

Technical Report

B4 School Check Data - Body Size

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1 Introduction

1.1 Purpose of the Report

This report provides an analysis of body size of four-year-olds in the population of the Bay Plenty District Health Board (DHB) area and Lakes DHB area. It provides a baseline analysis that can inform the planning of interventions to reduce the prevalence of childhood overweight and obesity and that will, in time, assist organisations working in the Bay of Plenty and Lakes districts to assess the effectiveness of actions to reduce the prevalence of childhood overweight and obesity.

1.2 Background

Toi Te Ora – Public Health Service (Toi Te Ora) is the public health service for the Bay of Plenty DHB and Lakes DHB areas. In 2013, Toi Te Ora set a goal to reduce the prevalence of childhood obesity by one-third by the year 2023. The Ministry of Health has recently developed a childhood obesity plan which aims to prevent and manage obesity in children. However, until now there has been limited data on the prevalence of overweight and obesity in children.

The New Zealand Health Survey provides national data on childhood obesity prevalence, and more recently has provided local estimates for DHBs of the prevalence of overweight and obesity. However, estimates of prevalence by the DHBs based on these national survey data have been limited by small sample sizes resulting in large uncertainties in the local estimates provided.

This report analyses and summarises the data gathered on the body size of four-year-olds measured by the B4 School Check (B4SC) program in 2013 and 2014 and so, for the first time, provides detailed and reliable body size data at the DHB level.

1.3 Structure

The report is divided into eight sections. Sections 1 and 2 provide the background and methods. Section 3 presents the data for the area covered by Toi Te Ora. This section includes analysis of child obesity by gender, ethnicity, and deprivation quintile. Sections 4 and 5 provide an overview of body size for the Lakes DHB population and Bay of Plenty DHB population, respectively. Section 6 provides data and analyses summarised for each of the seven local authorities for this population. Data tables, giving a breakdown by ethnicity, gender, and deprivation are included in Section 8.

2 Methods and Terminology

2.1 New Zealand – World Health Organization (NZ-WHO) Growth Charts

To define overweight and obesity in four-year-olds the NZ-WHO growth charts are utilised. The growth charts were developed using the World Health Organization Child Growth Standards (WHO Multicentre Growth Reference Study Group, 2009). The growth standards are based on the growth of 8,500 healthy children, exclusively breastfed to at least the age of four months and partially breastfed to 12 months, and raised in optimal conditions (there were no socioeconomic or environmental impediments to growth). The children come from six different countries and a range of different ethnicities. The Ministry of Health states the growth charts appear to be appropriate for Maori children (Ministry of Health, 2015a).

2.2 BMI z-scores (zBMI)

The BMI z-scores (zBMI) show the number of standard deviations a child is away from the 50th centile of BMI (or average BMI) for age. A positive value indicates the child is above the 50th centile while a negative value shows the child is below the 50th centile.

2.3 WellChild Centile Cut-offs

There are a number of definitions of overweight and obesity based on BMI-for-age that are used in New Zealand.

WellChild uses BMI-for-age centile cut-offs to define overweight and obesity that differ from the WHO cut-offs. Table 1 below gives the WellChild cut-offs and for comparison purposes gives the centile lines used on the WHO growth charts and the cut-offs used in a paper detailing the results of the first four years of the B4SC program.

Table 1: Comparison of three centile BMI-for-age weight category cut-offs in use in New Zealand and internationally

Weight category used in this report	BMI-for-age centile based WellChild Cut-offs (Ministry of Health, 2015a)	Centile lines from the WHO BMI-for-age growth charts (the coloured lines refer to the WHO growth charts included in Appendix 1)	Cut-offs used in a paper detailing the first four years of the B4SC program (Rajput <i>et al</i> , 2015)
Possible undernutrition – referred to as underweight in this report	Below the 2 nd	3 rd (red line)	NA
Overweight	91 st – 98 th	85 th (orange line)	85 th – 95 th
Obese	98 th – 99.6 th	97 th (red line)	Above the 95 th
Extremely Obese	Above the 99.6 th	NA	NA

2.4 Child Obesity Health Target 2015

A child obesity health target was introduced with the childhood obesity plan (Ministry of Health, 2016). This health target is relevant to the report as it utilises the B4SC data and the WellChild centile cut-offs to identify children who are overweight or obese.

The target is:

“By December 2017, 95% of obese children identified in the Before School Check (B4SC) programme will be referred to a health professional for clinical assessment and family based nutrition, activity and lifestyle interventions” (Ministry of Health, 2016).

The data presented in this report provide an indication of the proportion of children, and an estimate of the number of children, that will require referral based on the 2013 and 2014 B4SC data.

