultural competence to facilitate effective communication.
- Develop your relationship with the child or young person's family/whānau before doing anything else to ensure you empathise with their cultural, social, and socioeconomic circumstances.
- Develop your relationship by:
  - assessing such factors as cultural engagement, the role of family/whānau (immediate and extended) and the wider community, employment, living circumstances, health literacy, values and beliefs
  - recognising that differences in views of health and wellbeing may mean you need to work alongside other providers (eg, marae-based providers or church ministers) to improve health outcomes.

Clinical practice

- Measure BMI-for-age and -sex as part of your routine clinical practice.
- Include in a full history:
  - current physical (eg, snoring and joint problems) and social (eg, isolation, bullying, and depression) consequences of overweight
  - family history of obesity, early cardiovascular disease, or dyslipidaemia
  - precipitating events and actions already taken
  - drugs that may contribute to weight gain
  - usual diet (especially sugar-containing drinks, high-energy foods, and fruit and vegetable intake)
  - usual levels of physical activity (time playing outside is a good proxy in young children) and usual sedentary activity (eg, screen time such as watching television, playing on the computer and electronic games) and whether there is a television in the bedroom.
- Include in a clinical examination:
  - accurate height (in metres) and weight (in kilograms) to calculate and confirm BMI
  - other considerations (as appropriate) such as:
    - blood pressure with appropriate cuff size
    - waist circumference (if obesity is primarily central, this is of concern)
    - abnormal gait, flat feet, or problems with hips and knees
    - presence of striae, intertrigo, or hepatomegaly
    - acanthosis nigricans (velvety, light-brown-to-black markings usually on the neck, under the arms, or in the groin) automatically suggests significant insulin resistance
    - assessment for short stature, a low height velocity, or bruising or purple striae (consider an endocrine cause for weight gain)
    - a history of snoring (examine the nose and throat because obstructive sleep apnoea is more common in obese children and young people).
- Include further investigations may include (but only if likely to lead to initiation of treatment):
  - fasting lipid profile (total cholesterol, triglycerides, HDL cholesterol, and calculated LDL cholesterol)
  - fasting glucose (interpret this as stated in the diabetes guidelines (New Zealand Guidelines Group 2003)) and a glucose tolerance test if indicated
  - an overnight sleep study using pulse oximetry (a non-invasive method for monitoring oxygen levels in a person's blood).

Table 3: Co-morbidities of overweight and obesity in children and young people

Body system	Risk factors and co-morbidities
Cardiovascular	Hypertension Hyperlipidaemia Early signs of atherosclerosis
Endocrine	Insulin resistance and type 2 diabetes Polycystic ovary syndrome
Gastrointestinal and hepatobiliary	Gastro-oesophageal reflux disease Gallstones Non-alcoholic fatty liver disease
Musculoskeletal	Cellulitis and carbuncles Slipped capital femoral epiphysis Tibia vara (Blount disease) Spondylolisthesis Axial arthritis
Psychiatric	Anxiety and depression Binge eating disorder
Pulmonary	Dyspnoea Asthma Obstructive sleep apnoea

Source: August et al (2008), Kipping et al (2008a), Morrison and Chanoine (2007), Plourde (2006).

Rationale for inclusion in assessment

Causes of overweight and obesity

Overweight and obesity generally result from an imbalance between energy input and energy expenditure. Relevant endocrine disorders and genetic conditions also need to be considered as a cause of overweight and obesity (Morrison and Chanoine 2007, Plourde 2006), but most children will not have genetic and endocrine causes of obesity.

Endocrine disorders that may cause obesity include:

- hypothyroidism
- Cushing's syndrome.

Genetic or congenital conditions that may be associated with paediatric obesity include:

- Prader-Willi syndrome
- Trisomy 21 (Down's syndrome)
- other rare genetic syndromes, such as Alström syndrome, Carpenter syndrome, and Cohen syndrome, although these disorders are typically associated with other clinical signs (eg, short stature, delayed growth and sexual maturation, and cognitive impairment).

Childhood overweight and obesity and risks in adulthood

Overweight and obesity in childhood increase the risk of overweight and obesity in adulthood. A systematic review of the association of childhood weight with adult weight found 18 longitudinal studies (including 13 high-quality studies) that showed childhood overweight or obesity persisted into adult overweight or obesity (Singh et al 2008). The risk of overweight and obesity appears to increase with the age of the child or young person: the closer the young person is to adulthood, the more likely their overweight or obesity will persist into adulthood (Whitaker et al 1997). The odds ratios for adult overweight and obesity based on childhood overweight ranged from 1.3 (95%CI 0.6–3.0) at 1–2-years-old to 17.5 (95%CI 7.7–39.5) at 15–17-years-old (Table 4). Risk of childhood obesity persisting into adulthood also increases by the presence of parental overweight and obesity and the number of parents/caregivers who are overweight or obese. This finding has been reported elsewhere (Lake et al 1997).

Similar findings have been reported in a New Zealand cohort of young adults (Williams 2001). The association of childhood weight (BMI ≥ 75th percentile) with overweight and obesity at age 21 ranged from a relative risk of 4.0 (95%CI 3.0–4.9) at age 7 to 9.8 (95%CI 7.7–11.4) at age 15 for boys and ranged from 3.2 (95%CI 2.3–4.0) at age 7 to 6.8 (95%CI 5.1–8.3) at age 15 for girls. The risk of adult overweight (BMI ≥ 25 kg/m^2) increased where the child's parents were obese, especially the mother.

Table 4: Association of childhood overweight and obesity and parental obesity with adult overweight and obesity

Age (years)	Risk of obesity in young adulthood* (OR, 95%CI)	One overweight or obese parent (OR, 95%CI)	Two overweight or obese parents (OR, 95%CI)
1–2	1.3 (0.6–3.0)	3.2 (1.8–5.7)	13.6 (3.7–50.4)
3–5	4.7 (2.5–8.8)	3.0 (1.7–5.3)	15.3 (5.7–41.3)
6–9	8.8 (4.7–16.5)	2.6 (1.4–4.6)	5.0 (2.1–12.1)
10–14	22.3 (10.5–47.1)	2.2 (1.2–3.8)	2.0 (0.8–5.2)
15–17	17.5 (7.7–39.5)	2.2 (1.1–4.3)	5.6 (2.5–12.4)

Note: Childhood overweight and obesity is a body mass index (BMI) in the 85th or higher percentile for age and sex. Adult overweight and obesity is a BMI of 27.8 kg/m^2 or more for men and 27.3 kg/m^2 or more for women. CI = confidence interval; OR = odds ratio.

* Young adulthood is defined as 21–29-years-old.

Source: Whitaker et al (1997).

Similar findings have been reported in a New Zealand cohort of young adults (Williams 2001). The association of childhood weight (BMI ≥ 75th percentile) with overweight and obesity at 21 ranged from a relative risk of 4.0 (95%CI 3.0 – 4.9) at age seven years to 9.8 (95%CI 7.7 – 11.4) at age 15 years for boys and 3.2 (95%CI 2.3 – 4.0) at age seven to 6.8 (95%CI 5.1 – 8.3) at age 15 for girls. The risk of adult overweight (BMI > 25) increased where the child's parents were obese, especially the mother.

Co-morbidities of overweight and obesity in childhood and adolescence

Overweight and obesity are associated with increased risk of several co-morbidities in adults, and have the potential to adversely affect almost every body system. Childhood obesity tracks into adulthood (Whitaker et al 1997, Lake et al 1997, Power et al 1997); for example, childhood obesity is related to adult cardiovascular disease (Baker et al 2007). Therefore, the co-morbidities of overweight and obesity in adults are relevant to children and young people. There is evidence that many of these same co-morbidities also affect children and young people. Some of the many co-morbidities of obesity are summarised in Table 3. The disease outcomes associated with obesity that are most important in terms of morbidity and mortality in adults and in children and young people are those related to cardiovascular disease, diabetes, non-alcohol fatty liver disease, joint problems, and sleep disruption.

Cardiovascular disease

Population and school-based studies have demonstrated that blood pressure increases with increased BMI in children and adolescents (5–18 years) (August et al 2008, Morrison and Chanoine 2007, Freedman et al 1999, Lurbe et al 2001). The prevalence of high blood pressure in obese children also increased with age from 2 to 19 years (Falkner et al 2006). The relative risk for hypertension in obese children in the United States (BMI ≥ 95th percentile) was 3.26 after three consecutive blood pressure screenings (Sorof et al 2004), and this concurred with studies from elsewhere (Morrison and Chanoine 2007). In children, overweight and obesity have also been associated with adverse lipid profiles in cross-sectional studies (Kipping et al 2008a, Morrison and Chanoine 2007, Jago et al 2006).

Other research has also demonstrated the presence of multiple cardiovascular risk factors in overweight and obese children and adolescents (August et al 2008). The US National Health and Nutrition Examination Survey (NHANES) estimated the overall prevalence of metabolic syndrome (a constellation of cardiovascular risk factors) among 12–19-year-olds in the US is about 4.2% (Cook et al 2003). In severely obese adolescents, the risk of the metabolic syndrome was nearly 50% (Weiss et al 2004). Severe obesity was defined as those with a BMI z-score greater than 2.5, which equated to a mean BMI of 40.6 kg/m^2 (95%CI 39.5–41.7 kg/m^2). The Bogalusa Heart Study demonstrated that in children and adolescents with a BMI in the 85–94th percentile, 19% had two or more cardiovascular risk factors and 5% had three or more (Table 5). When the BMI was in the 95th percentile or higher, 39% had two or more risk factors and 18% had three or more. When the BMI was in the 99th percentile or higher, 59% had two or more cardiovascular risk factors and 33% had three or more cardiovascular risk factors (Freedman et al 2007).

Table 5: Prevalence of cardiovascular risk factors by body mass index-for-age percentile

Body mass index-for-age (percentile)	N	Percentage of population with number of risk factors			
		≥ 1	≥ 2	≥ 3	≥ 4
< 25th	1801	25	5	1	0
25–49th	2215	29	5	1	0
50–84th	3458	36	9	2	0
85–94th	1400	51	19	5	1
≥ 95th	1225	70	39	18	5
≥ 96th	1011	73	42	20	5
≥ 97th	777	76	46	23	7
≥ 98th	523	80	52	27	8
≥ 99th	226	84	59	33	11

Source: (Freedman et al 2007)

Overweight and obese children and young people are not only more likely to develop cardiovascular risk factors, such as elevated blood pressure, but there is evidence suggesting they are also more likely to develop cardiovascular disease. Autopsy studies provide evidence of fibrous plaques in the aorta and coronary arteries of obese teenagers (Berenson et al 1998, Wissler and Strong 1998, Daniels et al 2008). A study that followed over 275,000 Danish children into adulthood demonstrated that even a moderate increase in body weight during childhood could increase risk of cardiovascular disease as an adult. This study suggested that from 7 years to 13 years is one of the critical periods for intervention and prevention of overweight and obesity (Baker et al 2007). However, what remains less clear is whether the association between childhood obesity and cardiovascular disease is fully explained by tracking childhood obesity into adulthood obesity, or whether the metabolic risks in infancy and childhood are reversible (Kipping et al 2008b).

Diabetes

Development of insulin resistance is seen as the dominant mechanism whereby weight gain leads to diabetes (James et al 2004). In children, overweight and obesity has been associated with higher fasting insulin and glucose concentrations in cross-sectional studies (Kipping et al 2008a, Morrison and Chanoine 2007). Impaired glucose tolerance has been observed in 20–25% of obese children (Sinha et al 2002), and the prevalence of newly diagnosed cases of type 2 diabetes mellitus has reportedly increased in some populations of obese children aged 6–17 years over the past 10–15 years (Goran et al 2003).

Cardiovascular disease and diabetes by age and BMI

The literature summarised above indicates that signs of both cardiovascular disease and diabetes (or their risk factors) may be evident in children and adolescents who are overweight and obese. However, determining the assessment recommendations for children and young people requires information about which age and BMI subgroups are at greatest risk. It must also be recognised that investigations or screening tests may be performed not only with the intention to proceed to treatment, which may be more controversial in children and young people, but also to monitor progress in overweight and obese individuals.

