THE DISTRIBUTION OF OVERWEIGHT AND OBESITY IN CHILDREN AND YOUNG PEOPLE

Introduction

Increasing rates of childhood obesity are of concern, both in New Zealand and internationally [1,2]. This is because childhood obesity has significant adverse effects on health in childhood and beyond [3,4]. During childhood, obesity has been associated with adverse psychological effects, lower educational achievement [4,5], asthma, and slipped upper femoral epiphysis [6,7,8]. Childhood obesity has also been strongly associated with the clustering of cardiovascular risk factors which tend to persist thereby increasing the risk of cardiovascular disease in later life [4]. In the longer term, childhood overweight and obesity may also increase the risk of cardio-metabolic diseases (diabetes, hypertension, ischaemic heart disease and stroke), premature death, and polycystic ovary syndrome for those whose obesity persists into adulthood [3].

Obesity is determined by a complex mix of environmental factors, life course factors, intergenerational factors and underlying biology [9]. Risk factors linked to childhood obesity and overweight include early rapid weight gain, high birth weight, and maternal pre-pregnancy overweight, maternal smoking in pregnancy, short sleep duration and prolonged television viewing [10,11]. Parental obesity is also a strong predictor of childhood obesity [9,12]. Prolonged breastfeeding (> 4 months) and delaying the introduction of solids until six months are probably modestly protective factors [13]. Societal changes in the production and marketing of food, transportation, and work patterns have also been implicated in the creation of an 'obesogenic environment' that predisposes children to weight gain [9,12].

The following section begins with a brief review of the measurement of overweight and obesity, before exploring their prevalence in New Zealand children and young people using information from two data sources: The 2011/12 New Zealand Health Survey, and the Youth'12 Survey of secondary school students.

Notes on the Measurement of Overweight and Obesity

Obesity: Obesity is defined as an excess in adiposity or body fat mass. Measures of adiposity in current use include weight, weight for height, skin fold thickness (e.g. triceps/sub-scapular) and circumferences/diameters (e.g. waist-hip/waist-thigh ratios, mid-upper arm circumferences), each of which has its own reference standards and cut-off points [14].

Of these, the most popular is the Body Mass Index (BMI) which is calculated using the formula

$$BMI = \text{weight (kg)} / \text{height (m)}^2$$

Using height and weight to assess adiposity is generally viewed as being reliable, reproducible, non-intrusive and cheap, making BMI one of the most popular measures for obesity, both in New Zealand and overseas. In adults, cut-offs are based on mortality risk or other criteria, with those having a BMI of 25–29.9 kg/m^2 being traditionally classified as overweight and those with a BMI of 30 kg/m^2 or over being seen as obese. Using BMI to assess obesity in children however has a number of drawbacks, including the changes in body composition that occur as part of normal growth and with the onset of puberty, and ethnic differences in body composition for a given BMI [15]. These issues are discussed in more detail below.

Changes in Body Composition with Age: The Need for BMI Percentile Charts

Assessing obesity during childhood and adolescence is more complex than in adults, as both height and body composition change progressively with development. In particular, the proportion of fat mass to total body weight changes significantly during childhood, beginning at around 13–15% in term newborn infants and increasing progressively during the first year of life, to a maximum of 25–26% at 12 months of age. From 12 months to 4–6 years, the proportion of body fat then declines, to a nadir of around 12–16%, before increasing again between the ages of 6-10 years. By early adulthood, the proportion of fat mass is 20–25% for women and 15–20% for men [15]. As a result of these changes, when assessing the level of obesity in an individual child, BMI for age percentile charts are usually used, which extrapolate back the traditional adult cut-off points of 25–29.9 kg/m^2 and ≥30 kg/m^2, to the same points on the BMI distribution during the childhood years e.g. a male child with a BMI > 19.3 at the age of 5 years, is on the same point in the percentile charts as an 18 year old with a BMI of >30, and thus will be classified as obese [16]. As New Zealand to date has not developed its own BMI percentile charts for children, overseas standards must be used. Of these, the most popular were

developed by the International Obesity Taskforce (see Cole [16,17]) using pooled survey data from a number of different countries.

Ethnic Differences in BMI

With no BMI-for-age percentile charts specifically designed for New Zealand use, there remains a significant amount of debate about the appropriateness of the traditional BMI-for-age cut-offs for New Zealand children of different ethnic groups. While a number of studies have suggested that, for a given BMI, Māori and Pacific children have a lower percentage of body fat [18,19,20], others have argued that while statistical differences may exist, there are no clinically significant ethnic differences in the relationship between BMI and body composition and that a common standard should be used for children of all ethnic groups [20]. Overseas research also suggests that ethnic differences in body composition may increase during puberty, with differences being much less marked amongst children <8 years of age [21]. Similarly, ethnic differences in the onset of puberty may also make utilisation of a common BMI cut-off difficult, with puberty on average, occurring earlier amongst Māori and Pacific groups [22]. Such differences need to be kept in mind when interpreting ethnic specific obesity rates calculated using overseas percentile charts, as they may tend to overestimate obesity rates amongst Māori and Pacific children slightly.

The 2011/12 New Zealand Health Survey

The 2011/12 NZ Health Survey (2011/12 NZHS) [1] was a cross sectional survey carried out between July 2011 and August 2012, which collected information on 4,478 children aged from birth to 14 years. Information was collected in a similar way to the earlier 2006/07 NZ Health Survey, making it possible to compare overweight and obesity rates during these two periods. The following section briefly reviews changes in the prevalence of overweight and obesity in children aged 2–14 years between the 2006/07 and 2011/12 Surveys, before exploring the distribution of overweight and obesity by a range of socio-demographic factors in the most recent 2011/12 NZHS.

Data Sources and Methods

Definitions

The proportion of children and young people aged 2–24 years who are overweight or obese by age

The proportion of children aged 2–14 years who are overweight or obese by gender, ethnicity and NZDep06

Data Sources

The 2011/12 New Zealand Health Survey

The data on children aged 2–14 years in this section were derived from *The Health of New Zealand Children 2011/12: Key Findings of the New Zealand Health Survey*, and its associated data tables, downloadable at http://www.health.govt.nz/publication/health-new-zealand-children-2011-12 Regional results were sourced from http://www.health.govt.nz/publication/regional-results-2011-12-new-zealand-health-survey while data for young people aged 15–24 years was derived from *The Health of New Zealand Adults 2011/12: Key Findings of the New Zealand Health Survey*, and its associated data tables, which are downloadable at http://www.health.govt.nz/publication/health-new-zealand-adults-2011-12

Notes on Interpretation

Sample Size and Weighting: The 2011/12 NZHS [1] was a cross sectional survey carried out between July 2011 and August 2012, which collected information on 4,478 children aged from birth to 14 years, and 12,370 adults aged 15 years and over. The child survey included 2,968 European/Other, 1,592 Māori, 730 Pacific and 432 Asian children, with the data being weighted (e.g. to take into account response rates and individual item non-responses) to ensure that the results were representative of the total New Zealand child population. The weighted response rate for the child questionnaire was 85%, with the primary caregiver answering the questionnaire on their child's behalf. In addition, height and weight measurements were taken on all children aged 2–14 years using standardised equipment and procedures.

Ethnicity: In the NZHS, four ethnic groups were reported: Māori, Pacific, Asian and European/Other. Total response ethnicity was used throughout, with an individual being included in the analysis for each ethnic group to which they affiliated. As a result, ethnic groups cannot be directly compared with each other, with adjusted rate ratios which compare children by ethnicity comparing those in a particular group (e.g. Pacific) with those who are not in that ethnic group (e.g. non-Pacific) [1].

Age Standardisation: Age is an important determinant of health status. In the NZHS, all time trend results have been age-standardised, so that populations can be compared over time, and so that any differences reported are not due to changes in the population age structure. Similarly all rate ratio comparisons by gender, ethnicity and NZ Deprivation Index (NZDep) decile have been age adjusted, so that any differences identified cannot be attributed to differing age structures between the population groups. The method of age standardisation used was the direct method, using the World Health Organization world population age distribution [1]. Regional rates however, are presented as unadjusted prevalences, so that the actual prevalence of those affected in each region can be assessed, including by age group.

Other Standardisation and the Relative Index of Inequality: In addition to age standardisation, any ethnic comparisons have also been adjusted for gender. For neighbourhood deprivation comparisons (i.e. by NZDep06) rate ratios refer to the relative index of inequality [1]. This compares neighbourhood deprivation after adjusting for age, sex and ethnic differences. The relative index of inequality can be interpreted in the same way as adjusted rate ratios, although it is calculated in a slightly different way.

Regional Results: NZHS results are reported by region, with DHBs being grouped as follows: *Northern Region*: Northland, Waitemata, Auckland, Counties Manukau; *Midland Region:* Waikato, Bay of Plenty, Lakes, Tairawhiti, Taranaki; *Central Region*: Hawke's Bay, Whanganui, MidCentral, Hutt Valley, Capital and Coast, Wairarapa; *Southern Region*: Nelson Marlborough, Canterbury, South Canterbury, West Coast, Southern. It is anticipated that results will become available by DHB in future years, as more survey data is collected.

