National SCIENCE Challenges

A BETTER START

E Tipu e Rea

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Brief Evidence Reviews for the Well Child Tamariki Ora Programme

Report submitted to MoH on 11 December 2019

Whakapūpūtia mai ō mānuka,
kia kore ai e whati

Cluster the branches of the manuka,
so they will not break

Foreword

The Ministry of Health is responsible for the development of policy advice on children's health and the future direction of the Well Child Tamariki Ora (WCTO) programme. The WCTO programme is the universal health service in New Zealand, which is responsible for protecting and improving the health and wellbeing of children from birth to 5 years of age. This is achieved through health and development screening and surveillance, whānau care and support, and health education.

The current programme is based on the evidence available at the time of the last programme update in 2007. Therefore, the Ministry of Health is reviewing the current WCTO Framework and associated Schedule (developed in 2002) to ensure that WCTO services meet the current needs of children and their whānau, and address the issues they face. The present review was initiated in 2019 and is the second review of the programme, as the first was carried out in 2006. In preparation for this review, the Ministry of Health has commissioned an evaluation of the recent literature on some of the new and emerging issues for preschool children, as well as possible ways to address them.

The purpose of this review includes ensuring that the programme is underpinned by the latest research and evidence. This is particularly pertinent to the current Schedule of Universal Contacts delivered, and one of the work-streams of the review is to consider the timing, content, and intensity of the Schedule, and associated additional contacts. This work stream will support the development of an integrated framework of universal wellbeing contacts for the pregnancy to 24 years of age life course.

The Ministry of Health require the brief evidence reviews (BERs) to synthesise relevant evidence about what works in key areas for children, including development, vision, hearing, emotional and mental health, and growth. The BERs adopted the He Awa Whiria – Braided Rivers approach and include consideration of what will work for Māori tamariki and whānau, and Pacific children and families within each domain. The BERs have helped to identify any knowledge gaps where further work and research may be needed, to inform further development of the WCTO programme.

The WCTO review is a key health contribution to the Government's Child and Youth Well-being Strategy. It forms part of the Ministry of Health's work programme to transform its approach to supporting maternal, child, and youth well-being.

The Ministry of Health have commissioned A Better Start: E Tipu E Rea National Science Challenge to undertake 11 health related BERs that will inform the WCTO review and decision making on the future core service schedule, and additional health and social services for children in New Zealand. The aim of the BERs is to ensure that decisions are grounded in, and informed by, up-to-date evidence. BERs are intended to synthesise available evidence and meet time constraints of health care decision makers. Internationally health technology agencies have embraced rapid reviews, with most agencies internationally offering these alongside standard reviews. These 11 BERs that we have conducted have been performed in a very short time which was a very challenging task.

A Better Start is a national research programme funded by the Ministry of Business Innovation and Employment (MBIE). The objective of A Better Start is to improve the potential for all young New Zealanders to lead a healthy and successful life. To achieve this, A Better Start is researching methods and tools to predict, prevent, and intervene so children have a healthy weight, are successful learners, and are emotionally and socially well-adjusted. A Better Start consists of more than 120 researchers across 8 institutions.

The BERs cover 11 domains critical to the WCTO programme, which are: neurodevelopment (#1); parent-child relationships (#2); social, emotional, and behavioural screening (#3); parental mental health problems during pregnancy and the postnatal period (#4); parental alcohol and drug use (#5); excessive weight gain and poor growth (#6); vision (#7); oral health (#8); adverse childhood experiences (#9); hearing (#10); and family violence (#11). The BERs have synthesised relevant evidence about what works in key areas for children across these domains, which were assessed with careful consideration of what will work for Māori tamariki and whānau and Pacific children and families. They have also identified knowledge gaps where further work and research may be needed to inform further development of the WCTO programme.

Within each domain, a series of 6–14 specific questions were drafted by the Ministry of Health, and subsequently refined with input from the large team of researchers assembled by A Better Start. A Better Start established discrete writing teams to undertake each BER. These teams largely consisted of a post-doctoral research fellow and specialty expert, often in consultation with other experts in the field. Subsequently, each BER was peer reviewed by at least two independent experts in the field, as well as two Māori and a Pacific senior researcher. In addition, senior clinical staff from the Ministry of Health have reviewed each BER. These were then revised to address all the feedback received, checked by the editors, and finalised for inclusion in this report.

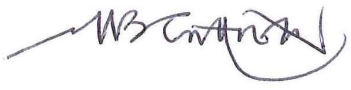
Whilst each of these domains are reviewed as discrete entities, there is considerably inter-relatedness between them. In particular, neurodevelopmental problems can be impacted by parent-child relationships, parental mental health, and pre- and postnatal drug exposure. Similarly, children who have problems with growth, vision, or oral health may also have neurodevelopmental disorders.

Most of the evidence available for these BERs comes from international studies with limited data from New Zealand, in particular there is limited information about Māori, Pacific, and disadvantaged families. These are the tamariki and whānau in whom the WCTO Programme services are more scarce, yet could potentially offer the greatest benefit.

The criteria for screening include the requirement for an effective and accessible intervention; the corollary is that screening should not be offered if there is no benefit to the individual being screened. The essential issue is therefore to identify those infants and preschool children and their whānau who would have better outcomes following intervention; this includes better outcomes for the whānau.

The current WCTO programme has had a greater emphasis on surveillance rather than screening. Many of the questions in the BERs address screening. A change in the WCTO programme that further extends into screening will require substantial upskilling of many WCTO providers, as well as redirection of resources. Importantly, Māori and Pacific iwi and community views must be considered before any new screening programmes are to be included.

It should be noted that a shift towards screening rather than surveillance may prevent health and behavioural problems. The economic benefits of prevention and early intervention are well documented, with early interventions showing that for every dollar spent there are substantial savings to health, social services, police, and special education resources.



Professor Wayne Cutfield
Director of A Better Start National Science Challenge
On behalf of the editors, authors and reviewers of the brief evidence reviews

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6 Excessive weight gain and poor growth

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Disclaimer

This brief evidence review was commissioned by A Better Start National Science Challenge (the Challenge) on behalf of the New Zealand Ministry of Health. It was prepared over a relatively short time based on the evidence available to the authors at the time of its preparation. The authors have made considerable efforts to perform a comprehensive and balanced evaluation of the existing evidence. However, this brief evidence review cannot be considered an exhaustive analysis of the existing peer-reviewed and grey literature on the topic, and it may not reflect the potentially conflicting views of all experts in the field. There could have been important omissions, and additional evidence might have also come to light since completion of this final draft. Thus, this brief evidence review should be considered with the appropriate caution. A previous version of this document was peer-reviewed by Māori and Pacific researchers and by independent experts in the field. Peer reviewers were anonymous, unless they have otherwise been identified by name. Please note that this brief evidence review does not represent the views of the Challenge or the Ministry of Health; rather, it reports the independent conclusions of the listed authors.

Conflicts of interest: L Daniels has no conflicts of interest to declare. BJ Taylor and WS Cutfield are well known researchers in the area of child growth, so L Daniels conducted the initial literature search for this report to reduce any bias on the inclusion of their published work.