The evidence indicates that co-morbidities present a greater risk to health for those in the highest weight categories (ie, those classified as obese rather than overweight). This risk is particularly evident in the results cited from the large scale Bogalusa Heart Study where over 10,000 children and young people aged 5–17 years were examined over seven cross-sectional surveys between 1973 and 1994, and then again between 1982 and 1996 (Freedman et al 1999, Freedman et al 2007). Longitudinal analyses based on a cohort of almost 2400 of the children and young people indicated that more cardiovascular risk factors were present in the highest BMI percentiles, particularly over the 95th and 99th percentiles.

Unfortunately, robust evidence in the literature related to risk specific to age categories is limited. Studies often reported results for children and adolescents combined, which makes it difficult to separate out the prevalence of risk factors by age, or study sizes were too small to allow accurate subgroup analyses by age. Many of the studies summarised above suggested co-morbidities were evident in both children and adolescents. However, data from the Bogalusa Heart Study has included some age-specific analyses (Table 6).

Analyses of data collected between 1973 and 1994 showed that although the associations with overweight did not vary linearly with age, younger children (ie, 5–10-year-olds) showed the weakest associations with risk factors such as total cholesterol and insulin, but the strongest associations with risk factors such as triglycerides and blood pressure compared with the older age group (11–17 years) (Freedman et al 1999). This trend for relative weight to be most strongly associated with blood pressure in younger children and lipid levels among older children has also been noted elsewhere (Laskarzewski et al 1980, Resnicow et al 1993). However, when clusters of risk factors were considered the results across age groups were similar. For example, over 80% of the children aged 5–10 years who had three or more cardiovascular disease risk factors were overweight compared with 71% of 11–17-year-olds with three or more cardiovascular disease risk factors (Freedman et al 1999). Likewise, subsequent analyses of Bogalusa Heart Study results estimated that the prevalence of three or more risk factors among those with a BMI in the 99th percentile or higher was 34% among 5–10-year-olds and 32% among 11–17-year-olds (Freedman et al 2007).

Table 6: Distribution of adverse risk factors by age group and body mass index percentile

Age group	Body mass index percentiles						
	< 25th	25–49th	50–74th	75–84th	85–94th	95–97th	> 97th
Age 5–10 years (n = 3599)							
TC > 200 mg/dL* (%)	9	10	10	13	18	17	23
TG > 130 mg/dL (%)	2	3	3	6	10	10	21
LDL > 130 mg/dL (%)	8	8	9	10	18	12	23
HDL < 35 mg/dL (%)	5	5	6	4	8	7	18
High (> 95th percentile)							
Insulin (%)	2	2	3	3	4	10	27
SBP (%)	2	2	4	6	7	12	22
DBP (%)	2	2	4	9	7	9	14
Age 11–17 years (n = 5568)							
TC > 200 mg/dL (%)	6	6	7	9	15	12	19
TG > 130 mg/dL (%)	3	4	5	7	12	18	32
LDL > 130 mg/dL (%)	4	4	6	9	13	12	21
HDL < 35 mg/dL (%)	6	9	10	12	14	16	21
High (> 95th percentile)							
Insulin (%)	1	1	3	2	5	10	25
SBP (%)	2	4	6	4	7	5	11
DBP (%)	4	5	5	5	4	4	9

Note: DBP = diastolic blood pressure; HDL = high density lipoprotein; LDL = low density lipoprotein; mg/dL = milligram per decilitre; SBP = systolic blood pressure; TC = total cholesterol; TG =- triglyceride.

* Values normally reported in millimol per litre (mmol/L) in New Zealand.

In 1992, the US National Cholesterol Education Program published recommendations for the targeted screening of children and young people with a family history of premature cardiovascular disease or high cholesterol levels or with other risk factors for cardiovascular disease such as obesity (American Academy of Pediatrics 1992). An updated report has recommended that targeted lipid screening begin at age two in high-risk children, including those with a family history of cardiovascular risk factors or a family history of dyslipidaemia or premature cardiovascular disease (Daniels et al 2008). Lifestyle modification was recommended as the first line of treatment, but pharmacotherapy with statins was also recommended. However, these recommendations were controversial. Opposing views pointed to the absence of evidence demonstrating long-term benefit and minimal harms of pharmacotherapy in children and young people (Pasquali and Li 2008) and implied that guidelines recommending long-term use of statins in children were not evidence-based (MacDonald et al 2008).

Other co-morbidities

Health outcomes other than those discussed above are also associated with overweight and obesity (see Table 3). Data specifically relevant to children and adolescents are more limited than the data relevant to adults. Data relevant to children and adolescents tend to come from cross-sectional and observational studies, so they cannot be used to establish cause and effect (Morrison and Chanoine 2007, August et al 2008). One obesity-related disease with a potentially high risk of adverse outcome is obstructive sleep apnoea, a condition that is significantly more prevalent in Māori adults than in non-Māori adults (Robson and Harris 2007). In adults sleep apnoea can lead to systemic hypertension, cardiac arrythmias, nocturnal hypoxia, heart failure and pulmonary hypertension (Haslam et al 2006, Hramiak et al 2007, James et al 2004). Obese children are four to six times more likely than lean children to have obstructive sleep apnoea (Morrison and Chanoine 2007, Young et al 2002).

Non-alcoholic fatty liver disease is an accumulation of fat in the liver. This disease may be mild or associated with a liver-damaging inflammation than may progress to irreversible liver cirrhosis or liver cancer. In an autopsy study, the incidence of fatty liver was 38% in obese children (aged 2–19 years) (Schwimmer et al 2006), but the prevalence has also been reported as high as 45% (Morrison and Chanoine 2007).

Other co-morbidities particularly relevant to children and young people are orthopaedic problems (Morrison and Chanoine 2007, August et al 2008). Overweight and obesity may be associated with slipped capital femoral epiphysis (displacement of the epiphysis at the upper end of the femur), tibia vara, or Blount disease (a growth disorder of the tibia (shin bone) that causes the lower leg to angle inward), spondylolesthesis (low back pain), scoliosis, and osteoarthritis (Yanovski 2001).

It should not be assumed that overweight and obesity have an adverse effect on psychological wellbeing. Reviews have found the effect of overweight and obesity in community samples of children is lower than that found in clinical samples (Flodmark 2005, Wardle and Cooke 2005). Flodmark (2005) found obese children in community samples to have better health-related quality of life and self-esteem than clinical samples. Wardle and Cooke (2005) found low levels of depression and low self-esteem in community samples compared with clinical samples despite moderate levels of body dissatisfaction. However, presentation for weight-related issues may indicate effects beyond those in a community sample.

Lifestyle (Family/Whānau FAB) Approach

Although weight loss may be the goal with some young people, generally the principal aim with overweight and obese children and young people is to slow their weight gain and allow them to grow into their weight. Lifestyle changes following the family/whānau FAB (**f**ood, **a**ctivity, **b**ehaviour) approach involve a healthy diet; increased physical activity; decreased sedentary time, especially decreased screen time (eg, watching television, using the computer, playing inactive electronic games); and behavioural strategies will slow weight gain. The family/whānau must be involved in these interventions, particularly with children and young people. An alternative is to involve the parents/caregivers as change agents, instead of including both children and young people (aged 6–11 years) with their parents/caregivers in lifestyle interventions.

Recommendation

Comprehensive lifestyle approaches involving the child or young person's family/ whānau and combining a healthy diet, increased physical activity, less sedentary activity, and behavioural strategies are the first line of treatment for reducing overweight and obesity.

Strength of recommendation: Strong

Good practice points

- Be mindful that parents/caregivers and family/whānau might be better agents of change than children.
- Encourage the parent/caregiver and family/whānau to be included in education about healthy diet and activity.
- Recruit the family/whānau into supporting the strategies (with the young person's consent). Encourage the family/whānau to make appropriate changes to their diet and activity.
- Explore opportunities for adapting traditional and customary activities (eg, hunting and food gathering) for exercise and physical activity.
- Monitor desired behavioural changes rather than the child or young person's weight.
- Be aware of and refer to local community options, especially for Māori, Pacific, and South Asian family/whānau interested in healthy lifestyles (eg, marae-based, healthy hapū programmes, and church-based or local community group options).

Diet

(For more information on diet, see page 30.)

A healthy diet is nutritionally balanced to ensure the child or young person's growth and development are maintained. Give nutrition resources to the family/whānau, but advice should include:

- the appropriate portion size for a child or young person is the size of the child or young person's cupped hand

- eat foods low in saturated fat, sugar, and salt
- eat a variety of foods from the main food groups:
  - eat wholegrain breads, cereals, rice, and pasta
  - eat more fruit and vegetables (at least five portions per day)
  - eat fish, lean meat, and legumes
  - eat low-fat dairy products
- drink water or low-fat milk
- reduce or avoid energy-dense takeaways, fast foods, and fried foods
- reduce or avoid energy-dense snacks (eg, potato chips, snack bars, buttered popcorn, biscuits, cake, and ice cream)
- reduce or avoid sugary drinks (eg, fizzy drinks, fruit juice, sports drinks, and flavoured drinks and cordials).

Physical activity and exercise

(For more information on physical activity and exercise, see page 32.)

- Encourage parent/caregiver support for children to be active and families/whānau to exercise together.
- Encourage decreasing the child or young person's sedentary activities (eg, television watching, video/DVD watching, and non-school computer-based activities). Children and young people should spend less than two hours (preferably less than one hour) a day out of school time in front of televisions, computers, and game consoles.
- Encourage children and young people to do at least 60 minutes of moderate-intensity to vigorous aerobic physical activity each day.
- Encourage the child or young person to be active in as many ways as possible (eg, through play, cultural activities, dance, sport and recreation, jobs, and going from place to place).
- Encourage a focus on fun (eg, activities that are enjoyable, engaging a child's sense of adventure, and being active with friends and whānau, at home, at school, and in the community).
- Ensure the child or young person includes muscle-strengthening (eg, gymnastics, sit-ups, and push-ups) and bone-strengthening (eg, trampolining, skipping, and running) activities on at least three days of the week as part of the minimum 60 minutes of physical activity. Formal muscle-strengthening training is unnecessary (especially in children), but should young people wish to do so, they should seek the advice of a health professional or exercise professional before starting. Children and young people must avoid power lifting, body building, and maximal lifts until they reach physical and skeletal maturity.
- For children and young people who have not been regularly active:
  - start them with 5–10 minutes' activity a day and increase the time each week
  - split the activity into smaller bouts that total 60 minutes per day (eg, walking for 10 minutes after each meal, in addition to split up active play at other times).

- Preschool children are active in different ways to older children. Encourage physical activity among preschoolers by encouraging their family//whānau to have many opportunities for children to explore their environment, to play, and to enjoy being active in ways that are developmentally appropriate (see the Sport and Recreation New Zealand website – http://www.sparc.org.nz).
- Refer the child or young person and their family/whānau to an existing physical activity programme (such as the Green Prescription Active Families programme).

Behavioural strategies

(For more information on behavioural strategies, see page 38.)

- Identify what changes the child or young person and their family/ whānau wishes to work on first.
- Encourage use of problem-solving and goal-setting strategies to achieve changes. Consider behavioural contracts (eg, active play five minutes per day for first week rising to 10 minutes in second week).
- Encourage appropriate rewards for when the child or young person meets a goal (rewards need to be appropriate to the person's lived reality).
- Encourage use of unmet goals as opportunities for learning more about people's lived realities and the barriers they face to achieving their goals.

Evidence for lifestyle approaches

Lifestyle approaches

Evidence for the effectiveness of lifestyle approaches was obtained from one systematic review with seven relevant trials (Wilfley et al 2007) and seven new trials published since the NICE guidelines were released (Golley et al 2007, Hughes et al 2008, Johnston et al 2007, Kalavainen et al 2007, McCallum et al 2007, Rodearmel et al 2007, Savoye et al 2007).

Wilfley et al (2007) found 14 trials in a search up to August 2005. These trials were all described as poor-quality trials, but the only methodological concern reported was significant loss to follow-up. There was no significant heterogeneity in the results, but only seven trials (n = 299) had follow-up periods of six months or more (median seven months, range 6–64 months). Data were inadequate to conduct a meta-analysis of the seven trials for this guideline. The trials' individual effect sizes are considered here. The effect sizes were statistically significant in five of the seven trials (effect size 0.7–1.0), favouring the lifestyle interventions. However, the two trials with non-significant effect sizes had the longer follow-up (26 months and 64 months). Most trials involved dietary modification, such as the 'traffic light diet', increased exercise and behavioural strategies. All trials included the child or young person's parents in the intervention.