2.5 Data Processing and Analysis

The B4SC data for 2013 and 2014 was extracted from the Lakes DHB B4SC database and the Bay of Plenty DHB B4SC database. The datasets were combined and cleaned. For example, data that had been entered into incorrect columns were identified and corrected.

BMI was calculated for each entry using the formula: $BMI = \frac{Weight}{Height^2}$ where weight is measured in kilograms and height in metres. BMI z-scores were calculated for BMI-for-age (age in months) using the WHO Anthro software.

A previous study using the B4SC data excluded extreme values of height and weight, making the assumption that these values are biologically implausible and therefore were considered to be incorrectly entered into the database (Rajput *et al*, 2015). In that study measurements with a weight or height z-score less than negative five or greater than five were excluded. In this analysis entries with a height z-score less than negative five and greater than five were also excluded. Entries with a weight z-score of below negative five were excluded. However entries with a weight z-score greater than five were not excluded because the nurses who performed the checks on these children were confident the extreme weight measurements were accurate. Children younger than four years old and those five years and older were excluded from the analysis.

A total of 8,021 height and weight records were extracted. Ten records were excluded due to incorrect or incomplete height and weight values. A further 281 were excluded due to being too old or too young. Therefore, in this analysis 7,729 height and weight records were used. This represents an estimated 88% of the total number of four-year-old children eligible to be seen in the B4SC programme in the Bay of Plenty and Lakes districts in 2013 and 2014.

The WellChild centile cut-offs were converted to zBMI cut-off values using a standard normal probabilities table. Each record was categorised as underweight, normal weight, overweight, obese, or extremely obese using zBMI cut-off values. Percentages were calculated using the total number of eligible height and weight records in the applicable area or subgroup. The numerator is the number of children in the weight category. The denominator is the total number of four-year-old children who were measured in the B4SC programme. The number of children in each group or subgroup can be found in the data tables in Section 8.

Unless otherwise stated, all graphs, figures and proportions given are for data combined from both 2013 and 2014.

Graphics were produced using Microsoft Excel 2010 and R 3.2.3.

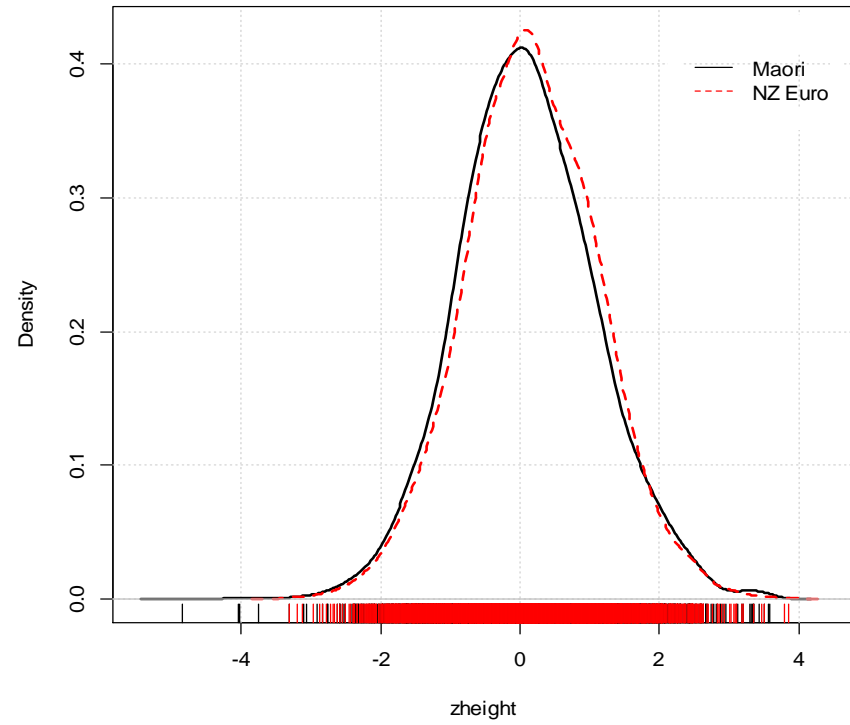
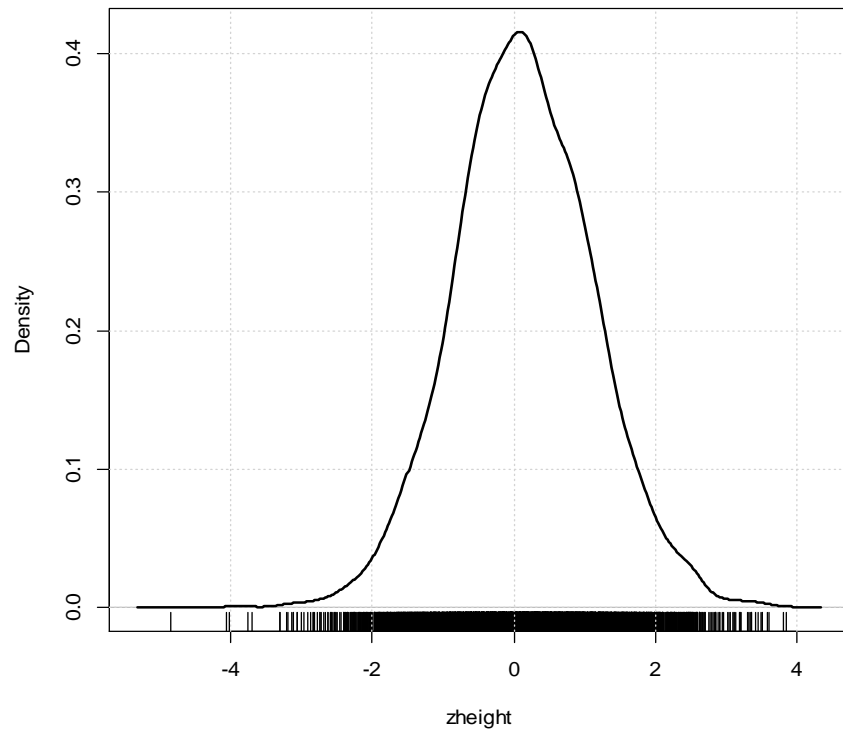
2.6 Height z-scores compared with and contrasted to the WHO Child Growth Standard