Measurement of Overweight and Obesity: Overweight and obesity in the NZHS was measured using body mass index (BMI). BMI is calculated by dividing weight in kilograms by the square of height in metres (kg/m^2). In the NZHS, for respondents aged 2–17 years, the age and sex specific BMI cut-off points developed by the International Obesity Taskforce (IOTF) were used to classify underweight, normal range, overweight and obesity. These BMI-cut-offs were designed to coincide with the adult cut-offs at 18 years [1].

Differences between estimates are said to be statistically significant when the confidence intervals for each rate do not overlap. Sometimes, however, even when there are overlapping confidence intervals, the difference between the groups can be statistically significant. Any differences between two variables where the confidence intervals overlap are tested using a t-test. The significance of a t-test is represented by the p-value. If a p-value is below 0.05, then we are 95 percent confident the difference between the two estimates is statistically significant [23].

Trends in Overweight and Obesity

Obesity Trends

Overall: The proportion of New Zealand children aged 2–14 years who were obese increased *significantly* (p=0.02) between NZ Health Surveys, with rates rising from 8.4% (95% CI 7.5–9.4) in 2006/07, to 10.3% (95% CI 8.9–11.9) in 2011/12.

By Gender: When broken down by gender, the proportion of boys aged 2–14 years who were obese increased *significantly* (p=0.05), with rates rising from 8.0% (95% CI 6.9–9.3) in 2006/07 to 10.2% (95% CI 8.4–12.3) in 2011/12. Rates however, did not increase *significantly* (p=0.17) for girls, being 8.8% (95% CI 7.3–10.4) in 2006/07 and 10.4% (95% CI 8.6–12.5) in 2011/12 (**Figure 1**).

By Ethnicity: When broken down by ethnicity, the proportion of Māori children aged 2–14 years who were obese increased *significantly* (p=0.03), with rates rising from 11.9% (95% CI 10.0–13.9) in 2006/07 to 16.4% (95% CI 12.5–20.9) in 2011/12. Obesity rates for children of other ethnic groups however did not increase *significantly* between 2006/07 and 2011/12; Pacific 23.1% (95% CI 19.7–26.8) → 25.5% (95% CI 20.7–30.7), Asian 5.9% (95% CI 3.7–8.8) → 7.6% (95% CI 4.6–11.7) and European/Other 5.6% (95% CI 4.5–6.9) → 6.2% (95% CI 5.0–7.6) (**Figure 1**).

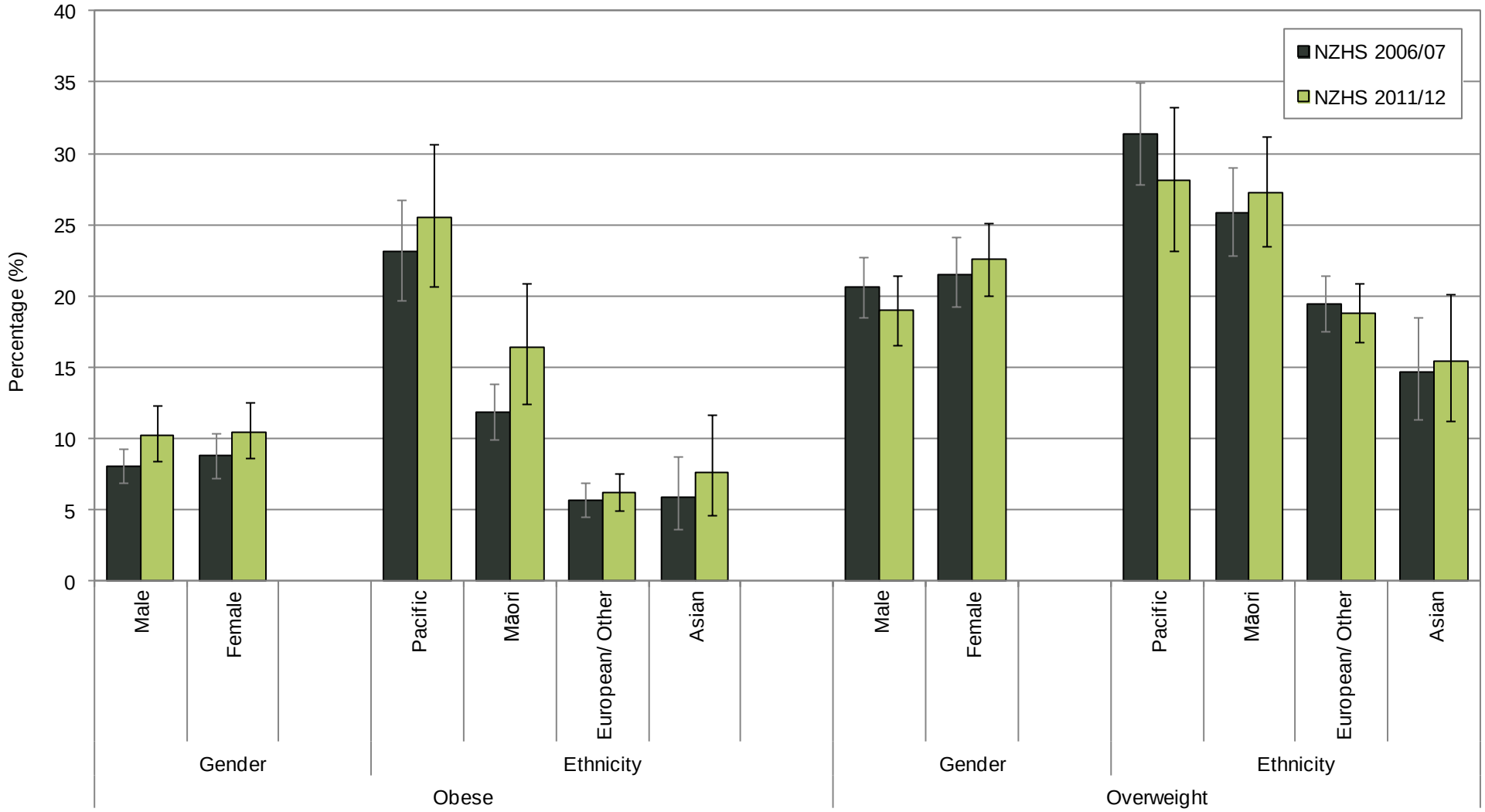
Overweight (but not Obese) Trends

Overall: The proportion of New Zealand children aged 2–14 years who were overweight (but not obese) did not change *significantly* (p=0.81) between NZ Health Surveys, with rates being 21.0% (95% CI 19.4–22.8) in 2006/07, and 20.7% (95% CI 19.0–22.5) in 2011/12.

By Gender: When broken down by gender, the proportion of boys and girls aged 2–14 years who were overweight did not change *significantly* between NZ Health Surveys, with rates for boys being 20.6% (95% CI 18.5–22.8) in 2006/07 and 19.0% (95% CI 16.6–21.5) in 2011/12. For girls rates were 21.5% (95% CI 19.2–24.1) in 2006/07 and 22.6% (95% CI 20.1–25.2) in 2011/12 (**Figure 1**).

By Ethnicity: When broken down by ethnicity, the proportion of Māori, Pacific, Asian and European/Other children who were overweight did not change *significantly* between NZ Health Surveys. Rates for Māori children were 25.8% (95% CI 22.8–29.0) in 2006/07 and 27.2% (95% CI 23.5–31.2) in 2011/12, while rates for Pacific children were 31.3% (95% CI 27.8–35.0) in 2006/07 and 28.1% (95% CI 23.2–33.3) in 2011/12. Rates for Asian children were 14.6% (95% CI 11.3–18.5) in 2006/07 and 15.4% (95% CI 11.3–20.2) in 2011/12, while rates for European/Other children were 19.4% (95% CI 17.5–21.4) in 2006/07 and 18.8% (95% CI 16.8–20.9) in 2011/12 (**Figure 1**).