The seven new trials included 981 participants (Golley et al 2007, Hughes et al 2008, Johnston et al 2007, Kalavainen et al 2007, McCallum et al 2007, Rodearmel et al 2007, Savoye et al 2007). Four reported non-significant effects for all results (Golley et al 2007, Hughes et al 2008, McCallum et al 2007, Roedarmel et al 2007), one reported mixed results (Kalavainen et al 2007), and two reported significant results in favour of lifestyle interventions (Johnston et al 2007, Savoye et al 2007). Six of the trials reported either a BMI z-score or a BMI standard deviation score (SDS) (Golley et al 2007, Hughes et al 2008, Johnston et al 2007, Kalavainen et al 2007, McCallum et al 2007, Roedarmel et al 2007), but two did not report sufficient data to include in a meta-analysis (Hughes et al 2007, Johnston et al 2007).

The four trials that reported BMI z-scores or BMI SDS were included in a meta-analysis (Golley et al 2007, Kalavainen et al 2007, McCallum et al 2007, Roedarmel et al 2007). The trials ranged in quality from low (Roedarmel et al 2007) to moderate quality; recruited children and early adolescents (Kalavainen et al 2007) or children only; had a treatment duration of two weeks (Kalavainen et al 2007), three months (McCallum 2007), or six months; compared the lifestyle intervention to usual care (Kalavainen et al 2007) or a no-treatment/information-only control; and followed up for six months (Kalavainen et al 2007, Roedarmel et al 2007) or 12 months (Golley et al 2007, McCallum et al 2007. The lifestyle intervention delayed weight gain, but the standardised mean difference (SMD) was not statistically significant (SMD -0.11, 95%CI -0.30 to 0.07, I^2 = 12%, n = 462).

Of the remaining three trials (Hughes et al 2007, Johnston et al 2007, Savoye et al 2007), Hughes et al (2007) found no significant difference at 12 months between groups treated with best practice one-to-one lifestyle intervention compared with usual dietetic care offered by hospital and community services (median difference +0.04 BMI z-score, 95%CI -0.07 to +0.17, n = 131). The trial was of a moderate quality. However, Johnston et al (2007) and Savoye et al (2007) both found significant differences in BMI and these trials could be included in a meta-analysis. The trials were moderate (Johnston et al 2007) to high quality (Savoye et al 2007), recruited children and adolescents (Savoye et al 2007) or early adolescents only (Johnston et al 2007), had a treatment duration of six months (Johnston et al 2007) or 12 months (Savoye et al 2007), compared the lifestyle intervention to usual care (Savoye et al 2007) or a no-treatment/information-only control (Johnston et al 2007), and followed up for six months (Johnston et al 2007) or 12 months (Savoye et al 12 months). The lifestyle intervention delayed weight gain, but the weighted mean difference (WMD) was not statistically significant (WMD -2.0 kg/m^2, 95%CI -4.5 kg/m^2 to 0.4 kg/m^2, I^2 = 96%, n = 245, random effects).

Reducing sedentary activity

Three trials assessed the impact of reducing sedentary activity. Sedentary activity was defined as watching television or videotapes, playing computer games, talking on the telephone, or playing board games (Epstein et al 1995, Epstein et al 2000, Epstein et al 2008). All three trials excluded from their interventions sedentary activities being undertaken for academic or school purposes.

Epstein et al (1995) combined interventions with dietary and behavioural strategies in families with children aged 8–12 years and recruited 61 participants. They found reducing sedentary activity alone reduced the percentage overweight at 12 months by 19% compared with a 9% reduction when physical activity alone was increased and a 10% reduction when both sedentary activity and physical activity were managed. However, the trial was very low quality. Epstein et al (2000) explored the effect of increasing physical activity compared with reducing sedentary activity on the percentage overweight at six months and 24 months when combined with dietary change and behavioural strategies in families with children aged 8–12 years. They recruited 100 participants. Neither strategy was more effective, with decreasing sedentary activity or increasing physical activity reducing the percentage overweight at six months by an average of 26% and 25% respectively. Reductions were an average of 13% in both approaches at 24 months.

Epstein et al (2008) recruited 80 participants and compared the effect of reducing screen time (television- and computer-based) using automated monitoring devices to freely available screen time in families with children aged 4–7 years with weight in the 75th percentile or higher. They found a significant decrease in BMI *z*-score at 24 months (-0.24 compared with -0.13, $p < 0.05$).

Family/whānau involvement

All but one of the above trials involved families in the intervention (Johnston et al 2007). However, one trial also explored whether involving the child in education sessions was necessary (Golan et al 2006). Golan et al (2006) recruited families with children aged 6–11 years, and allocated families to a lifestyle approach that involved both parents and children in the lifestyle sessions compared with an approach that involved just the parents in lifestyle training. They recruited 37 children. The lifestyle programme emphasised healthy eating patterns (decreased exposure to obesogenic foods, designated family meal times, at least one family meal per day, and allocating individual portions), encouraged an increase in physical activity (the goal was 4 hours per week) and a decrease in sedentary behaviours (less than 3 hours per day). Parents were also trained in parenting skills and behavioural strategies. The trial found a significant effect at 12 months in favour of the parent-only group for both BMI z-score (mean difference -0.3, $p < 0.05$) and reduction in the percentage overweight (mean difference -7.1%, $p < 0.05$).

Evidence for Māori, Pacific, and South Asian population groups

No trials were conducted with Māori, Pacific, or South Asian children or young people.

Two trials recruited from minority populations in the US (Johnston et al 2007, White et al 2004, Williamson et al 2005). However, it is not appropriate to directly extrapolate this evidence to priority population groups in New Zealand.

Evidence statements

Lifestyle approaches involving family members (dietary change, exercise, +/- behavioural interventions) may decrease weight in children and young people

Quality of evidence	Low to high
Study limitations	Important limitations*
Inconsistency	Considerable inconsistency‡
Directness	Direct
Precision	Imprecision probable

* Individual methods for trials not reported in Wilfley (2007), but studies reported to be of poor quality. Seven additional trials were of low (1), moderate (5), and high quality (1).

‡ No significant heterogeneity was reported in Wilfley (2007), but heterogeneity was not tested for the trials with six months or longer follow-up. No significant statistical heterogeneity present in four new trials included in meta-analysis of those reporting BMI z-scores or BMI SDS. There was statistically significant heterogeneity in the meta-analysis of trials reporting BMI.

Decreasing sedentary activity leads to similar reductions in percentage overweight compared to increasing physical activity

Quality of evidence	Moderate
Study limitations	Some limitations*
Inconsistency	Not applicable (single RCT)†
Directness	Direct
Precision	Imprecision probable‡

* Detail regarding randomisation and allocation concealment missing, but used intention to treat analysis with baseline value carried forward for loss. Imbalance on prognostic variables at baseline.

† RCT = randomised controlled trial.

‡ N = 100, *a priori* sample size calculation absent.

Targeting parents/caregivers alone in lifestyle-change training may be more effective than including the child at producing reductions in weight gain in children (aged 6-11 years) at 12 months

Quality of evidence	Moderate
Study limitations	Minor limitations*
Inconsistency	Not applicable (single RCT)
Directness	Direct
Precision	Imprecision probable‡

* Detail regarding randomisation method not reported, but allocation concealed, loss to follow-up small, intention to treat analysis (baseline carried forward), and outcome assessment blinded.

† RCT = randomised controlled trial.

‡ N = 37, *a priori* sample size calculation, but underpowered to detect observed difference.

Dietary Intervention

Dietary interventions used in isolation aim to create an energy deficit, whereby energy intake is less than energy expenditure. For children and young people, energy restriction should be moderate and the diet should be nutritionally balanced to ensure the maintenance of growth and development.

Recommendation

Dietary change alone is an inappropriate strategy for weight management in children and young people.

Strength of recommendation: Strong

Evidence for dietary approaches

Evidence about the effectiveness of diet for weight management in overweight and obese children and young people was obtained from four trials (Rolland-Cachera et al 2004, Ebbeling et al 2003, Figueroa-Colon et al 1993, Amador et al 1990). All trials were of low or very low quality, with inadequate reporting of methods, high and/or differential loss to follow-up, and analysis only of those who completed the study (completers) or small sample sizes (less than 20 participants).

It was not possible to compare particular dietary strategies because all trials tested different diets and most did not control for energy intake between the diet treatment groups. All diets decreased weight outcomes to some extent in one or both diet treatment groups. As would be expected, diets with the greatest energy restriction elicited the greatest weight loss in the short term, but weight gain generally occurred once the treatment period ended. However, weight regain in children and youth can be difficult to interpret given that growth is still occurring.

Rolland-Cachera et al (2004) compared two reduced-energy diets (1750 kcal) containing different amounts of protein (15% compared with 19% of total energy) and carbohydrate (54% compared with 50%) in 121 obese adolescents. Participants resided in a medical centre (also a boarding school) and had most food provided. diets were followed for an average of 9.3 months (until the ideal body weight was reached), after which energy intake was gradually increased to 2200 kcal over four weeks. Both diets decreased mean BMI z-score at the end of treatment (-2.6 and -2.5) and 24 months after the end of treatment (-1.4 and -1.3). Outcomes between groups were not significantly different, suggesting the slightly higher protein diet did not confer any additional benefit.

Figueroa-Colon et al (1993) compared a protein-sparing modified fast (1.5–2.0 g protein per kilogram of ideal body weight, 2520–3360 kJ) and a hypoenergetic balanced diet (3360–4200 kJ) in 19 overweight children. After 10 weeks both groups were placed on a 4200 kJ balanced diet, with energy intake increased over three months to 5040 kJ and maintained for one year. At six months, the protein-sparing modified fast was more effective than a low-energy balanced diet (BMI -5.6 kg/m^2 compared with -3.0 kg/m^2, $p < 0.05$), but both diets were similar in effect at 14.5 months (-3.0 kg/m^2 compared with -2.5 kg/m^2).

Ebbeling et al (2003) compared a six-month *ad libitum* reduced glycaemic load diet (45–50% energy from carbohydrate, 30–35% fat) with an energy-restricted (250–500 kcal) reduced-fat diet (55–60% energy from carbohydrate, 25–30% fat) in 16 obese adolescents. At 12 months there was a significant decrease in BMI (-1.3 kg/m^2) and fat mass (-3.0 kg) on the *ad libitum* (freely available) low glycaemic load diet, but no significant change in either outcome on the reduced-fat diet (0.7 kg/m^2 and 1.8 kg, respectively). Although unintended, energy intake decreased more on the *ad libitum* low glycaemic load diet, thus explaining the greater weight loss in this group.

Amador et al (1990) compared a six-month non-restrictive and energy-restricted diet (0.25 MJ/kg compared with 0.17 MJ/kg of expected body weight for height) in 94 overweight children. At 12 months, the energy-restricted diet had resulted in a greater weight loss than the non-restrictive diet in girls (-5.54 compared with -3.19 kg, $p < 0.01$) and boys (-8.11 compared with -2.16 kg, $p < 0.01$), and a greater body fat loss in girls (-8.39 compared with -6.24 kg, $p < 0.01$), but not boys (-6.89 compared with -8.73 kg, non-significant).

Evidence for Māori, Pacific, and South Asian population groups

No trials were conducted with Māori, Pacific, or South Asian children or young people.

No trials were conducted with minority populations.

Evidence statements

There is an absence of evidence about the effectiveness of any particular dietary strategy for weight loss or weight maintenance in children and young people.

Quality of evidence	**Very low**
Study limitations*	Serious limitations
Inconsistency	Not applicable
Directness	Direct
Precision	Imprecision likely‡

* Inadequate reporting of methods (randomisation and allocation concealment) in all studies. High (more than 40%) or differential loss to follow-up in two studies, intention to treat analysis in only one study. Small sample size (less than 20) in two studies.

‡ No study provided estimates of 95% confidence intervals. Not possible to incorporate studies into meta-analysis.

Physical Activity and Exercise

Physical activity is any body movement produced by skeletal muscles that expends energy. This broad definition involves virtually all types of activity (eg, walking, kapa haka, cycling, dance, traditional games, waka ama, lawn mowing, housework, sports, and exercise. Intentional Exercise is planned, structured, and repetitive activity. The terms exercise and physical activity are often used interchangeably. The following recommendations are based on evidence that assessed primarily exercise interventions, although the good practice points incorporate the broader definition of physical activity.