A population with similar height characteristics to the growth standard would be expected to have median height z-score of zero and a standard deviation (SD) about the mean of zero. The distribution should be approximately normal. The two frequency distribution plots (Figure 1) show the distribution of height z-scores to be approximately normal and centre on a z-score of 0 for the total population, New Zealand Europeans (NZ European), and for Maori. The summary statistics for height are displayed in Table 2 and are consistent with the WHO growth standard. In each case the mean and median are approximately equal (Table 2) and this is another indication that the distribution of height z-scores is approximately normal. The local data for height, including that for Maori is similar to the WHO growth standards for the B4SC age groups.

Table 2: Key summary statistics of B4SC height z-scores of 4 year olds in the Toi Te Ora area

	Mean	SD	Median	Number of children
Total population	0.15	0.98	0.13	7729
NZ European	0.17	0.96	0.15	2926
Maori	0.09	1.00	0.06	3944

Figure 1: Frequency distribution plots of height z-scores for the total population, NZ European and Maori



3 Toi Te Ora – Public Health Service Area

3.1 Overview

Figure 2 shows the percentage of children in each of the WellChild BMI centile categories. During 2013 and 2014, 8.6% of children assessed in the B4SC program were identified as obese which is a total of 665 children (or an average of 333 each year). It is possible that this is an under-estimate of the number of obese children in the population as not all children are measured in the B4SC program. A further 14.3% of children were identified as overweight giving a total of 1,105 children who were either overweight or obese during 2013 and 2014.

Figure 2: Body size of children in Toi Te Ora area (n=7729)