Figure 1. Proportion of Children Aged 2–14 Years who were either Overweight or Obese by Gender and Ethnicity, 2006/07 and 2011/12 New Zealand Health Surveys

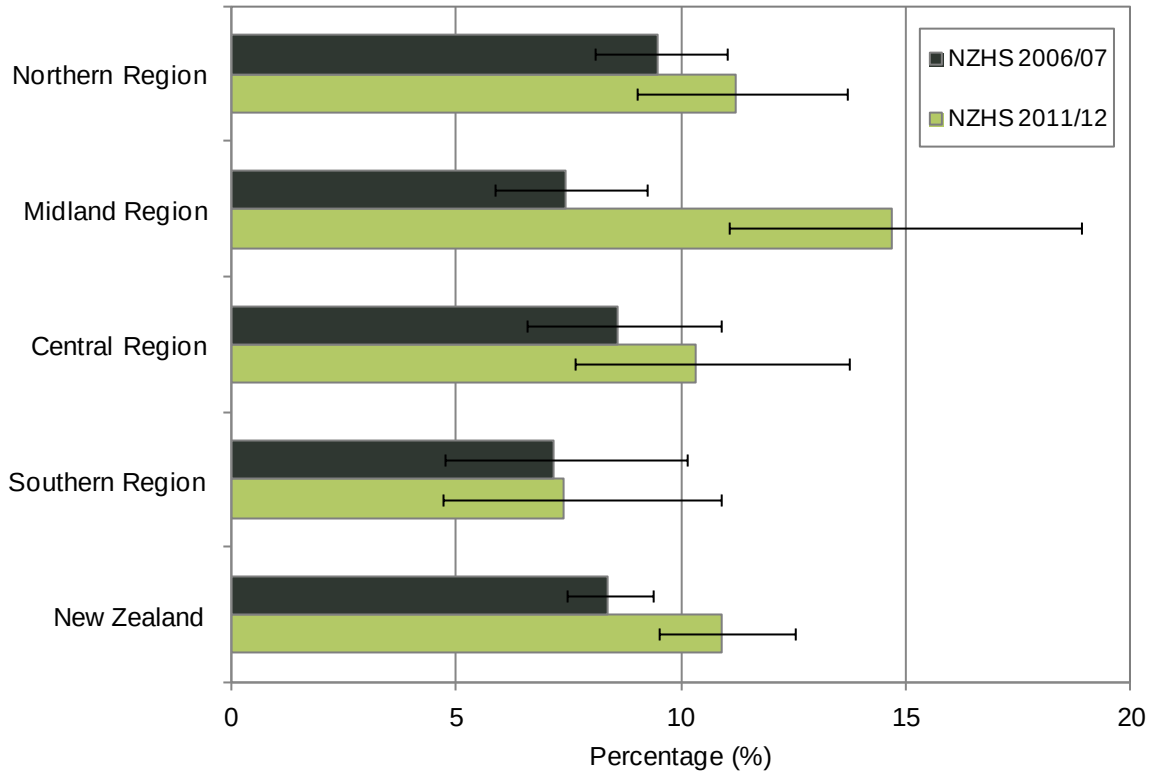


Source: 2006/07 and 2011/12 New Zealand Health Surveys; Note: Rates have been age-standardised

Obesity: Distribution by Region

When broken down by region, the proportion of children aged 2–14 years in the Midland region who were obese increased *significantly* (p=0.00) between NZ Health Surveys, with rates rising from 7.5% (95% CI 5.9–9.3) in 2006/07, to 14.7% (95% CI 11.1–18.9) in 2011/12. Obesity rates for Northern (p=0.22), Central (p=0.34) and Southern (p=0.90) children however, did not change *significantly*. Rates for Northern children were 9.5% (95% CI 8.1–11.0) in 2006/07 and 11.2% (95% CI 9.0–13.7) in 2011/12. Rates for Central children were 8.6% (95% CI 6.6–10.9) in 2006/07 and 10.3% (95% CI 7.6–13.7) in 2011/12, while rates for Southern children were 7.2% (95% CI 4.8–10.2) in 2006/07 and 7.4% (95% CI 4.7–10.9) in 2011/12 (**Figure 2**).

Figure 2. Proportion of Children Aged 2–14 Years Who Were Obese by Region, 2006/07 and 2011/12 New Zealand Health Surveys



Source: 2011/12 New Zealand Health Survey; Note: Rates are unadjusted for age

Current Distribution of Overweight and Obesity

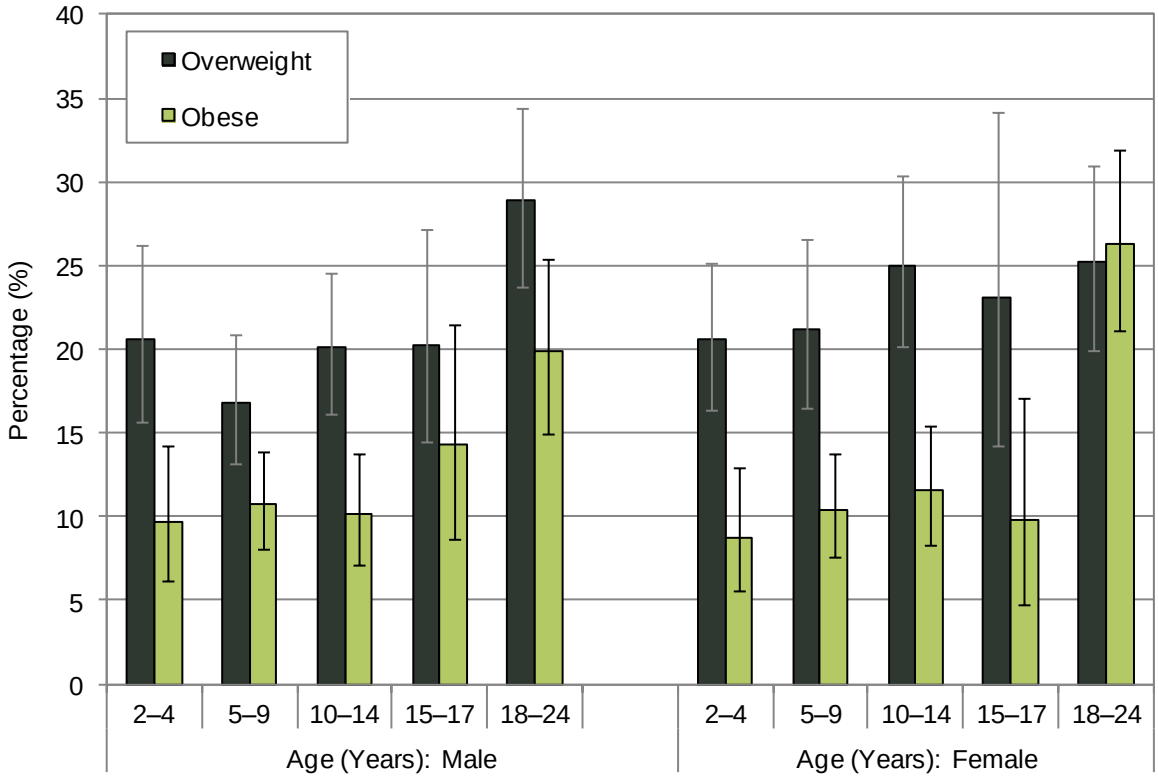
Distribution by Age

In the children's component of the 2011/12 NZHS, there were no *significant* differences in the (unadjusted) prevalence of obesity by age, with rates being 9.2% (95% CI 6.5–12.5) in those aged 2–4 years, 10.6% (8.6–12.9) in those aged 5–9 years and 10.8% (95% CI 8.7–13.2) in those aged 10–14 years. In the adult component of the 2011/12 NZHS however, obesity rates were *significantly* higher for those aged 18–24 years (22.9% (95% CI 19.6–26.6%)) than for those aged 15–17 years (12.0% (95% CI 8.0–17.2)).

There were also no *significant* age differences in the (unadjusted) prevalence of children who were overweight (but not obese) in the child component of the 2011/12 NZHS. Nor were there any *significant* differences between those aged 15–17 years and 18–24 years in the adult component of the NZHS.

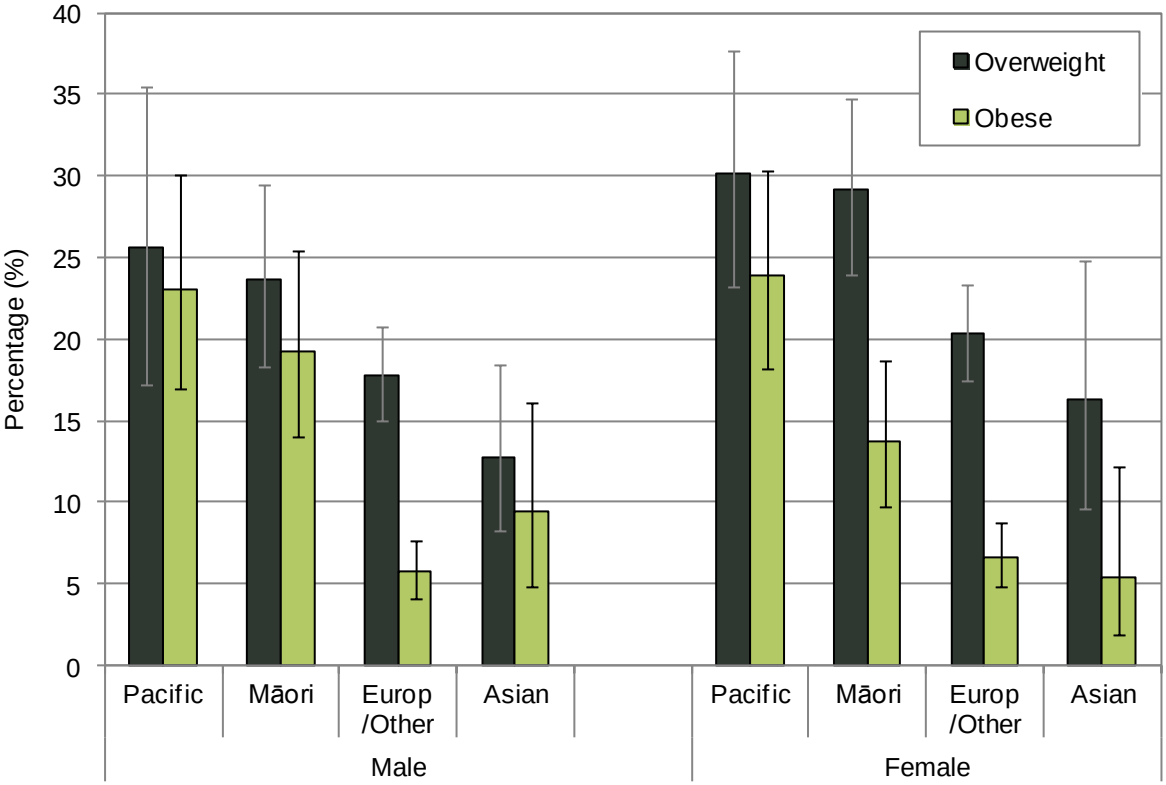
In addition, there were also no *significant* gender differences in the proportion of children age 2–14 years who were overweight or obese in the 2011/12 NZHS, once rates were adjusted for age. **Figure 3** reviews the (unadjusted) prevalence of children and young people aged 2–24 years who were either overweight or obese by gender and age in the 2011/12 NZHS.