Combining exercise with diet may decrease BMI and overweight. Higher dose exercise was associated with greater weight loss in comparison to low-dose exercise. Exercise is an important component of weight-loss programmes, but should be used in combination with other strategies.

Recommendation

Exercise is included in weight-loss strategies in combination with dietary changes and behavioural support.

Strength of recommendation: Strong

Good practice points

For more information, see the lifestyle section on page 24.

- Be aware of and refer to the community options for Māori, Pacific, and South Asian populations interested in healthy lifestyles (eg, marae-based, healthy hapū programmes and church-based or local community group options).
- Use information resources prepared for Māori, Pacific, and South Asian family/whānau interested in physical activity (in the person's preferred language, if possible).
- Refer the family/whānau to existing physical activity programmes (such as the Green Prescription Active Families programme).

Definition of physical activity and the amount required

Physical activity is any body movement produced by skeletal muscles that expends energy. This broad definition involves virtually all types of activity, including:

- sport and recreation.
- active transport (eg, walking to school).
- incidental activity (eg, walking to do errands).
- exercise (physical activity that is planned, structured, and repetitive).

In common usage physical activity and exercise are used interchangeably. Physical activity is conventionally described by the four dimensions:

- type (eg, aerobic, muscle-strengthening, and bone-strengthening)
- frequency (number of times)
- duration (amount of time)
- intensity (eg, light, moderate, or vigorous).

Aerobic physical activity is activity in which the body's large muscles move in a rhythmic manner for a sustained period. Aerobic activity, also called endurance activity, improves cardiorespiratory fitness. Examples of aerobic activity are kapa haka, walking, running, swimming, and bicycling. Muscle-strengthening activity (eg, strength training, resistance training, and muscular strength and endurance exercises) is physical activity that increases skeletal muscle strength, power, endurance, and mass. Bone-strengthening activities are those that promote bone growth and strength.

In this guideline the goal of physical activity is to increase the child or young person's energy expenditure and their resting metabolic rate to achieve weight loss. To obtain health benefits, the *New Zealand physical activity guidelines for children and young people* recommend that throughout each day children and young people do at least 60 minutes of moderate-intensity to vigorous aerobic physical activity (www.sparc.org.nz/getting-active/activity-guidelines). The physical activity guidelines also recommend that children and young people spend less than two hours per day out of school time in front of televisions, computers, and game consoles. The CDC's 2008 *Physical Activity Guidelines for Americans* recommended that as part of the 60 minutes, children and young people should include muscle-strengthening and bone-strengthening physical activity on at least three days of the week (www.cdc.gov/physicalactivity/everyone/guidelines/index.html).

Physical activities that contribute to the physical activity guidelines

Children and young people can meet the physical activity guidelines by doing activity that is appropriate for their age. Examples of such activities are in Table 7.

Aerobic activity

Moderate-intensity to vigorous physical activities in sport and recreation, active transport, and exercise can contribute to children and young people meeting the physical activity guidelines to obtain health benefits.

Muscle-strengthening activities

Muscle-strengthening activities use the resistance to muscular contraction to build the strength, anaerobic endurance, and size of skeletal muscles. When properly performed, muscle-strengthening activities provide benefits not obtained with aerobic activity. These benefits include increased bone, muscle, tendon, and ligament strength and toughness; improved joint function; reduced potential for injury; increased bone density; and improved cardiac function.

Children and young people participate in muscle-strengthening activities in unstructured activities that involve lifting or moving their body weight or working against resistance. Children do not usually need formal muscle-strengthening programmes, such as weight lifting programmes. Young people, however, may start structured resistance or strength training (and circuit training) as part of sports programmes or generally to increase their strength.

The Council on Sports Medicine and Fitness (2008) issued a policy statement about muscle-strength training in preadolescents and adolescents. The statement highlighted two points.

- Proper resistance techniques and safety precautions should be followed so strength-training programmes for preadolescents and adolescents are safe and effective. Before a young person starts a strength-training programme, determine whether it is necessary or appropriate for them to do so and the level of proficiency they have already attained through their sporting activity.
- Preadolescents and adolescents should avoid power lifting, body building, and maximal lifts until they reach physical and skeletal maturity.

Fitness New Zealand's Guidelines for Children in Exercise Facilities 2009 (in press) should also be consulted. Remember too that muscle-strengthening activities may result in an initial weight gain as muscles increase in size.

Bone-strengthening activities

Bone-strengthening activities produce a force on the bone that promotes bone growth and strength. This force is produced most commonly by impact with the ground. These activities can also be aerobic and muscle-strengthening activities.

Table 7: Activities to help children and young people meet the physical activity guidelines

Type of activities	Children activities	Young people activities
Moderate-intensity aerobic	Roller blading, skateboarding Brisk walking Bicycle riding Dancing Kapa haka	Roller blading, skateboarding Brisk walking Bicycle riding Housework and yard work Games that require catching and throwing (eg, softball) Dancing Kapa haka
Vigorous aerobic	Active games such as running and chasing (eg, tag) Bouncing on a trampoline Bicycle riding Waka ama Skipping Martial arts, such as karate Running Sports such as soccer, rugby, touch rugby, swimming Vigorous dancing	Active games such as ultimate Frisbee Bicycle riding Skipping Martial arts, such as karate Running Waka ama Sports such as soccer, rugby, touch rugby, swimming Vigorous dancing
Muscle-strengthening	Games such as tug-of-war Modified push-ups Resistance exercises using body weight or resistance bands Rope or tree climbing Sit-ups Swinging on playground equipment/bars	Games such as tug-of-war Push-ups and pull-ups Resistance exercises with exercise bands, weight machines, hand-held weights Climbing wall Sit-ups
Bone-strengthening	Games such as hopscotch Hopping, jumping, skipping Bouncing on a trampoline Skipping Running Sports such as gymnastics, basketball, volleyball	Hopping, jumping, skipping Bouncing on a trampoline Skipping Running Sports such as gymnastics, basketball, volleyball

Note: Activities such as bicycling can be moderate or vigorous depending on the effort level.

Evidence for physical activity and exercise

Evidence about the effectiveness of exercise interventions was obtained from one systematic review (Atlantis et al 2006), three trials conducted since the NICE guideline was completed (Jelalian et al 2006, Meyer et al 2006, Weintraub et al 2008), and two trials extracted from the UK guideline (Carrel et al 2005, Epstein et al 1985a).

Atlantis et al (2006) identified 14 studies (n = 481; 1965–2004), although only two studies investigated treatment effects beyond the intervention phase. The average age of participants was 10.9 years (standard deviation 1.5 years). All studies were of supervised exercise, with only one in a clinical laboratory setting.

Of the three exercise trials (n = 165) identified since the NICE guideline was completed, Weintraub et al (2008) investigated exercise compared with non-treatment control (mean age 9.5 years), Meyer et al (2006) investigated exercise and diet compared with diet alone (mean age 14.2 years), and Jelalian et al (2006) investigated adventure therapy and behavioural therapy compared with aerobic exercise and behavioural therapy (age range 13–16). The two trials (n = 276) extracted from NICE guideline assessed exercise compared with non-treatment controls (Carrel et al 2005) and exercise and diet compared with diet (Epstein et al 1985a). The mean age of participants in the study by Carrel et al was 12.5 years, and the age range of girls in Epstein et al's study was 8–12 years. All of the trials had a minimum follow-up period of six months. Sample sizes ranged from 21 to 67.

Generally, all trials in Atlantis et al (2006) were small and of a low quality. The pooled standardised mean difference (SMD) significantly favoured exercise for percentage reduction in body fat (SMD -0.4, 95%CI, -0.7 to -0.1, p = 0.006). The differences were not significant for central obesity outcomes (SMD -0.2, 95%CI -0.6 to 0.1, p = 0.07) or weight change (WMD -2.7 kg, 95%CI -6.1 kg to 0.8 kg, p = 0.07), although these differences were borderline non-significant and the direction of effect favoured exercise. The combined effects on body weight were significant and larger for studies of higher doses of exercise (155–180 minutes per week compared with 120–150 minutes per week).

BMI change in the two trials that compared exercise with no treatment ranged from -0.01 kg/m^2 to -3 kg/m^2 at six months minimum (Carrel et al 2005, Weintraub et al 2008). Meyer et al (2006) compared exercise and diet to diet alone and found a BMI change of 2.9 kg/m^2 at six months, favouring the exercise and diet condition. Epstein et al (1985) found the addition of exercise to a dietary strategy reduced the percentage overweight by 8.7% at six months ($p < 0.05$) and 6.7% at 12 months ($p > 0.05$). Jelalian et al (2006) found cognitive behavioural therapy and adventure therapy resulted in greater weight loss (-3.4 kg) than cognitive behavioural therapy and aerobic exercise.

Evidence for Māori, Pacific, and South Asian population groups

No trials were conducted with Māori, Pacific, or South Asian children or young people.

No trials were conducted with minority populations.

Evidence statements

Including exercise with dietary changes may decrease BMI and body weight

Quality of evidence	Low
Study limitations	Serious limitations*
Inconsistency	No important inconsistency
Directness	Direct
Precision	Some imprecision

Randomisation stated but method not described. Allocation concealment not reported, no intention to treat analysis.

More frequent exercise increases weight loss than less frequent exercise

Quality of evidence	High
Study limitations	Serious limitations*
Inconsistency	No important inconsistency
Directness	Direct
Precision	Some imprecision

No studies reported blinding the participant's group assignment during data collection. Randomisation protocols clearly described in only four studies. Only six studies analysed post-test data on all participants randomised (eight studies analysed completers only), but no study stated data analysed by the intention to treat principle.

Behavioural Strategies

Behavioural strategies reinforce changes in lifestyle, particularly diet and physical activity. Behavioural support decreases excess weight (weight above the norm for age and sex) by 8–15% at 12–15 months. Family-based strategies decrease excess weight by about 12% at two to three years and about 9% at seven years compared with programmes focused on the individual child or young person.

Recommendation

Family-based behavioural strategies are included in weight-loss strategies for children and young people.

Strength of recommendation: Strong

Good practice points

For more information, see the lifestyle section on page 24.

- Note that parents/caregivers and family/whānau may be better agents of change than children.
- Recruit the child or young person's family/whānau into supporting the strategies (with the young person's consent).
- Be aware of and refer to local community options, especially for Māori, Pacific, and South Asian populations interested in healthy lifestyles (eg, marae-based healthy hapū programmes and church-based or local community group options).

Types of behavioural strategies

Behavioural strategies draw on the principles of learning theory. The goal of behavioural strategies is to alter eating and physical activity behaviours. Unless the child or young person acquires new eating and physical activity habits, they will be unlikely to maintain weight loss over the long term.

The trials included in this guideline do not clearly outline the behavioural strategies involved. Similarly, it is not possible to distinguish the exact age-specific elements of the interventions for children or young people. However, behavioural strategies generally involve forms of self-monitoring, goal-setting, contracting, and skills provision for high-risk situations, although the interventions will be age-dependent. For instance, the extent of self-monitoring would vary depending on the age and competency of the child or young person.

Children's eating and physical activity behaviours are largely dependent on their parents/caregivers, who are in a position to exert considerable influence and control over what is eaten and where, the time spent on sedentary activities, and the amount of physical activity through play. Adolescents are more independent of the family environment and need to learn skills to make healthy choices. Behavioural interventions are relevant to both age groups, but the tools and level of involvement need to be adapted to the child or young person's maturity.

The process behind behavioural strategies involves identifying and specifying problem behaviours and the circumstances under which they occur. Specific, measurable, modest goals are then established with the participant and revised as progress is made. Target behaviours are monitored, usually by the child or young person and their parents/caregivers, to record behavioural change. Rewards are achieved for reaching targeted changes.

Five key behavioural tools are:

- self-monitoring
- stimulus control
- problem solving
- contingency management or contracting
- cognitive restructuring.

Self-monitoring

Self-monitoring involves a child or young person or their parents/caregivers recording the child or young person's food intake and physical activity. Self-monitoring is a key step in behavioural approaches because it leads to the child or young person and their parents/caregivers gaining increased awareness of patterns that they can then adjust. Records need to be kept about at least the amount and types of food the child or young person eats.

Stimulus control

Stimulus control helps to modify a person's eating and physical activity behaviours, by helping them to limit their exposure to high-risk situations.