Abbreviations

B4SC	B4 School Check
BMI	Body mass index
ISS	Idiopathic short stature
NZ	New Zealand
SDS	Standard deviation score (identical to z-score)
WCTO	Well Child / Tamariki Ora
WHO	World Health Organisation
WHtR	Waist-to-height ratio

Definitions

Early childhood – young children between 0 and 5 years of age

Growth – for the purpose of this report "growth" includes measures of weight and linear growth

Major centile line – the space between major percentile lines (such as between the 25^{th} and 50^{th} percentiles) that represents a change of two thirds of a standard deviation (or 0.67 of a SDS)

Obesity – refers to children who are classified as obese only

Overweight – refers to children who are classified as overweight only

Overweight and obesity – refers to children who are classified as overweight and/or obese

Summary

The aim of this review was to summarise the current evidence regarding the prevalence, long-term adverse outcomes and effective interventions for poor (underweight and short stature) and excessive (overweight and obesity) growth in early childhood (0-5 years), as well as summarizing the assessment tools and harms of growth screening in this age group.

Current evidence suggests that while the prevalence of obesity in New Zealand pre-school children appears to be declining slightly, there remains a large proportion of children who are considered obese. This is a concern due to the growing evidence for increased health risks into adulthood from childhood obesity. Recent concerns are also expressed regarding rapid weight gain trajectories, which are reported to also be associated with negative health outcomes later in life. The prevalence of underweight is much lower than for overweight and obesity in New Zealand children, and appears to have remained stable over time. It is unlikely that the prevalence of short stature has recently changed, but the number of children treated with growth hormone suggests recognition and treatment of children with short stature, if anything, is improving.

There is a need for improved recognition of excessive weight gain throughout the Well Child / Tamariki Ora (WCTO) setting to enable early detection and prevention of the development of an unhealthy weight. The key recommendations from this review which are based on current evidence are: 1) the use of BMI alongside weight and length/height growth charts for *all* children (birth to 5 years), for the identification of abnormal growth and the prevention of obesity, 2) develop, and require all WCTO providers to use a standardized protocol for clothing worn during weight measurements in the cooler months, and 3) provide appropriate interventions following a positive growth screen for *all* children, to prevent any long-term adverse outcomes.

Aim

The aim of this review is to summarise the current evidence for growth / obesity screening and surveillance in early childhood (birth to 5 years).

Review approach

A literature search was performed in the following databases: Cochrane, Medline (Ovid), PubMed and Google Scholar, with a focus on articles published between 2006 and September 2019. The search was conducted using various combinations of the terms: *young children, infant, child, Pacific, Māori, growth, weight, body mass index, overweight, obesity, adiposity rebound, underweight, failure to thrive, faltering, abnormal, rapid gain, linear, short stature, trajectories, screening, monitoring, surveillance, harm, view, belief, practice, intervention, prevention, treatment, management,* using Boolean operators: AND and OR. Key references from identified articles were also included, where appropriate. Literature was prioritised by *type*: 1) Meta-analyses, 2) Systematic reviews, and 3) Other key papers with methodological rigour; *country*: 1) New Zealand, 2) Australia, Canada, United Kingdom, United States, Europe, and the OECD; and *age range*: 1) Birth to 5 years, 2) >5 years. The search was limited to studies published in English.

6.1 Early childhood prevalence (ages 0-5 years)

6.1.1 Overweight and obesity

From the New Zealand (NZ) Health Survey, the prevalence of those overweight and/or obese has not changed in children aged 2-14 years over time between 2011/12 and 2018/19 (Table 6.1).

Table 6.1. Unadjusted prevalence of overweight and obesity in New Zealand children over time

	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
Overweight (%)[a]								
2-4 years	21.4	23.6	21.4	20.0	21.6	21.4	20.3	21.3
All: 2-14 years	21.1	21.7	23.2	21.7	21.2	21.2	19.8	19.8
Obese (%)[b]								
2-4 years	10.0	10.4	7.8	9.5	6.6	9.6	10.0	7.8
All: 2-14 years	10.7	10.5	9.9	10.8	10.2	11.3	11.5	11.3

Source: New Zealand Health Survey data[1].
[a] Overweight was classified as the equivalent of an adult BMI of between 25 and 29.9 kg/m^2 using IOTF standards[2].
[b] Obesity was classified as the equivalent of an adult BMI of ≥30 kg/m^2 using IOTF standards[2].

From a larger national dataset (collected as part of the NZ B4 School Check (B4SC) programme), the prevalence of both overweight and obesity in 4-year-olds between 2010 and 2016 shows a downward trend (by 2.2% and 2%, respectively) after making adjustments for sex, ethnicity, deprivation and area (Table 6.2)[3]. Worldwide rates of childhood obesity have also reported to have plateaued in high-income countries[4]. The obesity prevalence of very young children (<2 years) is unknown, because classification using BMI is not currently recommended for this age group.

Table 6.2. Prevalence of overweight and obese 4-year-old New Zealand children over time

	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Overweight or obese (%)[a]	35.0	34.3	33.5	33.3	33.6	32.8*
Obese (%)[b]	16.9	16.1	15.6	15.3	15.5	14.9**

Source: Shackleton et al. (2018)[3].
[a] Overweight or obese was classified as BMI-for-age ≥85th percentile (includes obese and extremely obese), using WHO standards.
[b] Obesity was classified as BMI-for-age ≥95th percentile, using WHO standards.
** Significant decreased trend between 2010/11 and 2015/16: RR = 0.989; 95% CI = 0.988-0.990 per year.*
*** Significant decreased trend between 2010/11 and 2015/16: RR = 0.979; 95% CI = 0.977-0.980 per year.*

Overall, the prevalence of obesity was highest for Pasifika and Māori children reported in the NZ Health Survey from 2018/19 and the B4SC during the 2015-2016 fiscal year (Table 6.3).

Table 6.3. Prevalence of obesity in New Zealand children, by ethnicity

Obesity (%)	European	Pacific	Māori	Asian
2-14 years[a]	8.2	28.4	15.5	9.9
4 years[b]	12.7	30.2	20.0	8.1

[a] New Zealand Health Survey data; obesity was classified as the equivalent of an adult BMI of ≥30 kg/m^2 using IOTF standards[2].
[b] Shackleton et al. (2018)[3]; obesity was classified as BMI-for-age ≥95th percentile, using WHO standards.

Differences in obesity prevalence between Māori and New Zealand European and other (NZEO), and Pacific and NZEO has been reported to be significantly influenced by the socio-economic position of the family and area of deprivation level[5].

Rapid weight gain is common in NZ preschool children. In the Prevention of Overweight in Infancy (POI) study, 351 (54%) of 678 children were considered to have abnormally rapid BMI increase between 6 and 24 months of age and of these, 148 (23%) were considered to be extremely rapid[6]. Rapid increase and extreme rapid increase in BMI was assessed and defined as a change in BMI Standard Deviation Score (SDS) greater than 2/3 and 4/3, respectively[6]. Forty percent of the children had a BMI $\geq 85^{th}$ percentile at 2 years of age[6].

6.1.2 Underweight

From the NZ Health Survey, the prevalence of underweight (thin) children aged between 2-14 years has remained stable between 2011/12 and 2018/19 (Table 6.4).