Figure 3. Proportion of Children and Young People Aged 2–24 Years who were either Overweight or Obese by Gender and Age, 2011/12 New Zealand Health Survey



Source: 2011/12 New Zealand Health Survey; Note: Rates are unadjusted

Figure 4. Proportion of Children Aged 2–14 Years who were either Overweight or Obese by Gender and Ethnicity, 2011/12 New Zealand Health Survey



Source: 2011/12 New Zealand Health Survey; Note: Rates are unadjusted for age

Distribution by Ethnicity

In the 2011/12 NZHS, Māori children aged 2–14 years were 2.10 (95% CI 1.64–2.68) times more likely to be obese than non-Māori children, while Pacific children were 3.08 (95% CI 2.41–3.93) times more likely to be obese than non-Pacific children, once rates were adjusted for age and gender. There were no *significant* differences however, in obesity rates between Asian and non-Asian children.

Similarly, Māori children aged 2–14 years were 1.40 (95% CI 1.18–1.67) times more likely to be overweight (but not obese) than non-Māori children, while Pacific children were 1.44 (95% CI 1.17–1.76) times more likely to be overweight than non-Pacific children, once rates were adjusted for age and gender. In contrast, Asian children were *significantly* less likely (RR 0.68 95% CI 0.49–0.94) to be overweight than non-Asian children.

Figure 4 reviews the proportion of children aged 2–14 years who were either overweight or obese by gender and ethnicity in the 2011/12 NZHS.

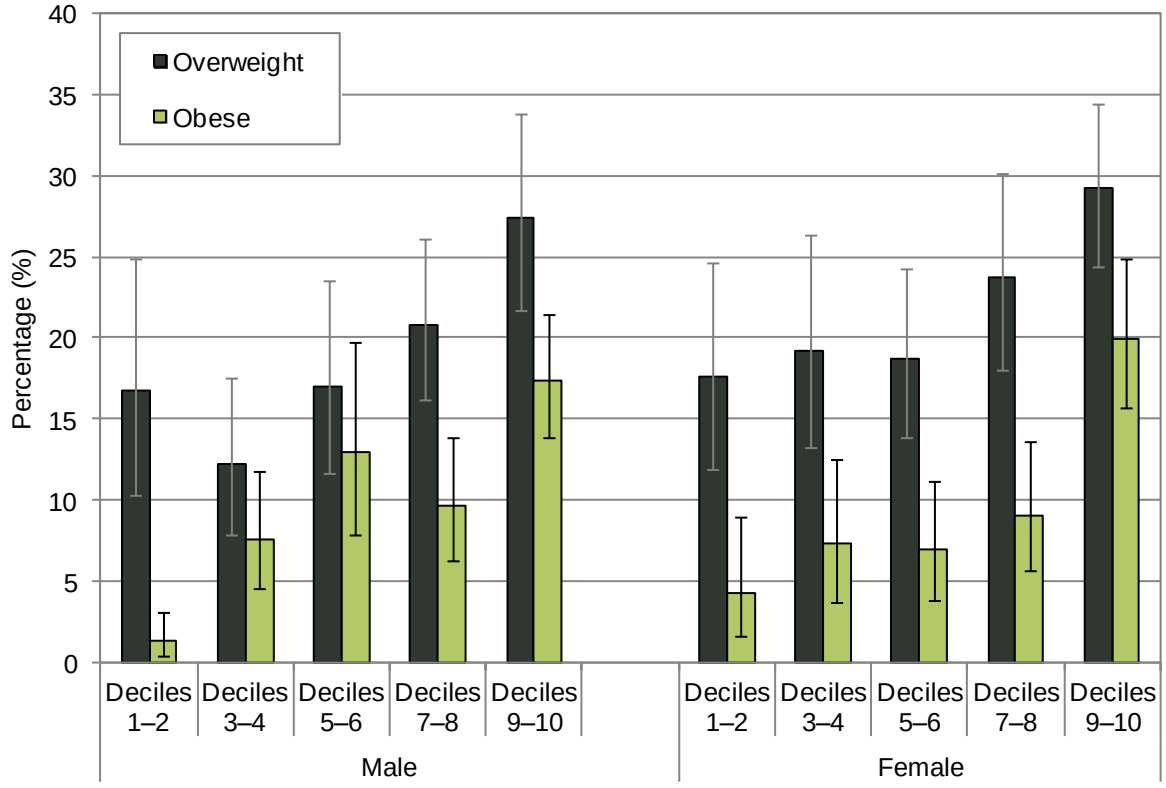
Distribution by NZ Deprivation Index Decile

In the 2011/12 NZHS, children aged 2–14 years who were living in the most deprived (NZDep06 deciles 9–10) areas were 2.33 (95% CI 1.37–3.93) times more likely to be obese than children living in the least deprived (NZDep06 deciles 1–2) areas, once rates were adjusted for age, sex and ethnic group. When rates were further broken down by gender, these differences remained statistically *significant* only for girls.

Similarly, children aged 2–14 years who were living in the most deprived (NZDep06 deciles 9–10) areas were 1.72 (95% CI 1.20–2.46) times more likely to be overweight (but not obese) than children living in the least deprived (NZDep06 deciles 1–2) areas, once rates were adjusted for age, sex and ethnic group. When rates were further broken down by gender, these differences remained statistically *significant* only for boys.

Figure 5 reviews the proportion of children aged 2–14 years who were either overweight or obese by gender and NZ Deprivation Index decile in the 2011/12 NZHS.

Figure 5. Proportion of Children Aged 2–14 Years Who Were Either Overweight or Obese by Gender and NZ Deprivation Index Decile, 2011/12 New Zealand Health Survey



Source: 2011/12 New Zealand Health Survey; Note: Rates are unadjusted for age

The Youth'12 Survey

Youth'12 was the third national survey of Year 9–15 students (Years 14 and 15 are those students who are repeating Years 12 and 13) in New Zealand, with previous surveys being undertaken in 2001 and 2007. The Youth'12 sample included 8,500 students aged 13–17+ years, which was approximately 3% of the 2012 New Zealand secondary school roll [24].

Data Sources and Methods

Definitions

The proportion of secondary school students aged 13–17+ years *who were overweight or obese*

Data Sources

The data on overweight and obesity in this section is derived from *The Youth'12 Overview: The Health and Wellbeing of New Zealand Secondary School Students in 2012* [25], and its companion document the *Youth'12 Prevalence Tables* [24].

Notes on Interpretation

Survey Methodology and Sample: Youth'12 is the third national health and wellbeing survey of secondary school students in New Zealand, produced by the Adolescent Health Research Group, with previous surveys being undertaken in 2001 and 2007. The Youth'12 Survey was a random survey of composite and secondary schools. For schools with more than 150 Year 9–15 students, a random sample of 20% of the roll were invited to participate, while for schools with a roll of <150, 30 students were randomly asked to participate. Overall, 73% of invited schools took part, with 68% of students who were invited to participate agreeing to do so. This resulted in total sample of 8,500 students (3% of the 2012 New Zealand secondary school roll). Students were asked to provide their address to determine their census meshblock (NZDep 2006), and the student's height and weight was measured using standardised measurement protocols [24].

Body Mass Index: Body mass index (BMI) was calculated using measured height and weight. The percentage of students who were overweight and obese was determined using age and sex specific BMI definitions for children and adolescents, as recommended by the International Obesity Taskforce [26].

Ethnicity Reporting: The Youth'12 ethnicity question was based on the 2001/2006 NZ Census ethnicity question, which asked students which ethnic group they belonged to, with multiple responses being possible. Students who had selected more than one ethnic group were also asked "Which is your main ethnic group (the one you identify with the most)?" Possible options included "I can't choose only one ethnic group". For the purposes of comparing ethnic groups, Statistics NZ's ethnicity prioritisation methods were used [27], which reported five ethnic groups: Māori, Pacific, Asian, European and Other.