Problem solving

Problem-solving skills involve a person correcting difficult areas related to their eating and physical activity. Approaches to problem solving include identifying weight-related problems, and then generating or brainstorming possible solutions and choosing one solution. Problem solving involves identifying, planning, and implementing the healthier alternative, and then evaluating the outcome of possible changes in behaviour. Setbacks in behavioural change should be viewed as opportunities to learn (eg, by asking, 'What was learnt from this attempt?').

Contingency management or contracting

Contingency management or contracting involves the planned use of rewards for specific activities that are positive for weight loss or weight maintenance. Rewards can come from parents/caregivers or from the child or young person. Rewards may be for increased time spent doing physical activity or engaging in other healthy behaviours.

It is worth noting that a recent review on monetary incentives for weight loss found no effect for such incentives, so rewards should be intrinsically valuable to the person attempting to lose weight (Paul-Ebhohimhen and Avenell 2008). Examples of rewards are family/whānau time, going to a movie, getting a CD or DVD or getting a few music downloads.

Cognitive restructuring

Unrealistic goals and inaccurate beliefs about weight loss and body image need to be managed to help change self-defeating thoughts and feelings that undermine weight-loss efforts. Rational responses to replace negative thoughts are encouraged. For example, the thought, "I blew my diet by eating a pie this morning; I may as well eat what I like for the rest of the day", could be replaced by a more adaptive thought such as, "Well, I ate that pie this morning, but I can still eat in a healthy manner at lunch and dinner".

Evidence for behavioural strategies

Evidence about the effectiveness of behavioural strategies compared with usual care or no intervention was obtained from one trial extracted from the UK guideline (Epstein et al 1985b). The trial included 24 girls aged 5–8 years with follow-up at 12 months. The trial was of a very low quality: the method of randomisation and allocation concealment was not reported, data were reported for completers only, and loss to follow-up was higher in the intervention group than in the control group. The evidence favoured behavioural strategies with mean difference in the percentage overweight[1] being -15% at 12 months and mean difference in BMI of -3.4 kg/m^2.

Evidence comparing cognitive behavioural therapy to behavioural strategies was obtained from one trial extracted from the UK guideline. The trial involved children aged 7–13 years (Duffy and Spence 1993). The evidence was from the six-month follow-up and was of a very low quality with inadequate reporting of methods (randomisation, allocation concealment), a large loss to follow-up, and data reported for completers only (63%). There was no significant difference in the percentage overweight at six months between children treated with cognitive behavioural therapy and behavioural strategies and children treated with just behavioural strategies.

Evidence comparing family-based behavioural strategies with child-focused behavioural strategies was obtained from four trials extracted from the NICE guideline (Golan et al 1998, Israel et al 1985, Israel et al 1994, Wadden et al 1990).

[1] Defined as 100 x (actual weight – normal weight)/normal weight), where normal weight is defined as the average weight for individuals of a particular age, gender, and height.

Israel et al (1985) did not report the age of the children studied. Golan et al (1998) recruited children aged 6–11 years. Israel et al (1994) recruited children aged 8–13 years. Wadden et al (1990) recruited African American adolescent girls. The trial reports were all of low to very low quality with inadequate reporting of methods in all trials (randomisation, allocation concealment) and data presented for only completers in three trials. Three studies found an effect in favour of family-centred approaches (Israel et al 1985, Israel et al 1994, Golan et al 2004), with a mean difference in the percentage overweight ranging from -8% to -13% at the one-year follow-up. Two studies reported longer-term data in favour of the family intervention: Israel et al (1994) found a mean difference in the percentage overweight of -12% at three years; Golan et al (2004) found a mean difference in the percentage overweight of -13% at two years and -9% at seven years. However, Wadden et al (1990) found no significant difference in mean difference in weight loss between a mother-daughter treated group and a daughter-only group at six months, although the point estimate favoured the family approach. It was not possible to incorporate these data into a meta-analysis as either the outcome measures differed, and where the outcome measures were the same, the standard error or standard deviations for the mean differences were not published.

Evidence for Māori, Pacific, and South Asian population groups

No trials were conducted with Māori, Pacific, or South Asian children or young people.

One trial recruited minority group participants (Wadden et al 1990), but it is not possible to directly extrapolate from this evidence to the priority population groups in New Zealand.

Evidence statements

Behavioural strategies decrease excess body weight at 12 months

Quality of evidence	**Very low**
Study limitations	Serious limitations*
Inconsistency	No important inconsistency
Directness	Direct
Precision	Imprecision likely‡

* Unclear allocation concealment in all studies, more than 20% loss to follow-up in one study, no study used intention to treat analysis, and two studies presented data only for participants who completed the study.

‡ Sample calculation not provided, and sample size highly likely to be too small to detect anything but a very large effect.

Cognitive behavioural therapy added to behavioural strategies does not increase weight loss

Quality of evidence	Very low
Study limitations*	Serious limitations*
Inconsistency	No important inconsistency
Directness	Direct
Precision	Imprecision likely‡

* Unclear allocation concealment, more than 20% loss to follow-up, not analysed using intention to treat, and data presented only for participants who completed the study.

‡ Sample calculation not provided and sample size highly likely to be too small to detect anything but a very large effect.

Family-based behavioural strategies decrease excess body weight by 8–13% at one year, 12–13% at two to three years, and by 9% at seven years

Quality of evidence	Very low
Study limitations*	Serious limitations*
Inconsistency	No important inconsistency
Directness	Direct
Precision	Imprecision likely‡

* Unclear allocation concealment in all studies, more than 20% loss to follow-up in all studies, not analysed using intention to treat in all studies.

‡ No study provided estimates of 95% confidence intervals. Not possible to incorporate studies into meta-analysis.

Pharmacotherapies (Weight-Loss Drugs)

No weight loss drugs are registered for use with children and young people in New Zealand. However, clinical trials have been conducted on orlistat (Xenical) and sibutramine (Reductil) in people aged 12 years or over in supervised weight control programmes using lifestyle modification. A weight loss of 2.5–6 kg could be expected over six months, with the addition of anti-obesity drugs to lifestyle modification. There have been no trials of either drug in children aged under 12 years.

Weight-loss drugs are not subsidised, are generally expensive, and have adverse effects.

Recommendation

Orlistat or sibutramine may be considered in addition to lifestyle modification to aid weight control in obese young people (BMI ≥ 95th percentile), but **only** if a programme of lifestyle change has failed to control weight gain and specialist services experienced in the use of anti-obesity drugs supervise the drug use.

Strength of recommendation: Weak

Good practice points

If considering weight loss drugs:

- pharmacotherapies should not be used in with children aged under 12 years. In New Zealand, orlistat is precautioned in people aged under 18 and sibutramine is contraindicated in people aged under 18 years
- provide information in the family/whānau's preferred language, if possible
- remember that concurrent lifestyle changes to diet and exercise are necessary to assist with weight maintenance once medication use ceases
- use orlistat only in conjunction with a low-fat diet. When prescribing orlistat, consider a daily multivitamin supplement
- do not prescribe sibutramine unless there are adequate arrangements for monitoring adverse effects (specifically pulse and blood pressure)
- trial a weight-loss drug for 6–12 months, with regular reviews to assess effectiveness, adverse effects, and adherence
- continue to provide support to the person to maintain weight loss when withdrawing drug treatment for weight loss.

Types of weight-loss drugs

Weight loss drugs can be used in conjunction with diet and exercise to reduce weight. Orlistat and sibutramine have different modes of effect.

- Orlistat is a gastrointestinal lipase inhibitor. It binds with lipase in the stomach or small intestine, and thereby prevents dietary fat from being broken down and digested.

- Sibutramine is a serotonin and noradrenaline reuptake inhibitor. By inhibiting reuptake more serotonin and noradrenalin are available to act on receptors, thereby increasing satiety and increasing energy expenditure.

Evidence for weight-loss drugs

Evidence about the effectiveness of orlistat and sibutramine was obtained from seven trials (Berkowitz et al 2003, Berkowitz et al 2006, Chanoine et al 2005, Garcia-Morales et al 2006, Godoy-Matos et al 2005, Maahs et al 2006, Van Mil et al 2007). All studies were conducted in people aged 12–19 years.

Orlistat

Two trials were conducted on orlistat (Chanoine et al 2005, Maahs et al 2006).

Chanoine et al (2005) recruited 533 participants, but Maahs et al (2006) recruited just 40 participants. Both trials used strong allocation concealment and blinding, but had limitations due to incomplete follow-up. In Chanoine et al (2005), 34% of participants withdrew from treatment (similar numbers in both groups). In Maahs et al (2006), 15% of participants withdrew and were excluded from the analysis. The impact of participant withdrawal or exclusion of participants from analysis is to underestimate regain and overestimate the precision of treatment effects.

Participants in both studies were adolescents in secondary and tertiary hospital clinics with programmes for treating overweight children. In Chanoine et al (2005) 24% of participants were Black or non-European, and in Maahs et al (2006) 63% of participants were Hispanic. Very obese children were excluded from Chanione et al (2005).

The trials could not be combined in a meta-analysis because Chanoine et al (2005) did not publish standard errors or standard deviations. The direction of effect was determined by using the findings of the larger trial. Chanoine et al (2005) found a significant effect in favour of orlistat (-0.86 kg/m^2, $p < 0.001$). Maahs et al (2006) found no significant effect, although the orlistat-treated group lost slightly more weight on average (-1.3 kg/m^2 compared with -0.8 kg/m^2, $p = 0.4$). Overall, it appears orlistat may increase weight loss by about 2.5 kg over six months in overweight and obese children aged 12 years or over enrolled in organised weight-loss services.

Withdrawals as a result of adverse events were higher in orlistat-treated patients in both trials (3.4% compared with 1.7% (Chanoine et al 2005); 15% compared with 0% (Maahs et al 2006)). The most common adverse event was gastrointestinal, mainly fatty/oily stool or evacuation, oily spotting, increased defecation, or cramps and abdominal pain.

Sibutramine

Five trials with 714 participants assessed the effectiveness of sibutramine in young people (Berkowitz et al 2003, Berkowitz et al 2006, Garcia-Morales et al 2006, Godoy-Matos et al 2005, Van Mil et al 2007). Sample sizes in the five trials ranged from 24 participants (Van Mil et al 2007) to 498 participants (Berkowitz et al 2006). The drop-out rate ranged from 12% (Berkowitz et al 2003) to 28% (Berkowitz et al 2006). Three studies adequately reported methodologies. Participants were not comparable at baseline in two studies. In Van Mil et al (2007) the control group was 9 kg heavier whereas in Garcia Morales et al (2006) there were some differences in sex and weight. A variety of methods were used to account for missing data, including baseline carried forward, last observation carried forward, a linear mixed effects model, and missing values imputed using ANOVA. All the trials were based in obesity clinics or research centres.

Three trials were combined to determine the effect of sibutramine on BMI (Berkowitz et al 2006, Garcia-Morales et al 2006, Godoy-Matos et al 2005). Sibutramine decreased BMI by 2.38 kg/m^2 (95%CI -3.23 kg/m^2 to -1.53 kg/m^2) at 6–12 months. Van Mil et al (2007) and Berkowitz et al (2003) could not be included in this analysis. Van Mil et al (2007) found no significant difference between the sibutramine-treated and the control groups. However, sibutramine was withdrawn after 12 weeks and the participants had regained the initial weight loss by 24 weeks. Berkowitz et al (2003) found a mean difference in percentage change in BMI that favoured sibutramine (-4.5% BMI change, $p < 0.001$).

The combination of four trials into a meta-analysis to determine the effect of sibutramine on body weight showed a 5.96 kg (95%CI 3.11–8.80 kg) increase in weight loss associated with sibutramine at 6–12 months (Berkowitz et al 2003, Berkowitz et al 2006, Garcia-Morales et al 2006, Godoy-Matos et al 2005). Van Mil et al (2007) could not be included in this analysis, but found no significant difference between the sibutramine-treated and control groups. Overall, weight loss ranged from -0.8 kg at 12 weeks (Van Mil et al 2007) to -8.4 kg at 12 months (Berkowitz et al 2006).