Table 6.4. Unadjusted prevalence of underweight over time in New Zealand children

	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
2-4 years (%)	3.7	7.2	7.0	5.2	4.6	5.0	6.4	6.6
All: 2-14 years (%)	4.0	4.8	4.3	4.4	4.3	4.2	4.5	4.8

Source: New Zealand Health Survey data[1].
Underweight was classified as the equivalent of an adult BMI of ≤18.5 kg/m2 using IOTF standards[2].

The larger numbers available from the B4SC suggests that the prevalence of underweight/possible undernutrition (BMI-for-age below the 2^{nd} percentile) has remained stable between the 2012 and 2016 period (0.71%; 0.55%; 0.61%; 0.60%; 0.52%, for 2012 to 2016 respectively)[7].

6.1.3 Short stature

The NZ Health Survey data does not report prevalence of short stature, only mean height[1]. A crude guide to the prevalence of marked short stature receiving clinical attention is reflected in the number of children treated with growth hormone for a growth disorder. Treatment is for children with growth hormone deficiency or a disorder characterised by short stature, including extreme short stature (height SDS <-3). During 2017/18, 336 children (<18 years of age) received growth hormone treatment for a growth disorder (Table 6.5). Of these, the majority (*n*=156) of cases were for the treatment of growth hormone deficiency (Table 6.6). The number of growth hormone treated children has increased by 30% over the past 10 years (Table 6.5) and this is largely attributed to increased numbers of treated children with idiopathic short stature (height SDS <-3). During this period, it is unlikely that there has been a decrease in childhood growth rates and adult stature. It is far more likely there is greater awareness and concern in families about short stature leading to referral for short stature assessment and management.

Table 6.5. Growth hormone (somatropin) dispensing over time in New Zealand children (<18 years)

	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
Total (n)	240	244	256	281	275	296	296	307	336

Source: PHARMAC[8].

Table 6.6. Indication for approval of growth hormone (somatropin) dispensing in New Zealand children (<18 years) between 2014/15 and 2017/18

Indication (n)	2014/15	2015/16	2016/17	2017/18
Growth hormone deficiency	130	140	146	156
Short stature without growth hormone deficiency	87	98	109	114
Turner syndrome	52	48	40	46
Prader-Willi syndrome	32	31	35	34
Specific pre-approval	7	12	12	13
Short stature due to chronic renal insufficiency	10	10	7	9
Exceptional circumstances	2	5	5	5

Source: PHARMAC[8].
Note: Approval may occur under more than one indication, leading to double counting.

6.1 Summary

The prevalence of overweight and obesity in NZ children is high (21.3% and 14.9%, respectively) but in 4-year-old children appears to have declined over the past 5-6 years. The prevalence of underweight is much lower (6.6%) and appears to have remained static over the past 5-6 years. Of note is the high prevalence of rapid and extremely rapid infancy BMI growth trajectories in a NZ study. Although it is unlikely that the prevalence of short stature has changed in recent decades the prevalence of those treated with growth hormone for marked short stature has increased by 30% over the past 10 years.

6.2 Long-term adverse effects

6.2.1 Overweight and obesity

It is well known that childhood obesity is associated with obesity during adolescence and adulthood[9] and that later reversal of obesity through interventions is difficult[10,11]. There is now also a large body of evidence describing the adverse consequences of childhood overweight and obesity on adult morbidity and mortality. Systematic reviews of evidence have reported that childhood overweight and obesity increases the risk of poor cardiovascular health (diabetes, hypertension, ischaemic heart disease, and stroke), a range of cancers, and premature mortality[12,13]. This now includes an increased incidence of childhood asthma[14].

While there has been a worldwide focus on BMI centiles and cut-offs for determining overweight and obesity, these measures are arbitrarily defined. More recent work suggests that a BMI even within the "normal" range (50th-74th percentiles) during adolescence is associated with increased mortality in adulthood[15]. While the data is limited to adolescence, it suggests that there is an important increased risk of mortality across the spectrum of higher BMI (≥50th percentile), not just those classified as overweight and obese (≥85th percentile) through cut-offs.

6.2.2 Underweight

There are many terms used to define underweight in young children, including: 'failure to thrive', 'faltering growth', 'growth faltering', or 'weight faltering'. Data from a meta-analysis showed that infants classified as having failure to thrive had poorer cognitive outcomes than control infants[16], which has been shown to continue into later childhood[17]. Failure to thrive is also associated with short stature in late childhood[18].

6.2.3 Short stature

Early studies reported behavioural, cognitive and socialization issues among short children [19,20], which led to the justification of treating markedly short healthy children with growth hormone (to promote greater adult height and therefore improved well-being). However, these early findings are not supported in more recent population studies[21]. A summary of the current evidence is that many studies of children with short stature report lower IQ's compared with control children[22], although it is unknown if this is causative. It is possible that these findings may not be clinically relevant as the lower IQ's are still reported to be within the normal range and short children are more likely to have other health and learning problems[22]. There is limited evidence for any physical limitations related to short stature, other than in some competitive sports[22].

Poor linear growth is a non-specific marker for underlying conditions (medical conditions, hormone deficiencies, genetic disorders and medications). An unrecognised chronic illness may lead to poor linear growth and ultimately short stature. For example, poor linear growth is a common presentation of coeliac disease which occurs two years before clinical diagnosis in 57% of girls and 48% of boys[23].

6.2.4 Sustained rapid weight gain

Crossing upwards two or more major centile lines (CDC growth charts) for weight-for-length between birth and 24 months of age is associated with a high prevalence of obesity at ages 5 and 10 years, with the highest risk being when this occurs in the first 6 months of life and for infants starting between the 75th and 90th percentiles[24]. The association between rapid weight gain and the development of childhood obesity has been well researched and consistently reported in meta-analyses and systematic reviews[25-27]. In a NZ study of Pasifika children, early rapid weight gain (increased weight SDS trajectories) from 2.5 years to 14 years of age was associated with measures of metabolic risk (including high insulin, cholesterol, blood pressure and abnormal liver function) at age 14 years, and risk of metabolic syndrome[28].

It has been consistently reported that rapid weight gain in infancy (up to 2 years) is related to obesity risk later in life[29]. Increased weight velocity from 1 year of age, and between 9 months and 5 years of age are predictors of adult BMI, waist circumference and abdominal diameter[30]. Similarly, higher BMI growth trajectories (ascending 50th-75th and 97th percentiles) between birth and 10 years of age were reported to be associated with higher adult BMI and waist circumference[31].

While the trajectory of rapid growth has generally been the focus of attention, a systematic review reported that while rapid BMI growth trajectories were significantly associated with higher adult body measures, similar findings were reported for children with stable high BMI trajectories (e.g., stable 75th percentile tracking), therefore, it is possible that outcomes in the long-term may be similar for high steady BMI trajectories as is for rapid BMI trajectories[32].

BMI percentiles decline after infancy and then rise between the age of 3 and 7 years until adulthood. Adiposity rebound (AR) is defined as the nadir or the inflexion point of BMI percentiles with age. An early adiposity rebound is associated with overweight and obesity in adulthood[33]. The mean age of an early adiposity rebound (in obese subjects) occurs around 2-3 years of age, as opposed to 6 years, and is the result of faster gains of fat mass[34], and is associated with later insulin resistance and coronary heart disease[33].