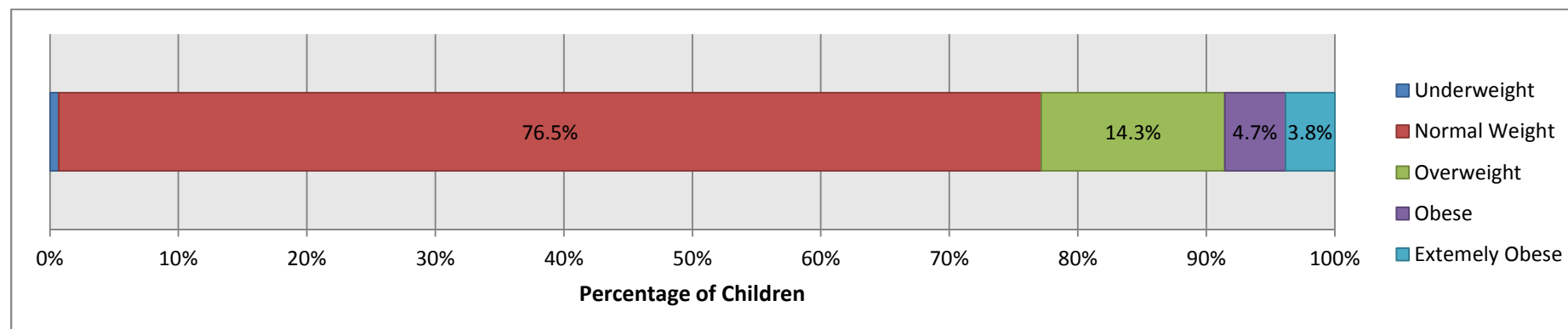
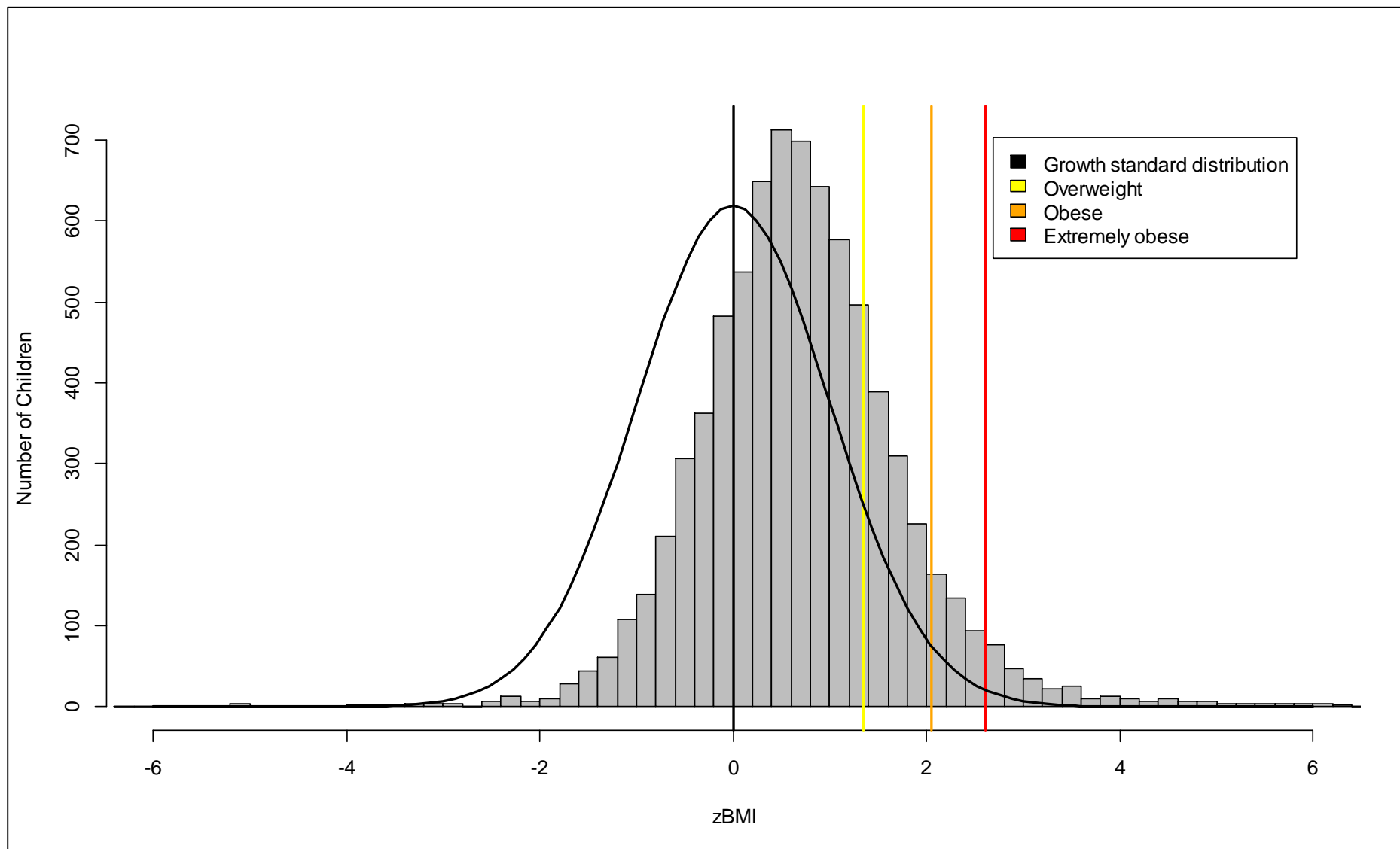


Figure 3 displays a histogram of zBMI scores for children measured in the B4SC programme in 2013 and 2014. Overlaid on the plot is the expected distribution of zBMI scores according to the WHO child growth standard and the WellChild weight category cut-offs. Relative to the growth standard, the histogram is shifted to the right. This means the entire population has a larger zBMI than expected. Figure 3 also shows that about twice as many children are overweight, three times as many are obese, and nine times as many are extremely obese compared to what is expected if our population was equivalent to the WHO growth standard population. The shifted zBMI distribution suggests a ubiquitous environmental cause (or causes) contributes to the high proportion of overweight and obese children.