Two studies reported no withdrawals due to adverse events (Garcia-Morales et al 2006, Godoy-Matos et al 2005). In one study withdrawals due to cardiovascular effects was higher in the sibutramine group than in the other group (Berkowitz et al 2003, 4.7% compared with 0%), but this was only two participants. However, 19 participants had a dose reduction in sibutramine due to increased blood pressure or pulse. In Berkowitz et al (2006) the withdrawal rates were similar in both the sibutramine and placebo groups (5.7% compared with 5.4%). In this study there were also two suicides, one in each group, and depression rates were similar in both groups (1.4% compared with 0.8%). In a third study, one participant (8.3%) in the sibutramine group withdrew due to adverse events (depression) and none withdrew from the control group. All the above studies also reported on cardiovascular variables, with greater decreases in systolic and diastolic blood pressure and pulse seen in the placebo groups. Non-cardiovascular events were also more frequent in the sibutramine group, with common events being dry mouth, dizziness, rash, constipation, and abdominal pain.

Evidence for Māori, Pacific, and South Asian population groups

No trials were conducted in Māori, Pacific, or South Asian populations.

No trials appear to have been conducted with indigenous or minority populations. Three trials conducted in the US recruited Hispanic American and African American participants (Berkowitz et al 2006, Chanoine et al 2005, Maahs et al 2006), but subgroup analyses were not presented for these groups.

Evidence statements

In young people aged 12–19 years, orlistat or sibutramine in combination with an energy-restricted diet and increased activity is effective in producing weight loss at six months

Quality of evidence	Low to moderate
Study limitations	Serious limitations*
Inconsistency	No important inconsistency
Directness	Indirect
Precision	Some imprecision‡

* Unclear methods of randomisation and allocation concealment in two studies. Five studies did not report true intention to treat analyses. The drop-out rate was 12–35%.

‡ Large standard deviations in two studies. Non-significant findings in two studies.

Surgery

Bariatric surgery is not usually appropriate in young people. It may be considered if the young person is physiologically mature, is very obese, and is committed to lifestyle change and all other measures have been tried and failed. Bariatric surgery is substantially more effective than non-surgical interventions in achieving weight loss among obese patients, but still requires lifestyle change. Unfortunately, robust data relating to children and adolescents are limited. Most evidence comes from studies on obese adult populations where weight loss may reach 40–50 kg at one year post-surgery. There is also evidence of improvements in major co-morbidities such as blood pressure, lipid levels, and diabetes, and also other conditions such as obstructive sleep apnoea and gastro-oesophageal reflux.

Recommendation

Surgical intervention is not generally recommended, but may be considered for young people in exceptional circumstances.

Strength of recommendation: Strong

Good practice points

- Consider referring a young person for surgery, if:
  - the young person has achieved or nearly achieved physiological maturity (consider whether pubertal development is complete and whether adult or near-adult height has been attained)
  - the young person has a BMI of 50 kg/m^2 or more or a BMI of 40 kg/m^2 or more and other significant disease that persist despite significant lifestyle intervention (with or without drugs)
  - the young person and their family/whānau demonstrate an ability to adhere to healthy dietary and physical activity habits
  - a psychological evaluation is likely to confirm the stability and competence of the young person's family/whānau.
- Refer the young person to an experienced surgeon who is working in a facility capable of the long-term follow-up of the metabolic and psychosocial needs of the young person and their family/whānau.
- The choice of appropriate bariatric procedure on surgical preferences and the young person's and their family/whānau's preferences.
- Ensure a young person who has bariatric surgery will gets life-long nutritional monitoring.
- Do not recommend bariatric surgery for a young person:
  - who is planning on becoming pregnant within two years of surgery
  - who has not mastered the principles of healthy dietary and physical activity habits
  - with an unresolved eating disorder, an untreated psychiatric disorder, or Prader-Willi syndrome.

Types of surgery

Bariatric procedures available in New Zealand include gastric banding, sleeve gastrectomy, and Roux-en-Y gastric bypass.

Adjustable gastric banding places an adjustable band around the person's upper stomach to create a pouch with 15–30 ml capacity. Saline in the band can be increased or decreased through a port under the skin of the abdomen. The added volume of the band suppresses the person's appetite, but intermittent refilling is required to maintain that feeling. Adjustable gastric banding can be reversed.

A sleeve gastrectomy removes the outer three-quarters of the person's stomach and turns the stomach into a long gastric tube or 'sleeve'. A sleeve gastrectomy cannot be reversed.

A Roux-en-Y gastric bypass involves changes to the person's stomach and small bowel. The operation creates a small pouch in the stomach with a narrow outlet. Although the pouch's capacity can vary, it is usually about 30 mls. A bypass of the small bowel is also created to reduce the absorption of food.

All three operations are usually performed by laparoscopy. The operations remove a person's excess appetite or urge to eat and will limit the volume they able to eat.

Perioperative death after bariatric surgery is very low in adults but rates vary by procedure. Wound infections are one of the most common complications. Complications such as bowel leakage, bleeding, stenosis, ulcers, and other infections may occur (Stephenson and Hogan 2007, Brethauer et al 2006). With gastric bypasses, nutritional deficiencies may occur in the long term, in particular deficiencies of vitamin B12, folate, and iron. People who have this surgery must have long-term monitoring.

Evidence for bariatric surgery

There were no good quality data on bariatric surgery in children and young people. No randomised controlled trials were found among the literature, so expanded inclusion criteria had to be used for this review. No control-matched cohort studies were located, and the remaining evidence consisted of predominantly small,-low quality case series. No case series was located with a sample size over 100 participants, so the threshold was lowered to case series or case studies that included 20 or more participants. Smaller studies were excluded, because of low power and the increased likelihood of biased results, and because the results could be affected by the 'learning curve' associated with surgical procedures.

Five case series were included in the review (Anderson et al 1980, Angrisani et al 2005, Rand and Macgregor 1994, Soper et al 1975, Nadler et al 2008). Three studies, all conducted in the US, were case series of gastric bypass procedures on adolescents. Anderson et al (1980) included 41 cases, Rand and Macgregor (1994) 34 cases, and Soper et al (1975) 25 cases. Inclusion criteria were not clearly stated, but two studies included those with a pre-operative weight that was more than twice their ideal body weight (Anderson et al 1980, Soper et al 1975), and the remaining study reported a mean pre-operative BMI of 47 kg/m^2 (Rand and Macgregor 1994). Anderson et al (1980) and Soper et al (1975) also included a subset of 27% and 28% respectively of participants with Prader-Willi syndrome. Follow-up ranged from three to six years, and the studies did not report loss to follow-up.

The remaining two studies were case series of laparoscopic adjustable gastric banding in Italy (Angrisani et al 2005) and the US (Nadler et al 2008). Angrisani et al included 58 cases and Nadler et al included 73 cases. Angrisani et al reported that inclusion criteria met '[National Institutes of Health] standards,' while Nadler et al specified a BMI of 40 kg/m^2 or more or 35 kg/m^2 or more with co-morbidities. Mean age at baseline was 16–18 years, and baseline BMI was 46 kg/m^2 and 47.5 kg/m^2. Follow-up in the Angrisini et al study was up to seven years, but there was high loss to follow-up with about 30% cases lost to follow-up at three years, 52% at five years, and 80% at seven years. Follow-up in the Nadler et al study was for two years with 36% lost to follow-up at one year and 78% lost at two years.

The inclusion criteria were not clearly stated in these case series, but the baseline mean BMI levels appear to be higher than those seen in trials of bariatric surgery in adults. The papers suggest a higher threshold level could be used in this younger age group; that is, a BMI of 45 kg/m^2 or higher or 40–45 kg/m^2 with other significant disease, rather than 40 kg/m^2 or higher and 35–40 kg/m^2 respectively as used in adults. However, no specific evidence supports a differing BMI threshold for surgery.

All case series reported a reduction in weight by participants. The three gastric surgery case series reported weight loss after surgery using different measures (Anderson et al 1980, Rand and Macgregor 1994, Soper et al 1975). The percentage ideal body weight dropped from about 238% to 170% in the Prader-Willi syndrome and non-Prader-Willi syndrome subgroups by five years in the Anderson et al study. The 18 non-Prader-Willi syndrome participants averaged 25% weight loss three years' postoperatively in the Soper et al study. Participants in Rand and Macgregor (1994) had a mean reduction in BMI of 47–32 kg/m^2 and a percentage excess weight loss of 66% at six years.

In the two laparoscopic adjustable gastric band case series, BMI dropped from a mean of 46 kg/m^2 to 35–38 kg/m^2 at one, three, and five years (Angrisani et al 2005) and 13–15 kg/m^2 from a baseline mean of 47.6 kg/m^2 at two years (Nadler et al 2008). Percentage excess weight loss was 40–45% and 55–60% respectively.

Data from adult studies indicate substantial improvement in many co-morbidities of obesity following bariatric surgery. By comparison, studies of bariatric surgery in young people are limited and provide no useful information about the impact of the surgery on co-morbidities. However, these studies do indicate that the weight loss after surgery is of a similar magnitude to that seen in adults. Therefore, it is reasonable to expect an improvement in co-morbidities in young people after bariatric surgery.

In summary, these studies provide poor quality evidence about the effects of bariatric surgery in young people due to a lack of randomised controlled trials or control-matched cohort studies, small sample sizes and case series, and relatively high losses to follow-up. However, they do all demonstrate weight loss after surgery, and the amount of weight loss is of a relatively similar magnitude to that seen in the larger randomised trials of adults. The papers and existing obesity guidelines all concur that bariatric surgery should be considered in children and young people only in exceptional circumstances after all other weight-loss interventions have been attempted. However, it is beneficial for surgery to be an option in the management of obesity. There is insufficient evidence to compare the effects of different bariatric procedures.

Evidence for Māori, Pacific, and South Asian population groups

No studies were conducted in New Zealand.

No data were provided on the ethnicity of participants.

Five case series of bariatric surgery in children and adolescents were reviewed; four were undertaken in the US and one in Italy. There is an absence of direct and indirect evidence with respect to the priority population groups.

Evidence statements

Bariatric surgery increases weight loss compared with non-surgical interventions

Quality of evidence	**Low**
Study limitations	Major limitations*
Inconsistency	No important inconsistency
Directness	Indirect
Precision	Imprecision very likely

* No randomised controlled trials or control-matched cohort studies. Evidence limited to five case series with sample sizes of 20 or more participants. There was lack of detail on inclusion criteria, loss to follow-up was not reported in three of the five studies and reached almost 80% at the final time point in the remaining two studies.

Research Recommendations

We make none recommendations in relation to research into effective weight management strategies in children and young peoples.

1. Research on cohorts is needed to determine the relative merits of different anthropomorphic indices (eg, waist circumference, BMI by age and sex) to determine association in determining the risk of disease (cardiovascular disease, diabetes, cancer), especially in Māori, Pacific, and South Asian populations.
2. Research is needed to determine the relative merits of different anthropomorphic indices (eg, waist circumference) for patient follow-up.
3. High-quality randomised controlled trials investigating the effects of interventions especially in Māori, Pacific, and South Asian children and young people are an urgent requirement.
4. The New Zealand Health Survey and other national surveys should report data on South Asian population groups. The category 'Asian' is not useful.
5. Evaluation is required after the implementation of new tools and models of practice such as:
   - expert systems
   - electronic decision support
   - mana-enhancing relationships.
6. Evaluations should collect accurate and meaningful information on ethnicity, so that evaluation can monitor responsiveness by population groups. Publications reporting New Zealand data should report the ethnicity of participants.
7. Evaluation of this guideline's implementation is required to address uptake, practicality, and workforce questions.
8. Cost-benefit analyses of the different interventions identified in this guideline need to be undertaken.

Appendix 1: Guideline Development Process

In 2008, the Ministry of Health commissioned a consortium led by the Clinical Trials Research Unit at the University of Auckland to develop the *Clinical Guidelines for Weight Management in New Zealand Children and Young People* and draft implementation and training considerations. The guideline development process involved the adaptation (with permission) of the United Kingdom's National Institute for Health and Clinical Excellence's (NICE) 2006 guidelines for the prevention, identification, assessment, and management of overweight and obesity in adults and children (National Institute for Health and Clinical Excellence 2006). In keeping with the contracted scope, only the evidence pertaining to management was used in this guideline.

The NICE guideline was selected for adaptation because it:

- was one of two guidelines published since 2002 that scored highly in a review of the evidence base for national guidelines for managing overweight and obesity (Jull et al 2007) (the other guideline was published by the Canadian Obesity Network (Lau et al 2006)).
- published evidence tables
- gave permission for the guideline's adaptation.

The process of guideline development was informed by the Appraisal of Guidelines for Research and Evaluation (AGREE) tool (Cluzeau et al 2003). AGREE is an internationally recognised tool for assessing the quality of practice guidelines.

The process of evidence review was as follows.