6.2.5 Risk factors for childhood obesity

There is growing evidence for the impact of maternal characteristics on a child's weight/BMI trajectory, including the development of childhood obesity. Systematic reviews have reported several maternal and infant factors which are associated with the development of childhood obesity[27,32].

There is strong evidence for maternal factors associated with the development of childhood overweight or obesity that include: higher pre-pregnancy BMI, excess gestational weight gain and tobacco use during pregnancy[27,32]. Also, accelerated weight gain in infancy and larger birth weight were associated with an increased risk of overweight and obesity in childhood[27,32]. Other important factors with fewer supporting studies are: gestational diabetes, low socio-economic status, and childcare attendance, with some other potentially modifiable factors such as: shorter infant sleep, inappropriate bottle use, and antibiotic use in infancy[27]. An observational study by Carling et al.[35] also reported in a risk analysis that greater duration of any breastfeeding (>4 months compared with <2 months) was beneficial in reducing the odds of rapid weight gain in their infant[35]. Although, evidence from a systematic review of 49 breastfeeding studies suggests that the impact of breastfeeding on childhood overweight is inconsistent[27], which may be a result of differences in defining breastfeeding status (e.g., partial, exclusive, predominant etc.) or other mediating factors not assessed in these studies. A NZ study found that less rapid early infant weight gain (between 0-9 months) was a mediating factor in the association between longer duration of breastfeeding and lower BMI in adulthood[36].

6.2 Summary

There is growing evidence for the increased risk of adverse effects in adulthood across the spectrum of higher BMI (>50th percentile), not just those who are overweight or obese. Also, children with rapid weight gain may have similar long-term outcomes as those with stable high weight. Long-term negative effects of underweight/failure to thrive is a poorer cognitive outcome and an association with short stature in later childhood. While there is limited evidence for the long-term physical implications of short stature, poor linear growth may be an early feature of unrecognised chronic disease, in which early detection could improve health outcomes.

6.3 Suitable assessments and tests for growth and obesity screening/ surveillance during childhood

The approach to the measurement of growth for screening/surveillance should be equivalent to those used to establish the growth charts[37]. Measurements of weight, length/height, head circumference and the calculation of BMI are the most common assessment methods of growth used in young children. Best practice is to take two measurements and then if these differ by more than 0.5 cm for height/length, 0.5 kg for weight, or 1 cm for waist circumference then a third measurement should be taken. The final measurement reported should be the average of the two closest measures[37,38]. The

measurement protocol used within the Well Child context in NZ is reported in the Practitioner's Handbook[38].

6.3.1 Weight

Measurement of weight requires an electronic scale on a firm surface. Weight should be taken naked for infants and children under 2 years. After 2 years of age children should be measured in light clothing only. Weight and BMI measures collected as part of the B4SC are reported to be higher than those collected for research purposes[39]. Weight measurements were recorded to be significantly higher (mean of 0.45 kg heavier) during colder temperatures and therefore subsequent BMI was also higher (mean of 0.41 kg/m^2 greater)[39]. The authors recommend that standardized protocols for subtracting an average clothing weight from the child's weight would help to improve the accuracy of the measurement, particularly during the cooler months. Weight scales should be regularly calibrated to ensure they are reading accurately.

6.3.2 Length (<2 years) and height (>2 years)

Imprecision of the measurements for length and height is high and attention to detail and adherence to protocols is required to obtain accurate measurements. Supine length measurement is performed to two years of age and requires a properly calibrated length board. Footwear and clothing (including a nappy) should be removed before measuring the infant. Standing height is performed on children >2 years of age and should be conducted using a rigid stadiometer placed upon a hard surface. Children should stand with their back to the stadiometer and head in the Frankfort Plane. Shoes, heavy clothing and any hair equipment that could interfere with the measurement should be removed prior. Stadiometers should be regularly calibrated.

6.3.3 Waist circumference

Waist circumference is not commonly assessed in the primary care setting. However, there is some evidence to suggest a waist circumference measurement alongside BMI may be beneficial for identifying children in need of further investigation for cardiometabolic risk[40], which may be more beneficial at the secondary care level. It is important that the waist measurement protocol is standardized as there are differing methods for measurement. The most appropriate method is to find the approximate mid-point between the top of the iliac crest and the lower margin of the last palpable rib, with arms relaxed at the sides, and without clothing[41]. Using a measuring tape, the measurement should be read at the end of the child's normal expiration[41].

6.3.4 Waist-to-height

The waist-to-height ratio (WHtR) (calculated as: waist circumference (cm) divided by height (cm)) is an emerging screening tool for cardiometabolic risk[40]. It is a valuable tool for identifying abdominal adiposity which is a risk factor for metabolic syndrome[42]. A recent study found that 55% of Swedish 5-year olds, with a normal BMI, had a WHtR $\geq$0.51 (recommended cut-off for abdominal obesity is 0.5)[42]. Therefore, when using BMI alone these children with elevated WHtR would be missed.

6.3.5 BMI

BMI is considered to be the best screening tool to identify overweight and obese children. There are several ways BMI can be reported: BMI, BMI percentage, BMI SDS, or BMI centile[43]. Currently, in the NZ

Well Child / Tamariki Ora (WCTO) setting BMI is assessed by BMI centile, which is calculated using the child's height and weight centiles and plotted appropriately on the growth chart[38], although knowledge of whether this practice is done on a regular basis through all WCTO visits is unknown. The BMI centile approach is reported to be accurate as it does not require the direct calculation of BMI[44] and has been reported to be successfully used amongst United Kingdom (UK) public health nurses[45]. However, it is important to note that while a single BMI centile measurement is useful for determining adiposity, it is not suitable for measuring change in adiposity[43].

In a recent study, BMI (using BMI SDS) was shown to be a better predictor of obesity than the emerging WHtR and therefore may be appropriate for use in clinical practice for identifying children who are overweight or obese[40]. Converting BMI to an SDS allows for changes in BMI to be tracked overtime as they are calculated relative to the age and sex of the child[46]. However, some care should be taken if using BMI SDS to track progress over time in obese children due to the compression effect of high SDS occurring above the 95th percentile[47,48]. This has led to a recommendation in the United States of America (USA) of using an alternative method of tracking which expresses BMI either as a percentage of the 95th percentile, or the difference from the 95th percentile, for these children[47]. Other suggestions have been made that would be suitable for use in electronic growth charts[49].

Alternative methods for assessing adiposity in children that are more accurate such as dual energy x-ray absorptiometry (DXA)[50,51] are not practical at the population level for screening due to the cost. DXA can also provide a measure of abdominal fat.

6.3 Summary

Due to findings of higher weight and BMI measurements during the cooler months of the year, standardized protocols should be developed for calculating and adjusting for clothing in the clinical setting. There is growing evidence for the use of WHtR for assessing cardiometabolic risk. The use of a single chart for tracking BMI SDS during childhood (0-5 years) should be considered in the WCTO setting. However, some discussion is required around the use of percentage above the 95th percentile for children who are being followed over time with a high BMI.