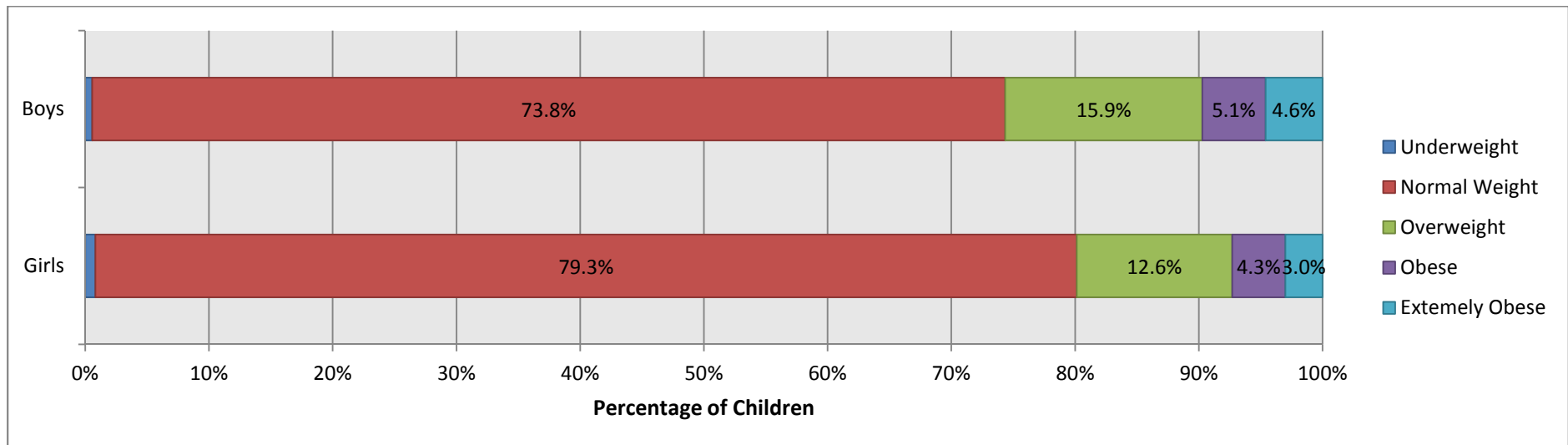
Figure 3: Distribution of zBMI scores for children checked during 2013 and 2014 (n=7729)



3.2 Gender

Figure 4 shows the body size distribution according to gender. A chi-squared test of independence was carried out ($\chi^2=40.9$, $df=4$, $p<0.001$) and this showed the observed counts were significantly different to the expected counts in each category. This means the difference seen in Figure 4 is statistically significant. That is, there is a real difference in body size according to gender. At this age a greater proportion of boys are overweight, obese, and extremely obese than girls.

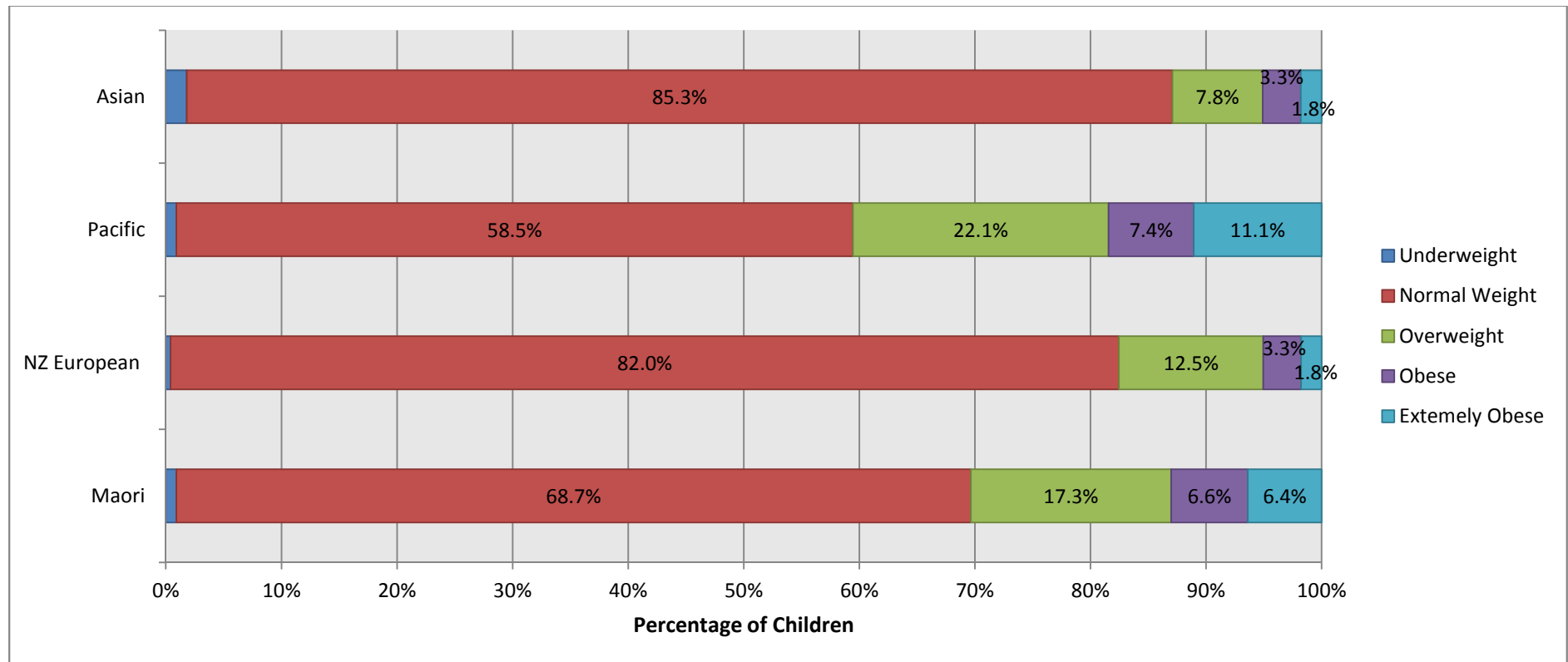
Figure 4: Body size, by gender, of children in Toi Te Ora area (Boys, n=3993; Girls, n=3736)