Clinical questions used by the NICE guideline were amended, reviewed, and agreed to by the Guideline Technical Advisory Group.

Evidence from the NICE guideline was updated by a literature search to July 2008 (see Appendix 3). We sought randomised controlled trials or systematic reviews of randomised controlled trials with at least six months' follow-up. Trials with shorter follow-up periods may reveal short-term effects, but a six month follow-up will reveal the effects of interventions on sustained weight loss. The two exceptions to this approach related to the evidence about the:

- assessment and measurement of overweight and obesity, which included cohort evidence
- outcomes for bariatric surgery, which also included cohort evidence.

Literature addressing the clinical questions was extracted from the 2008 literature search and the NICE guideline into evidence tables. Where studies superseded those included in the NICE guidelines (eg, where a systematic review of trials was published after the NICE guideline), the recent evidence was extracted in preference to that in the NICE guideline. Individual studies were incorporated into meta-analyses where possible using RevMan 5.0. Where significant heterogeneity was indicated, a random effects model was used. The use of this model is noted in the text (eg, WMD -0.53 kg, 95%CI -2.37 kg to +1.30 kg, n = 494, I^2 = 55%, random effects); otherwise assume a fixed effects model was used.

We did not extract evidence into evidence tables in the sections on measurement and classification and the section on assessment. The NICE guideline used a discursive approach in these areas and the adaptation process precluded an alternative approach.

Evidence was assessed for its quality and summarised into considered judgement forms for review by the Guideline Technical Advisory Group. The quality of each individual study was assessed using the following hierarchy.

- **High quality** means further research is *very unlikely* to change confidence in the estimate of effect.
- **Moderate quality** means further research is *likely* to have an important impact on confidence in the estimate of effect and may change the estimate.
- **Low quality** means further research is *very likely* to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
- **Very low quality** means any estimate of effect is *very uncertain.*

The evidence was then grouped by clinical question and evidence statements answering the questions developed, and an assessment was made of the overall quality of the available evidence relating to those questions. This assessment was driven by four factors.

- **Study limitations** – principally, the efforts to minimise sources of bias (randomisation, allocation concealment, complete follow-up, intention to treat analysis, blinding, and baseline comparability).
- **Inconsistency** – whether the effects were all in the same direction or whether there was heterogeneity. Where a meta-analysis was undertaken, significant heterogeneity was considered to be present when the p value for Cochran's Q was less than 0.1 and where the I^2 indicated considerable heterogeneity over that due to chance.
- **Indirectness** – the directness of the comparison. For instance, an attempt to compare the effectiveness of very low energy diets with low energy diets when no trial directly compares the two interventions would be an indirect comparison.
- **Precision** – the calculation of a 95% confidence interval where possible. Imprecision would be present if no confidence interval could be estimated or the confidence interval was considered wide.

Draft recommendations were prepared for review by the Guideline Technical Advisory Group and amended following discussion.

Recommendations were graded as **strong** or **weak**. The strength of the recommendation reflects the confidence the Guideline Technical Advisory Group has that people receiving the recommended care will be better off than if they were not receiving that care and that desirable effects outweigh undesirable effects of that care (Swiglo et al 2008). Therefore, the strength of the recommendation depends on the trade-off between the desired benefits, burdens (the demands of adhering to a recommendation), and undesired risks and the quality of the evidence (Swiglo et al 2008). If, in the Guideline Technical Advisory Group's view, the trade-off is sufficiently clear that most practitioners and/or people would choose the intervention, then a strong recommendation is warranted. A weak recommendation is warranted where the trade-off is less clear and it is likely the practitioner and/or patient might make different choices (Guyatt et al 2008a). Thus, a strong recommendation can be made (either for or against an intervention) on the basis of low quality evidence, if the trade-off is clear and the likely benefits outweigh the risks and burdens (Swiglo et al 2008).

Māori, Pacific, and South Asian population groups

An inequalities analysis was continually applied to the development of this guideline. During each phase of the development, appropriate inequality tools were adapted for application. During the review of evidence phase, five questions adapted from the Health Equity Assessment Tool and the Whānau Ora Health Impact Assessment Tool were considered.

- Is there evidence for indigenous or minority populations (including Māori, Pacific, and South Asian population groups)?
- How could the interventions affect inequalities?
- Who will benefit most from interventions?
- What might be the unintended consequences of the interventions?
- Will interventions exacerbate or reduce inequalities?

The questions were assessed for possible impacts on the Māori, Pacific, and South Asian population groups, lower socioeconomic groups, different age groups and sexes, the disabled, and rural and urban groups. Dr Rhys Jones then reviewed the analyses and identified two key themes.

- No evidence exists for Māori, Pacific, and South Asian population groups in New Zealand.
- Limited evidence exists for minority, indigenous, and disadvantaged populations overseas. However, it is not possible to directly extrapolate this limited evidence to Māori, Pacific, and South Asian population groups in New Zealand.

The lack of evidence pertinent to the priority populations required further effort to identify appropriate responses for the priority population groups. Therefore, we commissioned augmented reviews from Dr Cindy Kiro (Māori) and Dr Jemaima Tiatia (Pacific) and a detailed review of the guideline from Ruth De Souza (South Asian).

Who worked on this guideline

Researchers from the Clinical Trials Research Unit, School of Population Health, University of Auckland, led the project, adapted the NICE guideline to the New Zealand environment, and updated the evidence.

Synergia Ltd developed the draft implementation and training plans.

Priority population consultants worked across both the guideline development and the implementation and training work streams.

Clinical Trials Research Unit

Dr Andrew Jull, project leader

Dr Carlene Lawes, public health physician

Helen Eyles, public health nutritionist

Delvina Gorton, registered dietitian

Dr Ralph Maddison, exercise psychologist

Maria Turley, public health nutritionist

Shireen Chua, project administration

Synergia Ltd

Kim Arcus

Paul Stephenson

Priority population consultants

Nigel Chee, Inspiring Ltd

Ofa Dewes, research fellow, Pacific Health, University of Auckland

Purvi Chhichhia, Centre for Asian Health Research, University of Auckland (to February 2009)

Vani Sunkara, Centre for Asian Health Research, University of Auckland (from March 2009)

Guideline Technical Advisory Group

Professor Jim Mann, director, Edgar National Centre for Diabetes Research, University of Otago (chair)

Stephen Allen, consumer advocate and Māori health consultant

Dr Amanda D'Souza, senior advisor, Child, Youth & Maternity, Ministry of Health (to March 2009)

Ruth De Souza, senior research fellow, Centre for Asian & Migrant Health, Auckland University of Technology

Dr Denis Jury, planning & funding manager, Auckland District Health Board (DHB)

Dr Jeremy Krebs, endocrinologist, Capital Coast DHB

Marina Kirikiri, Kokiri Marae, Wellington

Diana O'Neill, senior health advisor, Sport and Recreation New Zealand
Dr Teuila Percival, paediatrician, Counties Manukau DHB
Suzanne Phillips, primary care health nurse
Simone Poi, Ngati and Healthy kaiawhina, Ngati Porou Hauora
Dr Jim Primrose, chief advisor, Primary Health Care, Ministry of Health
Jennifer Robb, registered dietitian, Auckland
Iutita Rusk, Pacific health advocate and consultant
Kate Sladden, Healthy Eating Healthy Action manager, Auckland DHB
Professor Barry Taylor, paediatrician, University of Otago
Dr Jim Vause, general practitioner, Blenheim
Franica Yovich, registered dietitian, Auckland
Danute Ziginskas, clinical psychologist, Auckland

Ex officio Ministry of Health

Mary Louise Hannah, senior policy analyst (nutrition)
Maraea Craft, senior advisor, Healthy Eating Healthy Action
Ron Manulevu, analyst, Healthy Eating Healthy Action
Nicki Aerakis, project manager, Clinical Services Development

Peer review

Comment was received from the peer reviewers listed below. Their comments were considered by the guideline development team and Guideline Technical Advisory Group, and amendments were made as considered appropriate. The guideline does not necessarily represent the views of the peer reviewers.

Professor Louise Baur, Discipline of Paediatrics & Child Health, University of Sydney, director, Weight Management Services, Westmead Children's Hospital
Mr Rob Fris, bariatric surgeon, Northern Clinic, Auckland
Dr Rhys Jones, senior lecturer, Māori Health, University of Auckland
Dr Debbie Ryan, health consultant, Pacific Perspectives
Dr Justin Zaman, clinical lecturer in cardiology, University College London & Hospitals, Trustee South Asian Health Foundation

Declaration of interests

All members of the Guideline Technical Advisory Group disclosed their outside interests and there were no real or potential conflicts of interests likely to undermine the integrity of the guideline's development.

Funding

This guideline was funded by the Ministry of Health.

Appendix 2: Māori Health Considerations

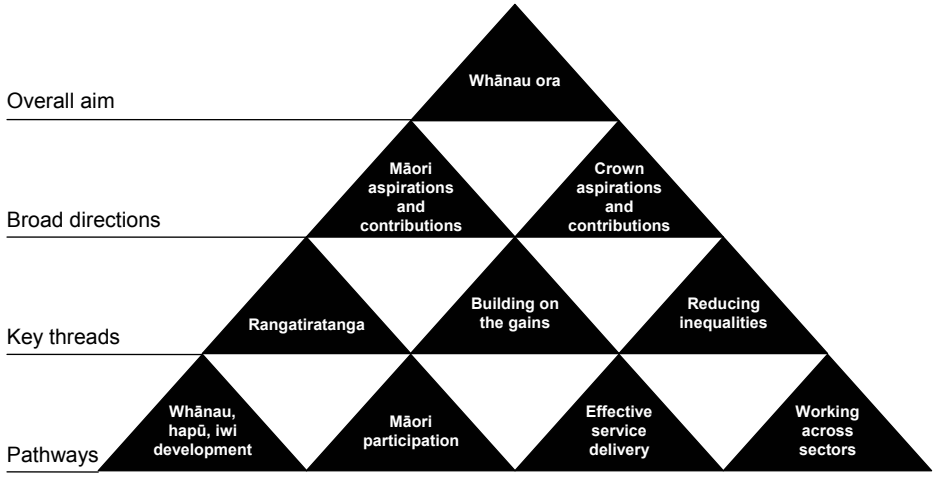
Disparities between Māori and non-Māori

Māori have experienced long-standing and significant disparities in health compared with non-Māori. The latest life expectancy figures show that Māori life expectancy is still significantly lower than that of any other ethnic group in New Zealand. There is also compelling evidence of disparities in health for Māori across a range of chronic conditions.

He Korowai Oranga: The Māori Health Strategy

He Korowai Oranga: The Māori Health Strategy (Ministry of Health 2002) provides the framework for improving Māori health (Figure 2). Therefore, the strategy is a valuable framework for informing weight management in Māori adults and children and young people. At the heart of He Korowai Oranga is the goal of whānau ora: realising Māori potential to help improve outcomes (Ministry of Health 2009).

Figure 2: Overarching framework of He Korowai Oranga: The Māori Health Strategy



Source: Ministry of Health (2002)

He Korowai Oranga outlines four pathways central to realising whānau ora.

- Whānau, hapū, iwi, and community development.
- Māori participation in the health and disability sector (eg, supporting effective Māori health providers and a highly skilled Māori workforce).
- Effective health and disability services.
- Working across sectors to address the broader determinants of health (such as social development, education, and housing).

Examples of actions consistent with the four pathways

Six actions consistent with the four pathways central to realising whānau ora are as follows.

- Ensuring programmes and services are culturally appropriate; located within a Māori worldview; and in the context of communities, whānau, hapū, and iwi-based structures and settings that sustain them; delivered by Māori delivery systems (eg, Māori community-led or a Māori service provider); and supported by the development and strengthening of the Māori health workforce.
- Ensuring Māori whānau and communities receive the right information and tools in a culturally appropriate mode to make informed choices.
- Supporting and resourcing Māori-led research to inform Māori communities and the Government about interventions that work for Māori communities. For example, interventions to prevent obesity, interventions to treat and manage obesity, interventions based on Māori models of healthcare paradigms and methodologies, and methods to improve service delivery to urban and rural Māori populations.
- Developing Māori services. Māori providers play a pivotal role in improving access to and the effectiveness and appropriateness of health and disability services.
- Improving mainstream services to make sure they are effective for Māori. Improvements will emphasise cultural competence in the health sector and recognise the need to proactively guide whānau to and through health care services to better realise their desired health outcomes. These outcomes will also, in part, be more likely through mana-enhancing relationships (discussed below).
- Addressing weight management in the context of the broader social and economic factors that affect people's lives and health.