- ***Standardized protocols for subtracting clothing weight worn during weight measurements in cooler months will improve measurement accuracy in the primary care setting [grade C].***
- ***There is limited evidence for use of the waist-to-height ratio to screen for cardiometabolic risk in the primary care setting [grade I].***
- ***Screening and tracking BMI may be feasible in primary care settings in NZ to support decision-making for further assessment and intervention [grade B].***

6.4 Optimal ages to assess and identify abnormal growth trajectories

Measures of weight and length/height should be conducted and plotted at all WCTO visits so identification of any abnormal growth (both height and weight) can be detected and managed in a timely manner. Regular growth measurement up to 5 years of age is important for the early detection of any growth concerns[52]. Inadequate growth may be a sign of a medical concern and therefore early detection is beneficial and warrants a referral for further investigation[53].

6.4.1 BMI

The use of BMI as a measure of nutritional status for those under 2 years is being debated[54], however it is probably superior to using weight-for-length[51,55] (described in Section 6.4.2). BMI is reported to be better at predicting both later obesity[56], and current body composition compared with weight-for-length measures at 1-2 months of age[57,58]. Certainly, over the age of 2 years BMI gives a useful indication of overweight or obesity.

BMI assessed in early childhood is predictive of overweight and obesity by 5 years of age[40]. Specifically, BMI SDS at 0-1 months and change in BMI SDS between 0-1 to 12 months and 18 to 48 months has been shown to be predictive of overweight or obesity at age 5 years[40]. Other research has also supported the assessment of early BMI trajectories (before the age of 6 years) for the prevention of obesity[47,55,56,58,59].

In the United States, BMI centiles are only assessed in approximately half of children during Well Child visits after 2 years of age[60], while we do not have NZ specific data on this, it is likely that the same would be found in our population, especially considering primary care electronic systems do not have BMI charts loaded, including Plunket's ePHR system (K Morrissey, personal communication 2019). This may lead to a missed opportunity of identifying children at risk of obesity before becoming obese. The American Academy of Pediatrics recommend plotting BMI on growth charts annually for children 2 years of age and older[61].

6.4.2 Weight-for-length

While the World Health Organisation (WHO) recommends the use of weight-for-length for screening under and over nutrition in children under 2 years of age[62], recent work suggests that BMI use in under 2-year olds is more predictive of obesity than weight-for-length[57].

6.4 Summary

There is a need for improved BMI tracking (at every WCTO visit) and implementation of BMI growth charts in the primary care setting (made available to all WCTO providers). The type of BMI chart (centiles, SDS, or other) for implementation requires further discussion. Although still under debate, the use of BMI in very young children (<2 years) would be beneficial for identifying rapid weight gain for the prevention of obesity.

- ***Screening and tracking BMI may be feasible in primary care settings in NZ to support decision-making for further assessment and intervention [grade B].***

6.5 Follow-up assessments after identification of abnormality

6.5.1 Short stature or sustained poor growth

In general, any child with measurements of length/height that are below the 2nd percentile[38] or that cross downwards over a major centile line on the WHO growth chart over at least a 6 month period after the first year of life, should undergo a clinical review and possible referral to secondary care services. These children are more likely to have an underlying disorder affecting growth and less likely to have normal variant short stature (familial short stature or constitutional delay of growth and development)[63]. Children with normal variant short stature display a slow growth rate until about a year

of age, after which the child's growth rate becomes normal. Also, for weight, a referral to secondary care is warranted when a consistently low BMI SDS of <-2 is recorded or poor weight gain (downward crossing of two major centile lines).

6.5.2 Rapid weight gain or obesity

In general, growth chart measurements (weight, length/height) that cross over two major centile lines (SDS change >0.67) upwards over time, or a BMI SDS of consistently >2 should instigate a referral to primary care services for clinical review of diet, activity and sleep patterns. Rapid increase in BMI SDS is occurring in a large proportion of young NZ children[6] and is currently not routinely assessed as part of the WCTO programme, regardless of recommendations in the clinical guidelines for weight management[64]. Young children whose BMI is rapidly increasing (which may predict later obesity) should also be offered brief food, activity and sleep advice[64] and a pre-emptive discussion about their growth (understanding the meaning of BMI, interpretation of, and health consequences of their growth). Those with extreme increase in BMI SDS (a change in BMI SDS greater than 4/3) may warrant further investigation. Children with stable high BMI (>75th percentile) are also of concern, and should also be offered brief food, activity and sleep advice as for those trending towards the 91st percentile[64].

6.5 Summary

Children with poor linear growth or short stature require secondary referral for clinical assessment. The inclusion of monitoring of young children who are rapidly gaining weight (using BMI growth charts for tracking, at all WCTO visits) is recommended, which is consistent with the clinical guidelines for weight management. Children with rapid weight gain (change in BMI SDS greater than 0.67) and stable high BMI (>75th percentile) should also receive brief food, activity and sleep advice and a pre-emptive discussion about their growth for the prevention of later obesity.

- ***Monitoring for poor growth (weight and length/height measurements) should be completed at all Well Child visits, for all children [grade A]***
- ***Screening and tracking BMI may be feasible in primary care settings in NZ to support decision-making for further assessment and intervention [grade B]***
- ***Pre-emptive discussions and brief food, activity and sleep advice should be given to children with rapid weight gain and stable high BMI [grade B]***

6.6 Interventions for sustained poor growth or short stature

6.6.1 Efficacy

Sustained poor growth

There are well established guidelines for the investigation and management of failure to thrive (e.g., BMJ Best Practice, 2018[65]). They primarily involve a careful clinical history to establish feeding patterns and social factors that might contribute to inadequate intakes in infants[66]. In approximately 10% of children, an underlying illness requiring specific treatment is found.

Short stature

For over 90% of secondary care referrals for short stature, idiopathic short stature (ISS) is diagnosed[67]. Treatment for severe ISS with recombinant growth hormone in childhood is consistently reported to improve short term growth and reverse growth failure[67,68]. No serious adverse effects of recombinant growth hormone treatment in children have been reported[68].

6.6.2 Long-term efficacy (later in childhood/adolescence)

Sustained poor growth

To date, there is little evidence for the later impact of early interventions for poor weight gain. A recent study reported successful early intervention of children with failure to thrive which resulted in normal IQ, schooling, and home behaviour in later childhood[18]. However, they remained shorter and lighter than normal[18].

Short stature

A Cochrane review on the use of recombinant growth hormone in children with ISS concluded that while treatment resulted in children gaining a height which was taller than that of their untreated control peers, they still remained relatively short when compared with normal stature controls[68]. A recent review also reported that recombinant growth hormone treatment has modest long-term effects on improving height in children with ISS[67].

6.6 Summary

While early interventions for poor growth (failure to thrive) appear to prevent any potential long term negative effects on cognition and behaviour, growth outcomes (length/height and weight) appear to still be lower in those with failure to thrive and short stature when compared with healthy controls even after appropriate effective interventions are conducted.

- ***Early intervention requiring a clinical review and possible referral to secondary care for children with poor growth for the prevention of long-term negative effects [grade A].***

6.7 Interventions for sustained rapid weight gain or obesity

An effective intervention should be available for children following a positive abnormal growth screen. However, there is still large debate regarding which interventions are the most effective for prevention and treatment of obesity in children under 5 years of age.