Comparison Between 2007 and 2012 Surveys

In the Youth'12 survey, 24.1% (95% CI 22.8–25.4) of students were overweight, and 12.6% (95% CI 10.1–15.1) were obese, as compared to the Youth'07 survey where 24.2% (95% CI 22.7–25.6) of students were overweight and 10.4% (95% CI 8.8–11.9) obese.

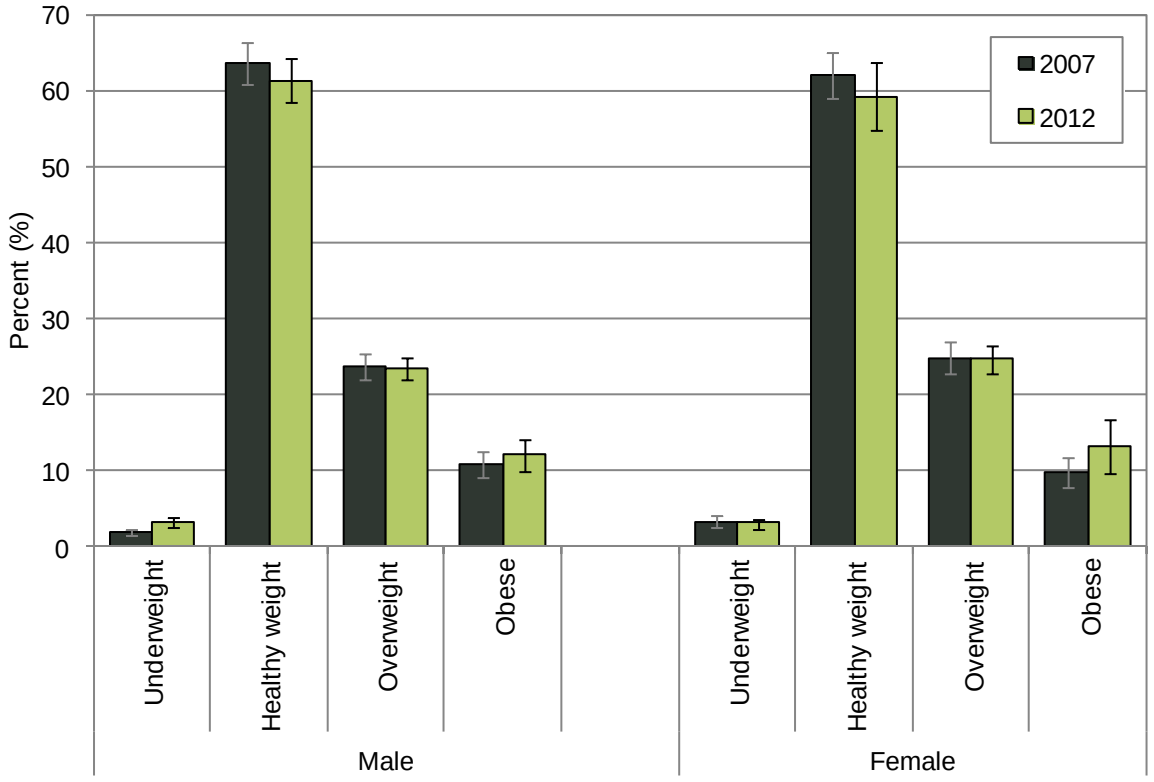
Distribution by Gender

In both the Youth'07 and Youth'12 surveys, there were no *significant* differences in the proportion of males and females that were overweight or obese. In the Youth'12 survey, 23.4% (95% CI 21.9–24.8) of males were overweight, and 12.1% (95% CI 9.9–14.2) were obese, while 24.7% (95% CI 22.8–26.5) of females were overweight, and 13.1% (95% CI 9.6–16.6) were obese (**Figure 6**).

Distribution by Age, NZ Deprivation Index Decile and Geography

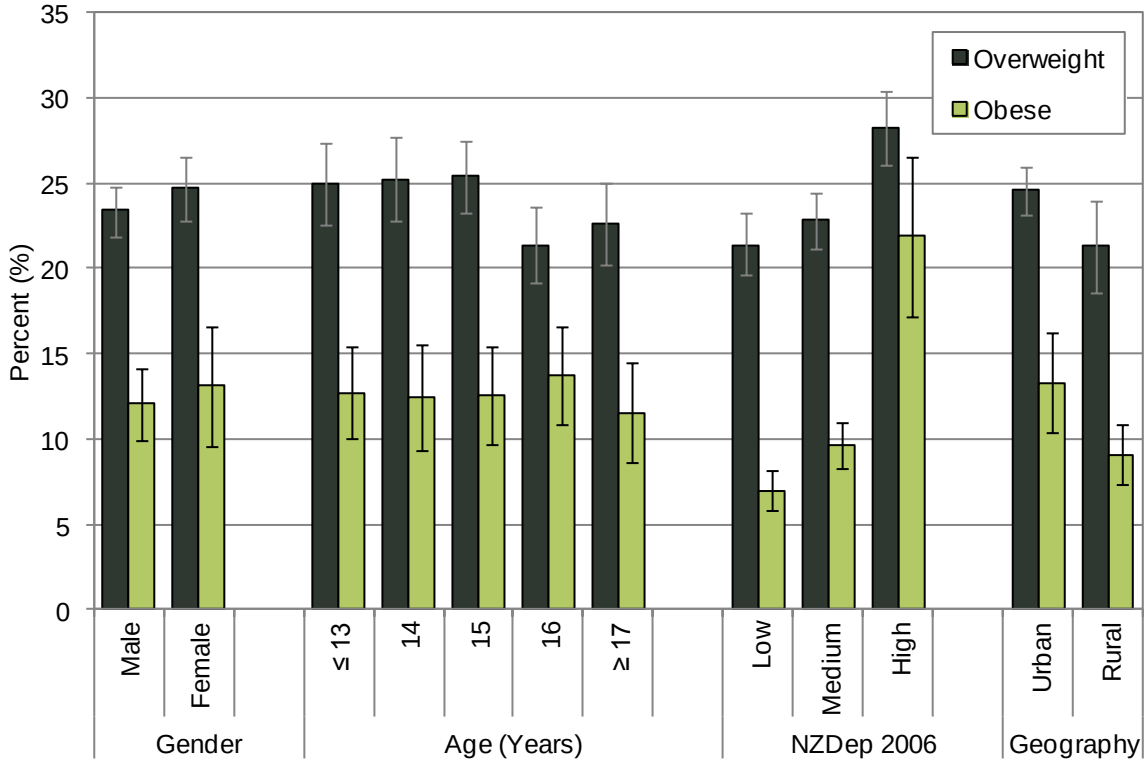
In the Youth'12 survey, there were no *significant* age differences (by single year of age) in the proportion of students who were overweight or obese. However, the proportion of students who were overweight was *significantly* higher for those from the most deprived (high=NZDep deciles 8–10) areas (28.2% (95% CI 26.1–30.4)) than for those from the least deprived (low=NZDep06 deciles 1–3) areas (21.4% (95% CI 19.6–23.3)). Similarly, the proportion who were obese was *significantly* higher for those from the most deprived areas (21.9% (95% CI 17.2–26.6)) than for those from the least deprived areas (7.0% (95% CI 5.8–8.2)). There were no *significant* rural vs. urban differences in the proportion of students who were overweight or obese. The proportion who were overweight was 24.6% (95% CI 23.2–26.0) in urban areas and 21.3% (95% CI 18.6–24.0) in rural areas. Similarly the proportion who were obese was 13.3% (95% CI 10.4–16.2) in urban areas and 9.1% (95% CI 7.4–10.9) in rural areas (**Figure 7**).

Figure 6. Proportion of Secondary School Students Aged 13–17+ Years who were Underweight, a Healthy Weight, Overweight or Obese by Gender, New Zealand Youth'07 and Youth'12 Surveys



Source: Youth'07 and Youth'12 Surveys

Figure 7. Proportion of Secondary School Students Aged 13–17+ Years who were Overweight or Obese by Gender, Age and NZ Deprivation Index, New Zealand Youth'12 Survey



Source: Youth'12 Survey; Note: NZDep2006: Low = Deciles 1–3; Medium = Deciles 4–7; High = Deciles 8–10

Local Policy Documents and Evidence-Based Reviews Relevant to Overweight and Obesity in Children and Young People

In New Zealand a number of policy documents and reviews consider the prevention and management of overweight and obesity. These are briefly summarised in **Table 1**, along with a range of guidelines and reviews which consider these issues in the overseas context.
In addition there are two in-depth topics related to Overweight and Obesity:
The Determinants and Consequences of Overweight and Obesity, and
The Treatment of Obesity in Children and Adolescents.