3.3 Ethnicity

For all ethnicities the proportion of children who are obese is greater than what is expected in a healthy population similar to the WHO growth standard population. In all ethnic groups apart from Asian the proportion of children assessed as overweight is up to three times greater than what is expected. The proportion of children for each WellChild weight category is different for each ethnicity (Figure 5). Pacific ethnicity has the greatest proportion of overweight and obese children. However, in the Toi Te Ora area the two main ethnic groups are Maori and NZ European while Asian and Pacific children make up only 7% of children assessed in the B4SC program. In terms of the population of obese or extremely obese children in the Toi Te Ora area 58% identify as Maori, 30% NZ European, 6% Pacific, 3% Asian, and 3% other ethnicities. The patterns according to ethnicity for the Toi Te Ora area are similar to those seen in the New Zealand Health Survey (Ministry of Health, 2015b).

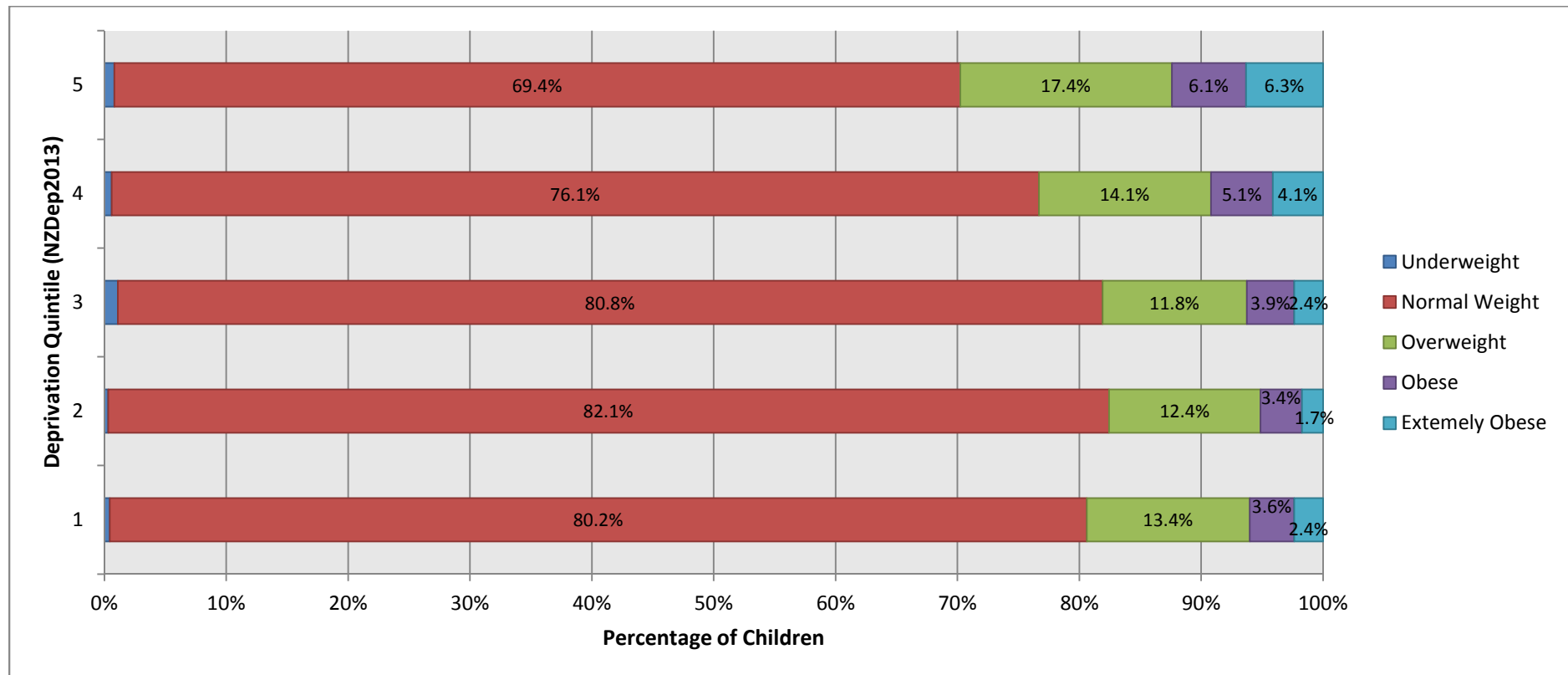
Figure 5: Body size, by ethnic group, of children in Toi Te Ora area (Asian, n=333; Pacific, n=217; NZ European, n=3944; Maori, n=2926)