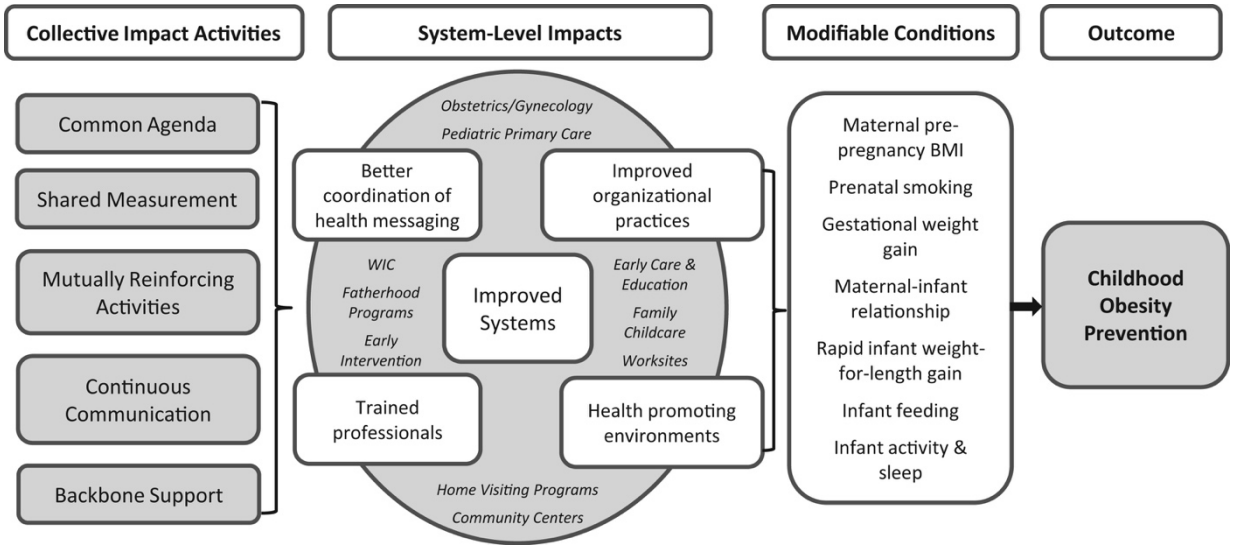
6.7.1 Prevention

Obesity prevention interventions that begin in early childhood may have the greatest impact on prevention of obesity[69]. A recently updated systematic review reported overall improved BMI and BMI SDS (reducing the risk of obesity) with combined dietary and physical activity interventions, when compared with a control group, in children aged 0-5 years[70]. Neither dietary alone or physical activity alone interventions were reported to be successful in this age group[70]. Studies assessing the preschool/childcare setting also do not appear to successfully influence obesity related behaviours (healthy eating and physical activity)[71,72].

The most recent promising results of interventions for obesity prevention to date are those from the Prevention of Overweight in Infancy (POI)[73] and the Intervention Nurses Start Infants Growing on Health Trajectories (INSIGHT) studies[74]. Results from the POI study, indicated that those children who received a brief sleep intervention (prevention of the development of sleep problems in the first 6 months and a modified extinction programme for those with sleep problems between the age of 6 months and 2 years[75]) reduced the risk of obesity compared with children who did not receive the sleep intervention[73], an effect which remained apparent at 5 years of age, despite no intervention having occurred for at least 3 years[76]. As this study was based in NZ it is directly relevant to the Well Child context and could easily be implemented nationwide. The INSIGHT study, from the US, reported that infants in their responsive parenting intervention were less likely to have a weight-for-length ≥95th percentile at 1 year of age compared with the control group[74].

Another systematic review reported that while the most effective obesity prevention interventions in childhood are those that focus on individual or family behaviour change, very few intervention studies have looked at the impact on the social context that drives behaviour[69]. There is a worldwide drive for support of a systems level approach (see Figure 6.1) for obesity prevention[69,77]. The WHO commission (ending childhood obesity) called on governments to act responsibly in ensuring that all children gain a healthy start to life[77] and the WCTO system provides a unique opportunity to support this type of systems level approach, including further recommended actions by the WHO commission[77].

Figure 6.1. Example of a systems level approach.



Reproduced from Blake-Lamb et al.[69], with permission from Elsevier.

While we know the prevalence of obesity is higher in Māori and Pasifika children[3], there is very little evidence for effective obesity prevention interventions in Indigenous populations. There is a small amount of evidence suggesting that the most effective interventions in pre-school children who identify as Māori and Pasifika are those which are predominantly parent/whānau focused, use behaviour change techniques, focus on skills, and link in with social networks and community[78].

6.7.2 Treatment

While the quality of evidence to date for the effectiveness of obesity treatment interventions is low, a systematic review reported that the most successful interventions in preschool children (<6 years of

age) were those which included multiple-components (diet, physical activity and behaviour) when compared with a control group, rather than interventions which focused on one component alone (i.e. diet)[79]. A systematic review of studies in children and adolescents aged between 2 and 18 years reported that treatment interventions that involved at least 26 hours contact time were more effective in reducing weight related changes than a control group after 6 to 12 months[80].

While the evidence regarding parental involvement in the treatment of overweight and obesity in children (5 to 11 years) is low and limited, a systematic review reported that parent-only interventions were more effective than waiting list control groups and were as effective as parent and child interventions in reducing BMI outcomes[81], however, it is unknown what influence parent-only interventions have on weight related outcomes in overweight and obese children under 5 years of age.

Currently, there is a lack of knowledge regarding which specific treatment intervention components are most effective and affordable for implementation at the population level[82]. However, a NZ study reported that any treatment intervention (multi-disciplinary, medical alone, medical and dietary, medical and physical activity) resulted in small but significant reductions in BMI SDS in children and adolescents aged between 3 and 16 years[83].

While the use of surgery and drugs are other means of treatment for obesity, these are not discussed in this review due to its lack of appropriateness and the very small amount of evidence in this area in children[84,85].

6.7.3 Currently implemented New Zealand intervention (prevention and/or treatment) programmes

Green Prescription Active Families (for children aged 5 to 18 years) is a nationwide programme for obesity intervention based on physical activity. The Green Prescription Active Families programme was evaluated in 2010 in a subsample (n=55) of children from three North Island locations. They reported a significant decrease in BMI of 1.0 kg/m^2 from baseline to 6 months, however, when this was split by sex this remained significant only for males[86]. A further report of the programme's performance was conducted in 2016 demonstrating overall a high degree of acceptance of participating children and families[87].

Throughout NZ there are a number community-based obesity intervention programmes targeted towards young children and families. Two programmes with reported success are Whānau Pakari and Project Energize. Whānau Pakari is a home-based multidisciplinary programme aimed at children aged 5 to 16 years in the Taranaki region with reported success in lowering obesity in participants[88]. Project Energize in the Waikato area which has also had success in reducing percentage body fat in young children, and long-term reductions in BMI have been reported[89]. Another small programme showing promise is the Toddler Better Health Programme in Nelson[90].

6.7.4 Long-term efficacy (later in childhood/adolescence)

There is a lack of studies assessing what the long term (beyond 1 year) impact is of early interventions on later weight status, yet what we do know is that reversing obesity through interventions in later childhood and adolescence is challenging[10,11]. One study reporting improvement in later childhood was the POI study, where an early (from 0-2 years) sleep intervention reduced the risk of obesity at 5 years of age, compared with those who did not receive the sleep intervention[76].