Table 1. Local Policy Documents and Evidence-Based Reviews Relevant to Overweight and Obesity in Children and Young People

Ministry of Health Policy Documents
Ministry of Health & Clinical Trials Research Unit. 2009. **Clinical Guidelines for Weight Management in New Zealand Children and Young People**. Wellington: Ministry of Health. http://www.health.govt.nz/publication/clinical-guidelines-weight-management-new-zealand-children-and-young-people This guideline aims to provide evidence-based guidance for the management of overweight and obesity in children and young people to those in primary care and community-based initiatives. The guidelines cover: measurement and classification; assessment; lifestyle changes following the family/whānau FAB (food, activity, behaviour) approach which involves a healthy diet; increased physical activity; decreased sedentary time, especially decreased screen time and behavioural strategies involving the whole family/whānau; dietary interventions; physical activity and exercise; family-based behavioural strategies; pharmacotherapies (orlistat) and surgery. The guideline has a particular focus on Māori, Pacific and South Asian populations.
Ministry of Health. 2003. **Healthy Eating – Healthy Action Oranga Kai – Oranga Pumau: A strategic framework 2003**. Wellington: Ministry of Health. Ministry of Health. 2003. **Healthy Eating – Healthy Action Oranga Kai – Oranga Pumau: A background 2003**. Wellington: Ministry of Health. http://www.health.govt.nz/publication/healthy-eating-healthy-action-oranga-kai-oranga-pumau-strategic-framework Ministry of Health. 2004. **Healthy Eating – Healthy Action: Oranga Kai – Oranga Pumau Implementation Plan: 2004–2010**. Wellington: Ministry of Health. http://www.health.govt.nz/publication/healthy-eating-healthy-action-oranga-kai-oranga-pumau-implementation-plan-2004-2010 Ministry of Health. 2008. **Healthy Eating – Healthy Action Oranga Kai – Oranga Pumau: Progress on Implementing the HEHA Strategy 2008**. Wellington: Ministry of Health. http://www.health.govt.nz/publication/healthy-eating-healthy-action-oranga-kai-oranga-pumau-progress-implementing-heha-strategy-2008 The Healthy Eating – Healthy Action strategic framework (Minister of Health 2003) and Implementation Plan (2004) addressed three of the New Zealand Health Strategy priorities: to improve nutrition, reduce obesity and increase the level of physical activity. The documents provide a planning tool and integrated policy framework for achieving the objectives, aimed at a variety of sectors and service providers including the Ministry of Health, District Health Boards and the Health Research Council. There are suggestions for action, milestones and progress measures in the key priority areas of lower socioeconomic groups, children, young people and their whānau (including older people), environments, communication and workplace. The background document (Ministry of Health 2003) provides the scientific evidence that underpins the Strategy. It is based on a review of the literature and extensive public consultation. It provides a summary of the issues identified in the areas of nutrition, physical activity, obesity, and includes chapters focusing on these issues for Māori, and Pacific Peoples. The progress document (Ministry of Health 2008) provides an outline of the main work streams undertaken by the HEHA Project Team between 2007 and 2008. The change of government in 2008 led to funding changes and a stocktake in 2009/2010 found that the number of HEHA initiatives had fallen to 801, from 1,254 in 2008/2009 [28].
Ministry of Health. 2006. **An Analysis of the Usefulness and Feasibility of a Population Indicator of Childhood Obesity**. Wellington: Ministry of Health. http://www.health.govt.nz/publication/analysis-usefulness-and-feasibility-population-indicator-childhood-obesity This paper provides an analysis of the usefulness and feasibility of an indicator to monitor obesity in children and young people and the effectiveness of strategies and interventions for the prevention and management of childhood obesity. It was intended as a guide for policy and funding decisions in the Ministry of Health, other government departments and District Health Boards. The report includes a literature review and consultation with experts to identify the best indicator: age-related body mass index (BMI) percentile. Ethical considerations including consent, privacy, psychosocial risks and costs are discussed and practical issues including the setting, the personnel requirements and the data collection process are described. The report concludes with a discussion of how the introduction of a systems performance indicator of obesity in childhood can contribute to the overall goal of reducing the prevalence of childhood obesity, and thus obesity and related disease in adulthood.

Ministry of Health. 2004. **Tracking the Obesity Epidemic: New Zealand 1997-2003**. Wellington: Ministry of Health. http://www.health.govt.nz/publication/tracking-obesity-epidemic

This report examined the changes in the prevalence of overweight and obesity in the total New Zealand population from 1977–2003 and for the Māori Population from 1989–2003. It uses graphical methods to visualise changes in the body mass index (BMI) distribution by age, gender, ethnicity and socioeconomic position. The data on which the report is based are derived from measurements of height and weight of adults aged 15–74 years from four national health and nutrition surveys: 1977 National Diet Survey, 1989 Life in New Zealand Survey, 1997 National Nutrition Survey, and 2002/03 New Zealand Health Survey.

Cochrane Systematic Reviews

Waters E, et al. 2011. **Interventions for preventing obesity in children**. Cochrane Database of Systematic Reviews doi:10.1002/14651858.CD001871.pub3 http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD001871.pub3/abstract

This updated review examined the effectiveness of interventions intended to prevent obesity in children, assessed by change in Body Mass Index (BMI). Fifty-five controlled trials (with and without randomisation) were included in the review, mostly targeting children aged six to 12 years. The meta-analysis (37 studies, 27,946 children) demonstrated that, overall, programmes were effective in reducing adiposity (standardised mean difference in BMI/zBMI -0.15kg/m², 95% CI -0.21 to -0.09), although not all programmes were effective and there was a high degree on unexplained heterogeneity. Intervention effects by age subgroups were: -0.26kg/m² (95% CI:-0.53 to 0.00) (0–5 years), -0.15kg/m² (95% CI -0.23 to -0.08) (6-12 years), and -0.09kg/m² (95% CI -0.20 to 0.03) (13-18 years). Eight studies reported on adverse outcomes but there was no evidence of adverse effects including unhealthy dieting or increased prevalence of underweight, or increased inequalities in health (assessed in fewer studies). The authors conclude that there is strong evidence to support targeted obesity prevention programmes, particularly those targeted at six to 12 year olds, although the heterogeneity and likelihood of small study bias means that results should be interpreted with caution. It was not possible to identify specific beneficial components but a number of promising strategies are identified including: school curriculum that includes healthy eating, physical activity and body image; increased sessions for physical activity and movement skills throughout the school week; improvements in nutritional quality of the food supply in schools; environments and cultural practices that support children eating healthier foods and being active; staff support and training; and parent support and home based activities. Further research needs to focus on how effective intervention components can be embedded in health and education systems to achieve long-term, sustainable benefits.

Oude Luttikhuis H, et al. 2009. **Interventions for treating obesity in children**. Cochrane Database of Systematic Reviews doi:10.1002/14651858.CD001872.pub2 http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD001872.pub2/abstract

This review assessed the efficacy of lifestyle, drug and surgical interventions for treating obesity in childhood. The review included 64 RCTs (5,230 participants). Lifestyle interventions focused on physical activity and sedentary behaviour (12 studies), diet (6 studies) and behaviourally orientated treatment programmes (36 studies). Drug interventions (metformin, orlistat and sibutramine) were assessed in 10 studies and there were no studies assessing surgical interventions. Meta-analyses indicated small but statistically significant reductions in overweight at six and 12 months follow up in lifestyle interventions involving children under 12 years and lifestyle interventions in adolescents with or without the addition of orlistat or sibutramine. Drug interventions trials were associated with adverse effects. The authors conclude that while there is limited quality data to recommend one treatment programme over another there is evidence to support the use of behavioural lifestyle interventions over standard care or self-help. They also suggest that the addition on orlistat or sibutramine should be considered in adolescents although sibutramine has been withdrawn since publication of the review. Orlistat is contraindicated in children under 12 years in New Zealand but can be used for 12 to 18 year old with caution (see *Clinical Guidelines for Weight Management in New Zealand Children and Young People* http://www.health.govt.nz/publication/clinical-guidelines-weight-management-new-zealand-children-and-young-people).

Other Systematic Reviews

Hendrie GA, et al. 2012. **Combined Home and School Obesity Prevention Interventions for Children: What Behavior Change Strategies and Intervention Characteristics Are Associated With Effectiveness?** Health Education & Behavior, 39(2), 159-71.

This review assessed the effectiveness of obesity prevention programmes targeting nutrition and physical activity in children, delivered in home and school/community based settings. Fifteen studies (12 RCTs, 2 quasi-experimental studies and 1 controlled clinical trial), mainly conducted in the USA and among young children, were included in the review. In view of the variety of reported outcomes, a narrative review was conducted. Seven studies were rated as effective, with significant differences between the intervention group and control group. It was not possible to assess whether ineffective studies were due to ineffective interventions or were not large enough to detect a difference. Effective studies had a median of ten behaviour-change techniques, compared with 6.5 in ineffective studies. Providing general information on behaviour-to-health links was more common in effective studies (6 out of 7) than in ineffective studies (1 out of 8). Prompting practice (i.e. rehearsing or repeating behaviour numerous times), and planning for social support or social changes (i.e. instrumental social support or prompting the person to think about how others could change their behaviour) were used in six of the seven effective studies The authors recommend family involvement in combined-setting interventions to increase the likelihood of effectiveness.