3.4 Socio-economic Deprivation

At all deprivation quintiles the proportion of children who are overweight and obese is greater than what is expected in a healthy population based on the WHO growth standard population. In four-year-olds the proportion of children who are obese is similar across deprivation quintiles one to three. However, the proportion sharply increases for quintiles four and five. Of note, the proportion of children who are obese is much higher in quintile five areas.

Figure 6: Body size, by deprivation, of children in Toi Te Ora area (Quintile 1, n=1099; Quintile 2, n=1270; Quintile 3, n=1360; Quintile 4, n=1677; Quintile 5, n=2298)



Maori are more likely to live in areas of high deprivation (Ministry of Health, 2015c). The increased proportion of obese children in high deprivation areas could be due to the changing ethnic makeup as deprivation increases rather than being solely due to increasing deprivation. Figure 7 shows the mean zBMI increases as the deprivation quintile increases with patterns similar to those seen in Figure 6. Figure 8 tests to see if the relationship between mean zBMI and deprivation quintile (Figure 7) remains when accounting for the changing ethnic makeup that is observed as deprivation increases. This is done by grouping the data by ethnicity as shown in Figure 8. From this analysis it is evident that Maori children have a higher mean zBMI than NZ Europeans at all deprivation quintiles and that mean zBMI increases for both ethnic groups displayed, from quintile 3 through to quintile 5. When ethnicity is accounted for (Figure 8) the slopes of the increase of mean zBMI for Maori and the NZ European ethnicity for deprivations three to five is not as steep as the slope for all ethnic groups combined, indicating the changing ethnic composition of each quintile partially accounts for the effect of deprivation on mean zBMI seen in Figure 7.

Figure 7: Mean zBMI of B4SC children during 2013 and 2014 by socioeconomic status

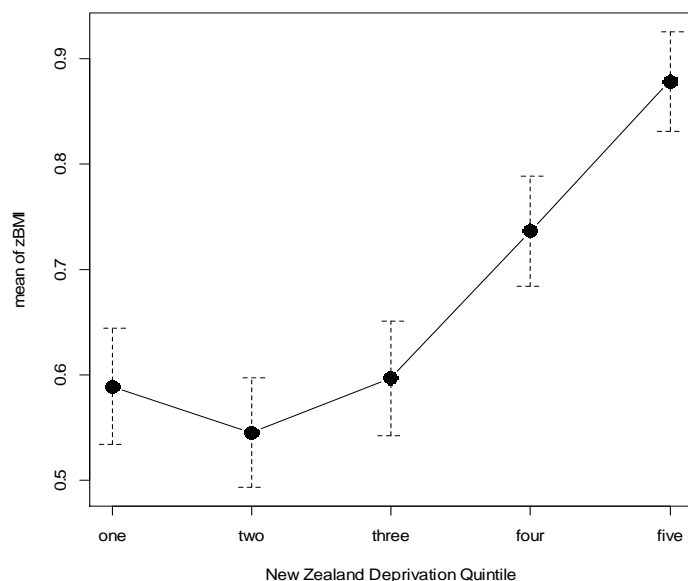
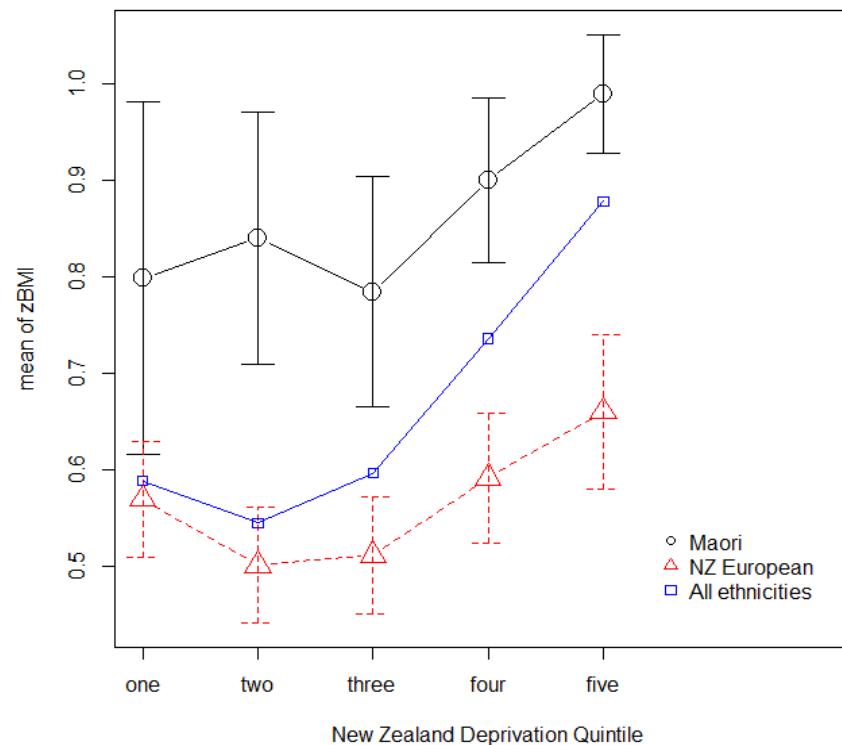