6.7 Summary

To date, the most appropriate interventions for obesity prevention in young children (0-5 years) are those combining diet and physical activity. This multi-component approach appears to be also the most effective for the treatment of obesity in this age group, as well as those interventions with longer contact time. Although, what is unknown is the effectiveness and affordability of these interventions at the population level and the long-term impact on weight status. Recent NZ and USA studies suggest a sleep intervention can be even more effective with a halving of obesity prevalence 3 years after the intervention finished.

- ***Obesity prevention interventions (diet, physical activity and sleep advice) should be available for young children at high risk of future obesity [grade B].***
- ***Treatment of young children with rapid weight gain and/or obesity may be feasible if it includes multi-components (diet, physical activity and behaviour), and sufficient contact time [grade C].***
- ***There is promising but limited evidence for the use of a sleep intervention for obesity prevention in the primary care setting [grade B].***

6.8 Known harms from screening for poor growth

While there is a potential for harm from growth screening, there is very little recent evidence to support this. There is a small amount of evidence for weight screening and the impact on parents and children. However, there is no evidence of harm from screening for linear growth.

In the UK, two studies have reported on potential harms after weight feedback was sent to parents from the national school-based weight screening programme. One study of children aged between 6-7 years and 10-11 years reported that few children found the process distressing (particularly older overweight children), and there was evidence of parental dietary restriction of overweight girls[91]. Another study in children aged 4-5 and 10-11 years reported no harms (no difference in weight-related teasing or low self-esteem) after providing weight related feedback to parents following screening of their child's weight[92].

Growth charts are reported to be easily misunderstood by parents[93]. However, it is important to provide feedback to parents and children to encourage awareness and monitoring of their child's growth. However, this should be done in a way that prevents any harm. For parents, acceptance of their child's weight status has been shown to be a positive experience when the healthcare professional discussing this with them is non-judgmental and empathetic[94].

It is important to consider that there is also possible harm from growth screening if there is no appropriate intervention available following a positive screen, which is the case in some (often rural) areas of NZ. There is also potential harm if the information given is neither non-judgemental or empathetic, which can discourage families from engaging with healthcare providers in general. Therefore, more training and support for primary healthcare professionals who conduct routine growth screening is required to ensure they gain confidence in delivering information appropriately.

6.8 Summary

There is limited evidence regarding harms which are related to growth screening in childhood and no evidence of any reported harms in early childhood (<5 years). In the NZ context, it is important to consider the potential harm caused by not providing an appropriate intervention when a growth screen is positive, or if the information is given in a judgemental or non-empathetic manner. More training and support for healthcare professionals conducting growth screening is required.

6.9 Known harms from screening for excessive weight gain

There is concern that harm may be caused from screening for obesity, for example psychological (disordered eating behaviours), social (stigmatism and bullying) or physical (impaired growth) harms. A systematic review on screening for obesity reported that there is no evidence of harm in screening children for excess weight, however, it is important to note that this statement was generated from the fact that there were no studies assessing harm (based on their inclusion criteria), rather than there being no harm detected[80]. Further work is needed to determine whether there are any potential harms (physical, psychological, social, or ethical) associated with obesity screening in childhood.

As mentioned in Section 6.8 harm could be caused when there is no appropriate intervention available following a positive screen for obesity or if the information is given in a judgemental or non-empathetic manner. Through personal communication[95] there are also reports of concerns amongst parents of obese (≥98th percentile) children regarding inconsistent messages from healthcare professionals and stigma around weight and health status, affecting further engagement with healthcare professionals and obesity interventions. Support for training primary healthcare professionals who conduct obesity screening is required to improve communication of this sensitive information.

6.9 Summary

While it has been reported that there is no harm from obesity screening in childhood, this was because of a lack of studies reporting and collecting data on potential harm. Further work is required in this area. As discussed in Section 6.8, it is important to consider the potential harm caused by not providing an appropriate intervention when obesity is detected, or if information is given in an unsympathetic manner, suggesting further training of healthcare professionals is needed to improve the delivery of this information.

6.10 Is clinical diagnosis of short stature in childhood currently well managed in New Zealand, following a positive screen?

There is currently no data available regarding the management of growth disorders following a positive screen in NZ children. However, it is assumed that diagnosed growth disorders (i.e. short stature and failure to thrive) are well managed in NZ as District Health Boards (DHBs) must follow specific service specifications for children and young people[96], although this has not been evaluated to date. As a benchmark, the number of children treated with growth hormone over the past 10 years has increased by 30%[8], which is likely a reflection of improved awareness, assessment and management, rather than increasing prevalence of short stature.

6.10 Summary

While there is no reported data on the management of short stature in NZ, it is assumed to be well managed in the secondary care setting due to the requirements of service by DHBs and increasing numbers of children treated with growth hormone over the past 10 years.

6.11 Is clinical diagnosis of obesity in childhood currently well managed in New Zealand, following a positive screen?

There is evidence that the conversation with caregivers about the diagnosis of obesity in NZ is poorly handled, with reports of health professionals providing inconsistent messages and weight stigmatization[95]. This points to the need for enhanced professional education and support in this area.

A retrospective study of children presenting to secondary care (Southern District Health Board) between 2010 and 2015 reported that of the children who were obese by measurement, only 45% were given a diagnosis of obesity, however, it was noted that not all practitioners used the term "obesity" but alternatives for example "overweight", "high BMI", "weight issues"[97]. Furthermore, investigations were performed on approximately 25% of those children diagnosed as obese, and approximately 73% were given a management plan[97]. In a survey of Waikato primary healthcare professionals, it was reported that while obesity in children was a concern, only half conducted assessments (i.e. height, weight, BMI) in children, and few followed obesity management guidelines[98].

A NZ study of overweight and obese children aged 3 to 16 years, who were referred to secondary care for obesity intervention, reported small reductions in BMI SDS across their methods of intervention (paediatrician only, paediatrician and dietitian, paediatrician and external programme, or multidisciplinary)[45].

The key issue for all obesity management programmes is engagement. Almost all studies describe better results for those that engage fully and complete the programme. In the obesity area, there is also a problem with engagement after referral to the programme as >50% of NZ parents see their overweight or obese child as having a normal weight[99], with this especially so for younger children. Thus, home based programmes with a strong engagement ethos are important[88,100-102].

6.11 Summary

There is room for improvement in the diagnosis and management of childhood obesity in NZ. Consistent use of WHO growth standards in both primary and secondary care systems, the regular use of BMI growth charts, and when identified, empathetic and non-judgemental information giving is important. Programmes that focus on parental engagement and retention and that address both nutrition and activity are important.

6.12 Māori and Pacific views, practices, and beliefs about childhood screening

6.12.1 Poor growth / short stature

There is no reported literature regarding the views, practices, and beliefs about screening for poor growth or short stature in both Māori and Pacific Island populations.