Nixon CA, et al. 2012. **Identifying effective behavioural models and behaviour change strategies underpinning preschool- and school-based obesity prevention interventions aimed at 4–6-year-olds: a systematic review**. Obesity Reviews, 13, 106-17.

This review sought to identify the most effective behavioural models and behaviour change strategies used in preschool and school-based interventions aimed at preventing obesity in four to six year olds. Twelve studies with at least six month follow-up (4 RCTs, 5 cluster RCTs and 3 controlled trials), three of which did not have full data available, were included in the review. The most commonly used model was social cognitive theory (SCT)/social learning theory (SLT) (where behaviour change is viewed as an interaction between personal, e.g. skills and self-efficacy, behavioural, e.g. modelling and rewarding/reinforcement, and environmental factors, e.g. provision of fruit). A narrative synthesis was undertaken due to study variability. Interventions that were based on SCT/SLT, that combined high levels of parental involvement with interactive school-based learning, that targeted physical activity and dietary change, and that had long-term follow-up, were most effective. The authors recommended that in addition to high parental involvement and programmes targeting both dietary and physical activity changes, interventions should also focus on developing children's (and parents') perceived competence at making dietary and physical changes. The conclusions should be interpreted with caution given that most of the data were provided by parents and carers, and were open to positive reporting bias.

Lippevelde W, et al. 2012. **Does parental involvement make a difference in school-based nutrition and physical activity interventions? A systematic review of randomized controlled trials**. International Journal of Public Health, 57(4), 673-78.

Parental involvement is widely advocated as important for school-based interventions. This review examined the effectiveness of parental involvement in school-based obesity prevention interventions in children and adolescents. Only five studies (4 cluster RCTs and 1 RCT), four of which focused on both nutrition and physical activity behaviours and one targeted physical activity in combination with alcohol use prevention, met inclusion criteria. Some positive effects of parental involvement were identified, in particular interventions which used parental modules including different strategies and addressing several home-related determinants and parenting practices concerning eating and physical activity behaviours. However, no conclusive evidence was identified concerning the added value of parent involvement, due to the paucity of studies testing this hypothesis. The authors conclude that further research, comparing interventions with and without a parental, is required.

Niemeier BS, et al. 2012. **Parent participation in weight-related health interventions for children and adolescents: A systematic review and meta-analysis**. Preventive Medicine, 55(1), 3-13.

This review assessed the effectiveness of child and adolescent weight-related health interventions with a focus on levels of parental participation. Thirty-six RCTs (7,455 participants, range six to 1,029) with 42 interventions were included in the review. Interventions included education on nutrition, physical activity or behaviour, physical activity sessions, behaviour therapy, or a combination of these. Seventeen were preventive interventions, and 25 were treatment interventions for overweight or obese children or adolescents. Ten interventions did not include parents, nine interventions provided the option for parents to participate, and 23 required parents' participation. Study quality was not reported. Interventions that required parental participation (24 interventions) had greater success than interventions with no parent participation (11 studies) (p=0.027). No significant differences in success rates were found between interventions with different age groups, prevention compared to treatment and single compared to multiple activity interventions. Among the prevention studies only, parent participation (p=0.01) and intervention duration (p=0.006) were significant positive predictors of intervention effectiveness. The authors conclude that interventions that include parental participation are likely to be more effective in reducing BMI in children and adolescents than those without.

Ho M, et al. 2012. **Effectiveness of Lifestyle Interventions in Child Obesity: Systematic Review With Meta-analysis**. Pediatrics, 130(6), e1647-e71.

This review examined the effectiveness of lifestyle interventions incorporating a dietary component on both weight change and cardio-metabolic risks in overweight/obese children. Thirty-eight controlled trials were included in the review, 33 of which had complete data for meta-analysis on weight change; 15 reported serum lipids, fasting insulin, or blood pressure. Most of the studies were conducted in children and/or adolescents aged over five years. The number of participants ranged 16 to 258 (median 72). Lifestyle interventions produced significant weight loss compared with no-treatment control conditions (12 studies, 899 participants): pooled BMI reduction 1.25 kg/m^2 (95% CI 0.32 to 2.18) and BMI z score reduction of 0.10 (95% CI 0.02 to 0.18). Studies comparing lifestyle interventions to usual care also resulted in significant immediate and post-treatment effects on BMI up to one year from baseline. Weight loss was greater when the duration of treatment was longer than six months. Significant improvements were also identified in low-density lipoprotein cholesterol, triglycerides, fasting insulin and blood pressure up to one year from baseline. No differences were found for high-density lipoprotein cholesterol. The heterogeneity of the included studies made it difficult to give definitive recommendations for practice, although a variety of components appeared to be more effective, including family involvement and a structured exercise training programme. The longer term effectiveness of interventions, particularly on cardiovascular outcomes, remains unknown.

Kesten JM, et al. 2011. **A systematic review to determine the effectiveness of interventions designed to prevent overweight and obesity in pre-adolescent girls**. Obesity Reviews, 12(12), 997-1021.

This review assessed the effectiveness of interventions aimed at preventing overweight and obesity in pre-adolescent girls. Thirty studies met the inclusion criteria (4 cluster RCTs, 14 RCTs, 11 controlled trials and 1 cohort pre–post trial), most of which were set in schools and included a combination of physical activity and nutrition components. Trials lasted at least three months and 19 lasted at least 12 months. Results for girls had to be reported separately. Data extraction for the calculation of effect sizes was possible for 21 studies. There were 66 effect sizes of less than 0.2 (no effect), 56 categorised as low, 16 as medium and two as high. While interventions (including reducing sedentary behaviours and modifying school food provision) aimed at pre-adolescent girls had potential to reduce the risk factors associated with childhood overweight and obesity, the sustainability of intervention effects was unclear and it was difficult to arrive at simple recommendations for best practice from the existing evidence.

Nguyen B, et al. 2011. **A review of electronic interventions for prevention and treatment of overweight and obesity in young people**. Obesity Reviews, 12(5), e298-e314.

This review assessed the effectiveness of interactive electronic media (CD-ROM, internet and emails, internet only and telemedicine) interventions for the prevention or treatment of obesity and/or obesity related behaviours in children and adolescents (18 years and under). Twenty-four studies of 21 interventions (11 RCTs, 5 non-RCTs and 5 other study designs) were included in the review (5,812 participants, study size from 35 to 2,840 participants). Most of the studies were conducted in the US. Among children (4 studies) three studies showed limited benefits on the prevention of obesity and one study demonstrated modest benefits of home-based internet behaviour programmes on treating obesity. Among adolescents (20 studies) six studies showed modest benefits on prevention; six studies were poor quality and did not provide adiposity outcomes, and eight studies showed benefits on treating obesity in terms of body mass index, body fat, psychosocial factors, diet and physical activity. The authors conclude that while electronic intervention appeared to show promise for prevention and treatment of obesity in children and adolescents, the results of the review should be viewed with caution due to the poor quality of studies and further research is required.

Bond M, et al. 2011. **Systematic review of the effectiveness of weight management schemes for the under fives**. Obesity Reviews, 12(4), 242-53.

This review assessed the effectiveness and cost-effectiveness of weight management schemes for the under fives. Inclusion criteria were restricted to controlled trials with objective measures, eliciting only four effectiveness RCTs for inclusion in the review. There were no treatment or cost-effectiveness studies. One trial showed a statistically significant difference between groups with significantly smaller increases in BMI in children in the intervention arm (0.48 versus 1.14; p=0.008). None of the trials reported any statistically significant differences in weight or physical activity. Although there were positive trends in weight measures these changes failed to reach statistical significance and the authors conclude the further RCTs are required. Potential important intervention features which require further assessment are identified, including cultural sensitivity, sustained moderate to vigorous exercise, active engagement of the parents in the programme and as role models of healthy living, and active engagement of the children in nutrition education.

Kelly KP & Kirschenbaum DS. 2011. **Immersion treatment of childhood and adolescent obesity: the first review of a promising intervention**. Obesity Reviews, 12(1), 37-49.

This review assessed the effect of immersion treatment (weight loss camps and residential programmes) on changes in weight status among obese children under 18 years of age. The review included 22 studies, only one of which had a control group (obese waiting list children) and five had a comparison group and only one study randomly assigned participants. Interventions lasted at least 10 days, and included controlled diet, activities, nutrition education, and therapy and/or education regarding behaviour change. Eleven programmes included long-term follow-up evaluations at four months to 3.6 years. All the studies achieved weight loss among participants, with an average reduction in per cent-overweight of 23.9% from pre- to post-immersion and 20.6% from pre-immersion to follow-up. The authors compared these results with the results of a separate meta-analysis published in 2007 of outpatient programmes targeting lifestyle changes which found reductions in per cent-overweight of 8.2% during treatment and 8.9% at follow-up [29], stating that immersion programmes produced an average of 191% greater reductions in per cent-overweight at post-treatment and 130% greater reduction at follow-up. These results should be interpreted with extreme caution given that these interventions have not been directly compared and there is no indication that the population is the same. It is also of note that both authors are employed by a company that provides immersion treatment for obese children.