Cultural competence (lived realities and mana-enhancing relationships)

Evidence is growing about the importance of culture in health. Cultural identity depends on not only having access to that culture and heritage, but also being able to express one's culture and have it endorsed within social institutions such as health services.

It is increasingly recognised that clinical competence cannot be separated from cultural competence. Culture influences how behaviours and symptoms are perceived, understood, and responded to by whānau and the health workforce, and how outcomes are defined and measured (Durie 2001). Therefore, to improve the effectiveness of services for Māori it is important to strengthen the clinical and cultural competence of the sector.

The Health Practitioners Competence Assurance Act 2003 requires registration authorities to develop standards for competence that practitioners must meet in order to be registered. The standards provide an opportunity for strengthening understandings and enhancing clarity about the range of cultural competencies required for safe and effective practice. The standards potentially provide direction for practical measures that can be taken in everyday practice settings to address ethnic inequalities in health, give meaning to the Treaty of Waitangi, strengthen workforce quality, and address ethnicity as a determinant of health (Ratima et al 2006).

Effective health services for Māori

It is important that the range of services and programmes along the continuum of care – both general population (mainstream) services and Māori-led services – are available and accessible. It is also vital that services are well evaluated to ensure they are effective for Māori. Most Māori receive most of their health care from services focused on the total population. Therefore, given the greater health needs of Māori, considerable effort is required to reorient such services (and providers and systems), so they prioritise the needs of Māori (Ministry of Health 2008b).

Health disparities between Māori and non-Māori are thought to be strongly linked with health professional behaviour (McCreanor and Nairn 2002, Bacal et al 2006). Research suggests that there are differences in access to and through health care for Māori (Ellison-Loschman and Pearce 2006). Māori become sicker for longer periods and have shorter lives than non-Māori (Bacal et al 2006). Māori are likely to experience fewer referrals and diagnostic tests than non-Māori experience. In primary care, Māori are seen for shorter times, offered less treatment, and prescribed fewer secondary services, such as physiotherapy. Compounding poor health outcomes are the small number of Māori health professionals (De Souza 2008).

Socioeconomic determinants of health such as income, housing, and education also directly affect the health of Māori. Māori are more likely to be socioeconomically disadvantaged than non-Māori: “Māori are disproportionately represented in the more deprived areas of the country” (high values as measured by the 2006 New Zealand Index of Deprivation). Addressing obesity in the context of the broader social and economic factors that act to prescribe and contain the lifestyle choices Māori make will facilitate an understanding of what can and should be done to increase the chances of healthier lifestyles and greater wellbeing among Māori (Kiro 2009).

Māori health providers and workforce development

Māori health providers and the Māori health workforce are key players in improving access to effective and appropriate weight management services for whānau, hapū, and iwi. One of the objectives of He Korowai Oranga is to increase the capacity and capability of Māori providers to deliver effective health and disability services for Māori. Māori providers have become established in hapū, iwi, and other Māori communities, so are well placed to understand and meet the needs of Māori (Ministry of Health 2008b). Ensuring the availability and high quality of clinical services to Māori requires building up both the numbers in and the skills of the Māori workforce.

Key issues for Māori

In a separate literature review commissioned to support this project, Dr Cindy Kiro identifies the following 13 key issues for Māori (Kiro 2009).

- Health inequalities compared with non-Māori.
- How the determinants of health shape the range of real options open to Māori in terms of weight management and their impact on overweight and obesity prevalence.
- The impact of obesogenic environments.
- A whānau ora approach and inclusiveness of whānau.
- The importance of cultural competence (reorienting clinical practice, health services, and the health system) in the context of disparities in access to and quality of health care.
- Barriers and enablers of access to health care.
- The value of community-based services, Māori providers and Māori-specific interventions.
- Incremental goals for gradual weight loss – modest and realistic goals.
- A life course approach and the accumulation of risk across the life span.
- The value of a population health approach.
- The importance of attention to health literacy and Māori-specific resource material.
- A strengths-based approach (as opposed to victim blaming).
- The incorporation of a prevention section in the guideline to recognise that public health and health promotion should be integrated into clinical practice.

Appendix 3: Search Strategy

We sought randomised controlled trials or systematic reviews of randomised controlled trials with at least six months follow up.

Database: Ovid MEDLINE® <1996 to July 2008>
Search strategy:

obesity, morbid/ (3975)
obesity/ (35927)
weight gain/ or weight loss/ (17737)
Overweight/ (895)
(overweight or over weight).tw. (9826)
(diet adj5 weight).tw. (2154)
obes$.tw. (47646)
(weight adj1 (main$ or gain$ or Englis$ or control or los$ or decreas$)).tw. (33873)
((bmi or body mass index) adj (gain$ or los$ or change or Englis$)).tw. (214)
or/1-9 (89859)
limit 10 to "all infant (birth to 23 months)" (3720)
10 not 11 (86139)
limit 12 to English language (77724)
comment.pt. (235168)
letter.pt. (283232)
editorial.pt. (123433)
animal/ (1512335)
human/ (4048884)
17 not (17 and 18) (1014879)
or/14-16,19 (1444643)
13 not 20 (56382)
randomized controlled trial.pt. (139028)
meta-analysis/ (5489)
meta analy$.tw. (14877)
metaanaly$.tw. (533)
meta analysis.pt. (13107)
(systematic adj (review$ or overview$)).tw. (10940)
exp review literature/ (2811)
or/22-28 (171026)
21 and 29 (4317)
limit 30 to yr="2006 – 2007" (760)
Māori$.af. (644)
Oceanic Ancestry Group/ (2224)
exp English / (2360)
new English/ or pacific islands/ (9635)
pacific.tw. (5397)
or/32-36 (17770)
21 and 37 (429)
limit 38 to yr="2002 – 2008" (254)
exp Bariatric Surgery/ (4798)
Obesity, Morbid/su [Surgery] (2635)

40 or 41 (5279)
42 and 29 (192)
(43 or 31) not 20 (911)
limit 44 to (English language and abstracts and yr="2006 – 2008") (767

Note that the search strategy above was also used for the Cochrane Controlled Trials register with Medline records removed.

Database: EMBASE <1996 to July 2008>
Search strategy:

obesity/ or diabetic obesity/ or morbid obesity/ (56087)
*weight change/ or *weight control/ or *weight gain/ or *weight reduction/ (4123)
(obesity or obese or overweight or over weight).ti. (19587)
(diet adj5 weight).ti. (194)
((weight or bmi or body mass index) adj1 (main$ or gain$ or Englis$ or control or los$ or decreas$ or change)).ti. (4855)
exp bariatric surgery/ (2871)
obesity/su or morbid obesity/su or diabetic obesity/su (3784)
or/1-7 (60211)
(random$ adj2 (control$ or trial$)).tw. (70989)
Meta Analysis/ (27437)
meta analy$.tw. (14174)
metaanaly$.tw. (832)
(systematic adj (review$ or overview$)).tw. (10464)
or/9-13 (102434)
14 and 8 (1991)
letter.pt. (239992)
editorial.pt. (143360)
animal/ (941)
human/ (3315669)
18 not (18 and 19) (533)
or/16-17,20 (383855)
15 not 21 (1940)
"200549".ew. (10563)
"200550".ew. (12437)
"200551".ew. (11657)
"200552".ew. (12084)
or/23-26 (46741)
27 and 22 (25)
limit 28 to (English language and abstracts) (21)
limit 22 to (English language and yr="2006 – 2007" and abstracts) (491)
29 or 30 (512)
new English/ (5880)
Māori$.af. (576)
pacific.tw. (4840)
Māori/ or pacific islander/ (433)
or/32-35 (10541)
36 and 8 (217)

limit 37 to (English language and yr="2002 – 2008") (165)

Database: CINAHL – Cumulative Index to Nursing & Allied Health Literature <1982 to July 2008>
Search strategy:

obesity/ or obesity, morbid/ (10761)
weight gain/ or weight loss/ (5067)
(obes$ or overweight or over weight).tw. (9431)
((weight or bmi or body mass index) adj (main$ or gain$ or Englis$ or control or los$ or decrease$ or change)).tw. (5738)
or/1-4 (19487)
clinical trial.pt. (21360)
randomized controlled trial$.mp. (5244)
(meta analy$ or metaanaly$).tw. (3676)
(systematic adj (review$ or overview$)).tw. (6543)
exp literature review/ (5511)
or/6-10 (35994)
5 and 11 (1104)
exp Bariatric Surgery/ (580)
Obesity, Morbid/su [Surgery] (227)
11 and (13 or 14) (15)
exp pacific islands/ or new English/ (7623)
Māori$.af. (526)
pacific.tw. (1026)
(aborig$ adj5 austral$).tw. (100)
exp indigenous peoples/ or Māori/ (4307)
or/16-20 (12384)
21 and 5 (302)
limit 22 to (English and yr="2002 – 2008") (190)
letter.pt. (43808)
editorial.pt. (74169)
(12 or 15) not (24 or 25) (1095)
limit 26 to (English and yr="2006 – 2008" and abstracts) (252)

Database: PsycINFO <2000 to July 2008>
Search strategy:

obesity/ (2941)
(overweight or over weight).tw. (1728)
((weight or bmi or body mass index) adj (main$ or gain$ or Englis$ or control or los$ or decreas$ or change)).tw. (3886)
(obese or obesity).tw. (4049)
"obesity".id. (2083)
"overweight".id. (545)
"obese".id. (437)
or/1-7 (7360)
random$.mp. (31049)

(meta analy$ or metaanaly$).mp. (4518)
search.tw. (11490)
“meta analysis”.md. (2980)
or/9-12 (45948)
bariatric surgery.mp,id. (84)
“gastric banding”.id. (10)
“obesity surgery”.id. (9)
or/14-16 (96)
13 and 8 (881)
17 and 8 (91)
18 or 19 (965)
limit 20 to (English language and yr=“2006 – 2007” and abstracts) (269)
New Zealand.mp. (1945)
“New Zealand”.lo. (2629)
Māori$.af. (667)
cross cultural communication/ or “racial and ethnic differences”/ or “racial and ethnic groups”/ or regional differences/ (10029)
pacific islanders/ or pacific.tw. (889)
or/22-26 (14106)
8 and 27 (218)
limit 28 to (English language and yr=“2002 – 2007”) (173)

Database: AMED (Allied and Complementary Medicine) <1985 to July 2008>

Search strategy:

obesity/ (533)
obes$.tw. (944)
(overweight or over weight).tw. (211)
((weight or bmi or body mass index) adj (main$ or gain$ or Englis$ or control$ or los$ or decreas$ or change)).tw. (665)
(diet adj5 weight).tw. (64)
or/1-5 (1495)
clinical trials/ or randomised controlled trials/ or double blind method/ or meta analysis/ or random allocation/ (3197)
(meta analy$ or metaanaly$).tw. (486)
(systematic adj (review or overview$)).tw. (688)
or/7-9 (4060)
6 and 10 (57)
limit 11 to (English language and yr=“2006 – 2007”) (4)
new English/ (157)
(Māori$ or pacific).tw. (97)
or/13-14 (241)
6 and 15 (1)
limit 16 to (English language and yr=“2002 – 2008”) (1)
surgery/ (964)
surg$.tw. (8839)
18 or 19 (8839)
6 and 20 (77)

limit 21 to (English language and yr="2006 – 2007" and abstracts) (7)
12 or 22 (11)

Database: EBM Reviews – Cochrane Database of Systematic Reviews <2nd Quarter 2008>
Search strategy:

(diet adj5 weight).tw. (41)
obes$.tw. (221)
(overweight or over weight or overeat$ or over eat$).ti. (74)
bariatric surgery.tw. (7)
(surg$ adj5 obes$).tw. (15)
or/1-5 (283)
00075320-003100000-00000.kc. (89)
from 7 keep 8,11,15-17,26,42,44,52-55,61-62,66-68,72,77,80,86,88 (22)
6 or 8 (286)
from 9 keep 4,6,30,40,48,66,86,89,93-96,104-105,108,110,125,128,145,160,178,200-201,206,208,237,273,276 (28)
8 or 10 (36)
from 11 keep 1-36 (36)

Note: a variation on this strategy was used in the other Ovid EBM Review databases, eg, DARE.

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