6.12.2 Rapid weight gain

There appears to be no specific reported data on the Māori and Pasifika views, practices, and beliefs about childhood screening for rapid weight gain. What we do know is that the growth rates for both Māori[103] and Pasifika[104,105] children appears to be much steeper than it is for reference children. Furthermore, a focus away from weight and instead on children's happiness is important to Māori parents and caregivers[106].

6.12.3 Obesity

Recent evidence has found that Pasifika families are less likely to participate in an intervention for obesity treatment after weight screening compared with NZ European families[107]. One study reported a relatively low level of concern amongst Pasifika parents regarding the weight status of their children and therefore interventions targeting parental awareness and then family support may be the most beneficial[108].

Among a group of Māori parents, knowledge of obesity appeared to be low with very little concern for obesity in children (under 5 years of age), as parents reported obesity to be "only applied to people who were seriously overweight"[106]. There was reported concern that weight stigmatization in children would lead to bullying, discrimination and the development of eating disorders[106].

The acceptability of using prediction models for determining obesity risk in children under 5 years was reported in a study which included 437 Māori and 125 Pasifika parents and caregivers[109]. Of the caregivers, 59% of Māori and 62% of Pasifika "definitely or probably" would like to know information about their child's obesity risk[109].

6.12 Summary

To date, we know very little regarding the views, practices and beliefs of Māori and Pacific Island populations regarding childhood growth screening. However, there does appear to be some concerns regarding the impact of weight stigmatization amongst Māori parents.

6.13 Recommendations for further action

Further research

- What harms are associated with obesity screening in New Zealand children?
- Determine effective interventions for the prevention of overweight and obesity in Māori and Pasifika children.
- Identify possible modifiable factors of excess weight gain in early infancy for the prevention of later obesity, particularly for Māori and Pasifika children.
- Determine the long-term impact of early interventions on growth related outcomes in New Zealand children.
- New Zealand parents and healthcare professionals' attitudes and beliefs regarding weight screening and weight status during childhood.
- Views, practices and beliefs of weight screening and weight status during childhood in Māori and Pacific Island populations.
- Develop and determine the appropriateness of New Zealand ethnic-specific cut-off points for defining overweight and obesity in children under 5 years of age.
- Evaluation of the management of diagnosed growth disorders (short stature and failure to thrive) following a positive screen in New Zealand children.

6.14 Graded evaluations

Table 6.7. Graded evaluation of screening tools and associated recommendations for policy and practice.

Screening tool	Grade	Estimated net benefit	Level of certainty	Recommendation
Standardized protocol for subtracting the weight of clothing worn during weight measurement	C	Small	Moderate	This protocol should be used during the cooler months and/or when removal of clothing for weight measurement is not appropriate/possible.
Waist-to-height ratio for assessing cardiometabolic risk	I	Insufficient	Low	Insufficient evidence for routine use of the waist-to-height ratio in young children in primary care.
Monitoring for poor growth	A	Substantial	High	All children should have weight and length/height measured at every Well Child visit.
BMI tracking chart (SDS)	B	Moderate	Moderate	BMI screening/tracking should be completed for all children.

Grade: A, B, C, D, or I.
Estimated net benefit: substantial, moderate, small, nil or harmful, or insufficient (evidence).
Level of certainty: high, moderate, or low
For more detailed explanation see Supplementary Information - Grade definitions and levels of certainty.

Table 6.8. Graded evaluation of interventions and associated recommendations for policy and practice.

Intervention	Grade	Estimated net benefit	Level of certainty	Recommendation
Pre-emptive discussion, and brief food, activity and sleep advice	B	Substantial	Moderate	This intervention should be provided to all children with rapid weight gain and stable high BMI, where appropriate.
Early intervention for poor growth (clinical review in primary care and possible referral to secondary care)	A	Substantial	High	Children with poor growth* should undergo a clinical review and possible referral to secondary care for early intervention. *Poor linear growth: <2nd percentile, or crossing one major centile line over 6 months. *Poor weight gain: consistently low BMI SDS <-2, or downward crossing of two major centile lines.
Obesity prevention interventions including diet and physical activity	B	Moderate	Moderate	Children with high risk of future obesity should receive brief food, activity and sleep advice.
Treatment for young children with rapid weight gain and/or obesity should be multi-component and provide sufficient contact time	C	Small	Low	Children with rapid weight gain* and/or obesity should be *offered* an appropriate multi-component (diet, physical activity and behaviour) intervention. *Rapid weight gain: change in BMI SDS greater than 0.67.
Sleep intervention for obesity prevention	B	Substantial	Moderate	If a sleep intervention is offered, patients should understand that the evidence, while promising, is limited.

Grade: A, B, C, D, or I.
Estimated net benefit: substantial, moderate, small, nil or harmful, or insufficient (evidence).
Level of certainty: high, moderate, or low.
For more detailed explanation see Supplementary Information - Grade definitions and levels of certainty.

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Supplementary Information - Grade definitions and levels of certainty

Table S1. Grade definitions for screening tools and interventions

Adapted with permission from the U.S. Preventive Services Task Force 2012.[i]

Grade	Definition	Recommendation for policy and practice
A	• The authors recommend this screening tool/intervention. • There is high certainty that the net benefit is substantial.	• This screening tool/intervention should be offered or provided.
B	• The authors recommend the screening tool/intervention. • There is high certainty that the net benefit is moderate, or there is moderate certainty that the net benefit is moderate to substantial.	• This screening tool/intervention should be offered or provided.
C	• The authors recommend selectively offering or providing this screening tool/intervention to patients based on professional judgment and patient preferences. • There is at least moderate certainty that the net benefit is small.	• This screening tool/intervention should be provided for selected patients depending on individual circumstances.
D	• The authors recommend against this screening tool/intervention. • There is moderate or high certainty that the screening tool/ intervention has no net benefit or that the harms outweigh the benefits.	• The authors discourage the use of this screening tool/intervention.
I	• The authors conclude that the current evidence is insufficient to assess the balance of benefits and harms of the screening tool/intervention. • Evidence is lacking, of poor quality, or conflicting, and the balance of benefits and harms cannot be determined.	• If the screening tool/intervention is offered, patients should understand the uncertainty about the balance of benefits and harms.

Table S2. Levels of certainty regarding net benefit

Adapted with permission from the U.S. Preventive Services Task Force 2012 [1].

Level Of Certainty	Description
High	• The available evidence usually includes consistent results from well-designed, well-conducted studies in representative populations. • These studies assess the effects of the preventive service on health outcomes. • This conclusion is therefore unlikely to be strongly affected by the results of future studies.
Moderate	• The available evidence is sufficient to determine the effects of the preventive service on health outcomes, but confidence in the estimate is constrained by such factors as: – the number, size, or quality of individual studies; – inconsistency of findings across studies; – limited generalizability of findings to routine practice; – lack of coherence in the chain of evidence. • As more information becomes available, the magnitude or direction of the observed effect could change, and this change may be large enough to alter the conclusion(s).
Low	• The available evidence is insufficient to assess effects on health outcomes, because of: – the limited number and/or size of studies; – important flaws in study design and/or methods; – inconsistency of findings across individual studies; – gaps in the chain of evidence; – findings not generalizable to routine practice; – lack of information on important health outcomes. • More information may allow estimation of effects on health outcomes.

[i] https://www.uspreventiveservicestaskforce.org/Page/Name/grade-definitions