Ciampa P, et al. 2010. **Interventions aimed at decreasing obesity in children younger than 2 years: A systematic review**. Archives of Pediatrics & Adolescent Medicine, 164(12), 1098-104.

This review assessed the evidence for interventions designed to prevent or reduce overweight and obesity in children younger than two years. Twelve articles representing 10 studies (5 RCTs and 7 non-randomised) were included in the review, assessing educational interventions to promote dietary behaviours or a combination of nutrition education and physical activity. Intervention durations were generally less than six months. Studies were assessed as poor or fair quality. Overall, studies found modest success in affecting outcome measures such as dietary intake and parental attitudes and knowledge about nutrition; however, no intervention improved child weight status. The authors conclude that further rigorous research is required to assess whether intervention targeting children in this age group have clinically important and sustainable effects.

Treadwell JR, et al. 2008. **Systematic review and meta-analysis of bariatric surgery for pediatric obesity**. Annals of Surgery, 248(5), 763-76.

This review assessed the effectiveness of bariatric surgery in paediatric patients. Eighteen studies were included in the review, assessing laparoscopic adjustable gastric banding (LAGB) (8 studies, 352 participants), Roux-en-Y gastric bypass (RYGB) (6 studies, 161 participants) and other surgical procedures (5 studies, 158 participants). The average age of participants was 16.8 years (range 9–21). All but one of the studies were retrospective and only one study had a (non-similar) control group, limiting the reliability of the findings. Meta-analysis indicated sustained and significant BMI at longest follow up for LAGB and RYGB but both procedures were associated with complications, which were more severe for RYGB. Three issues arising when considering bariatric surgery in paediatric patients are identified: informed consent; potential for interference with physical growth and/or sexual maturation; and compliance with postsurgical diets. Further higher quality studies, with improvements in long term data, are required.

Other Relevant Evidence

National Institute for Health and Care Excellence. 2013. **PH47 Managing overweight and obesity among children and young people: lifestyle weight management services**. London: National Institute for Health and Care Excellence. http://www.nice.org.uk/nicemedia/live/14298/65523/65523.pdf

These guidelines are intended for service commissioners and providers in the U.K. NHS, as well as health professionals and interested members of the public. They provide recommendations on lifestyle weight management services for overweight and obese children and young people aged under 18. The recommendations cover planning services, commissioning programmes, core components of lifestyle weight management programmes, developing a tailored programme plan to meet individual needs, encouraging adherence, raising awareness of programmes, formal referrals to programmes, providing ongoing support, programme staff: training, knowledge and skills, training in how to make programme referrals, supporting programme staff and those making programme referrals, and monitoring and evaluating programmes. Further details on the evidence on which the recommendations are based can be found here: http://publications.nice.org.uk/managing-overweight-and-obesity-among-children-and-young-people-lifestyle-weight-management-ph47/the-evidence-2 and here: http://guidance.nice.org.uk/PH47/SupportingEvidence .

National Health and Medical Research Council. 2013. **Clinical practice guidelines for the management of overweight and obesity in adults, adolescents and children in Australia.** Melbourne: National Health and Medical Research Council.
http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/n57_obesity_guidelines_130531.pdf

These Australian guidelines have been designed primarily for management of overweight and obesity at the individual level in primary health care. They are based on the 2010 evidence-based guideline from the Scottish Intercollegiate Guideline Network (SIGN): *Management of obesity: a national clinical guideline* as well as on systematic literature review (see below). They cover both adults and children and follow the 5As approach: Ask and Assess, Advise, Assist, Arrange. Recommendations are graded according to the SIGN grading system.

National Health and Medical Research Council. 2013. **Clinical practice guidelines for the management of overweight and obesity in adults, adolescents and children in Australia - Systematic Review**. Melbourne: National Health and Medical Research Council.
http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/n57a_obesity_systematic_review_130601.pdf

This systematic review was commissioned to inform the Australian guidelines above. It addresses two questions: What are the health outcomes associated with weight loss in individuals with overweight or obesity? and What are the impacts of weight reduction interventions on degree and duration of weight loss? The review covers literature published in English since 2007. It includes 70 systematic reviews/meta-analyses and reports of individual studies (RCTS) that had a follow up period of longer than 12 months

World Health Organization. 2012. **Population-based approaches to childhood obesity prevention**. Geneva: World Health Organization. http://www.who.int/dietphysicalactivity/childhood/approaches/en/

This report identifies a broad range of population-level actions that governments can take to prevent childhood obesity. It suggests that a comprehensive childhood obesity prevention strategy should incorporate aspects of each of the key components. The first component is the structures within government, including leadership, “health-in-all” policies, dedicated funding for health promotion, non-communicable disease monitoring systems, workforce capacity, and networks and partnerships to support childhood obesity prevention policies and interventions. The second component is population-wide policies and initiatives that help to create environments that support healthy diets and physical activity, such as regulations, taxes and subsidies, and social marketing campaigns that affect the population as a whole (or large population groups). The third component is multi-component community-based interventions, typically applied across multiple settings (including early childcare settings, schools and other community settings), tailored to the local environment and implemented locally.

White House Task Force on Childhood Obesity. 2010. **Solving the Problem of Childhood Obesity Within a Generation. Report to the President**. Washington: Executive Office of the President of the United States. http://www.letsmove.gov/white-house-task-force-childhood-obesity-report-president

In 2010 the American Academy of Pediatrics joined the White House and federal departments to launch the Let's Move initiative to reduce rates of childhood obesity. This Task Force report identifies a comprehensive set of recommendations aimed at reducing childhood obesity, based on literature reviews, and consultation with experts and the broader public. Recommendations include: getting children a healthy start in life (including good prenatal care, support for breastfeeding, quality child care and limited "screen time"); empowering parents and caregivers (improved health messages and labelling, reduced marketing of unhealthy products, improved healthcare including BMI measurement for all children); providing healthy food in schools; improving access to healthy, affordable food; and getting children more physically active. The website http://www.letsmove.gov/ has a variety of resources for families and professionals.

US Preventive Services Task Force. 2010. **Screening for Obesity in Children and Adolescents: US Preventive Services Task Force Recommendation Statement**. Pediatrics, 125(2), 361-67.

This updated statement about screening for overweight in children and adolescents from the US Preventive Services Task Force includes an examination of the evidence for the effectiveness of interventions to address overweight and obesity in children and adolescents, and the magnitude of potential harms of treatment. The Task Force concludes that there is moderate certainty that the net benefit is moderate for screening for obesity in children aged six years and older and for offering or referring children to moderate- to high-intensity interventions (>25 hours of contact with the child and/or the family over a 6-month period) to improve weight status. There was not sufficient evidence to support screening children under the age of six and no evidence was found regarding appropriate intervals for screening. There is adequate evidence that the harms of behavioural interventions are no greater than small and harms of screening were judged to be minimal. The net benefit of screening was judged to be at least moderate.

National Institute for Health and Clinical Excellence. 2006. **Obesity: guidance on the prevention, identification, assessment and management of overweight and obesity in adults and children**. London: National Institute for Health and Clinical Excellence. http://publications.nice.org.uk/obesity-cg43

These evidence-based guidelines include a systematic literature review examining the management of obesity in children (available at http://guidance.nice.org.uk/CG43/Guidance/Section/5a/pdf/English). Multicomponent interventions that include behaviour change strategies to increase physical activity levels or decrease inactivity, improve eating behaviour and dietary intake, are identified as the treatment of choice in clinical care. Recommendations for children include: addressing lifestyle with the family; using BMI, adjusted for age and gender, as a practical estimate of overweight, but interpreted with caution as it is an indirect measure of adiposity; and consideration of referral to specialist service for children with significant comorbidity or complex needs.

Foresight. 2007. **Tackling Obesities: Future Choices – Project Report**. 2nd Edition. London: Government Office for Science, Department for Business, Innovation and Skills. http://www.bis.gov.uk/foresight/our-work/projects/published-projects/tackling-obesities/reports-and-publications

This UK Government Foresight Programme report sought to examine how society might deliver a sustainable response to obesity in the UK over the next 40 years. The report includes an evidence-based review to identify the broad range of factors that influence obesity and identify effective interventions, an examination of the relationships between key factors influencing levels of obesity and their relative importance, and an analysis of future levels of obesity and the most effective future responses. Given that once gained, weight is difficult to lose, the report focuses on prevention. Behaviour change, changing the environment, changing biology (e.g. through promoting breastfeeding) and the role of technology are examined. The report concludes that evidence-based evidence supports the need for a substantial degree of intervention to affect an impact on the rising trend in obesity. It identifies a case for a national debate on the appropriate level for policy intervention and the apportioning of responsibility. Five core principles are identified: a system-wide approach, redefining the nation's health as a societal and economic issue; higher priority for the prevention of health problems, with clearer leadership, accountability, strategy and management structures; engagement of stakeholders within and outside Government; long-term, sustained interventions; and ongoing evaluation and a focus on continuous improvement.

Note: The publications listed were identified using the search methodology outlined in Appendix 1 (Search Methods for Policy Documents and Evidence-Based Reviews)

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