Figure 8: Mean zBMI of B4SC children during 2013 and 2014 by socioeconomic status and grouped by ethnicity



4 Lakes District Health Board Area

In the Lakes DHB area, 25% of four-year-old children measured in the B4SC programme were found to be overweight, obese, or extremely obese (Figure 9). In a healthy population this figure would be 9%. Of note, the proportion of extremely obese children is 11 times greater than for the WHO growth standard population.

Key findings for B4SC children in 2013 and 2014:

- 21.9% of girls are overweight, obese, or extremely obese compared with 28.7% of boys
- 35.5% of Pacific children are overweight, obese, or extremely obese compared with 31.1% of Maori, 20.3% of NZ European, and 12.5% of Asian children (note that Pacific children are a small population group, n=76)
- The proportion of overweight, obese and extremely obese children increases with deprivation. In deprivation quintile 5 areas 30.2% of children are overweight, obese, or extremely obese.

Figure 9: Body size of children in Lakes DHB area (n=2849)

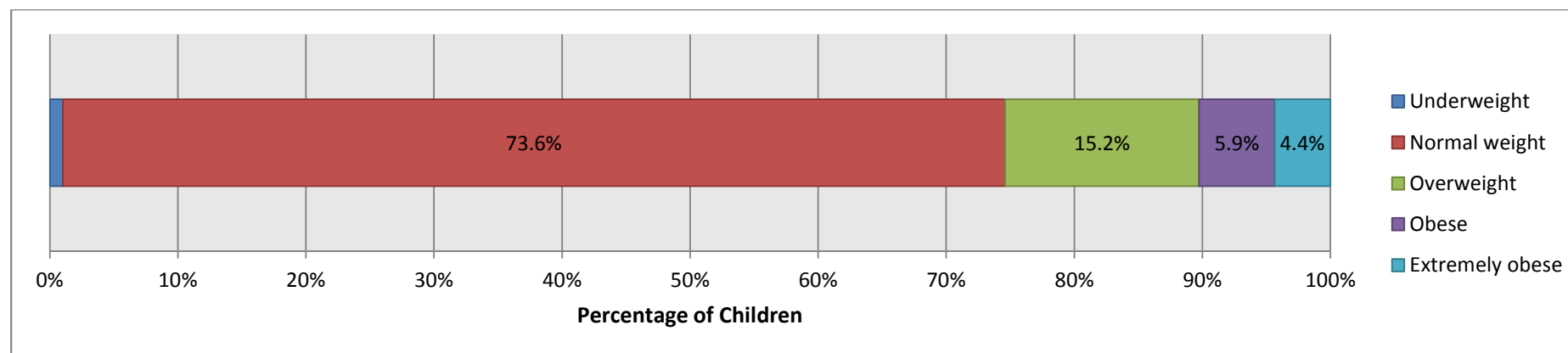


Figure 10 displays the distribution of zBMI scores for Lakes DHB. The entire distribution is shifted to the right of the growth standard distribution while the height z-scores (Figure 1) are almost the same as the growth standard. This shows that excess weight and therefore excess BMI is a population-wide phenomenon.

Figure 10: Distribution of zBMI scores for children in Lakes DHB area checked during 2013 and 2014 (n=2849)

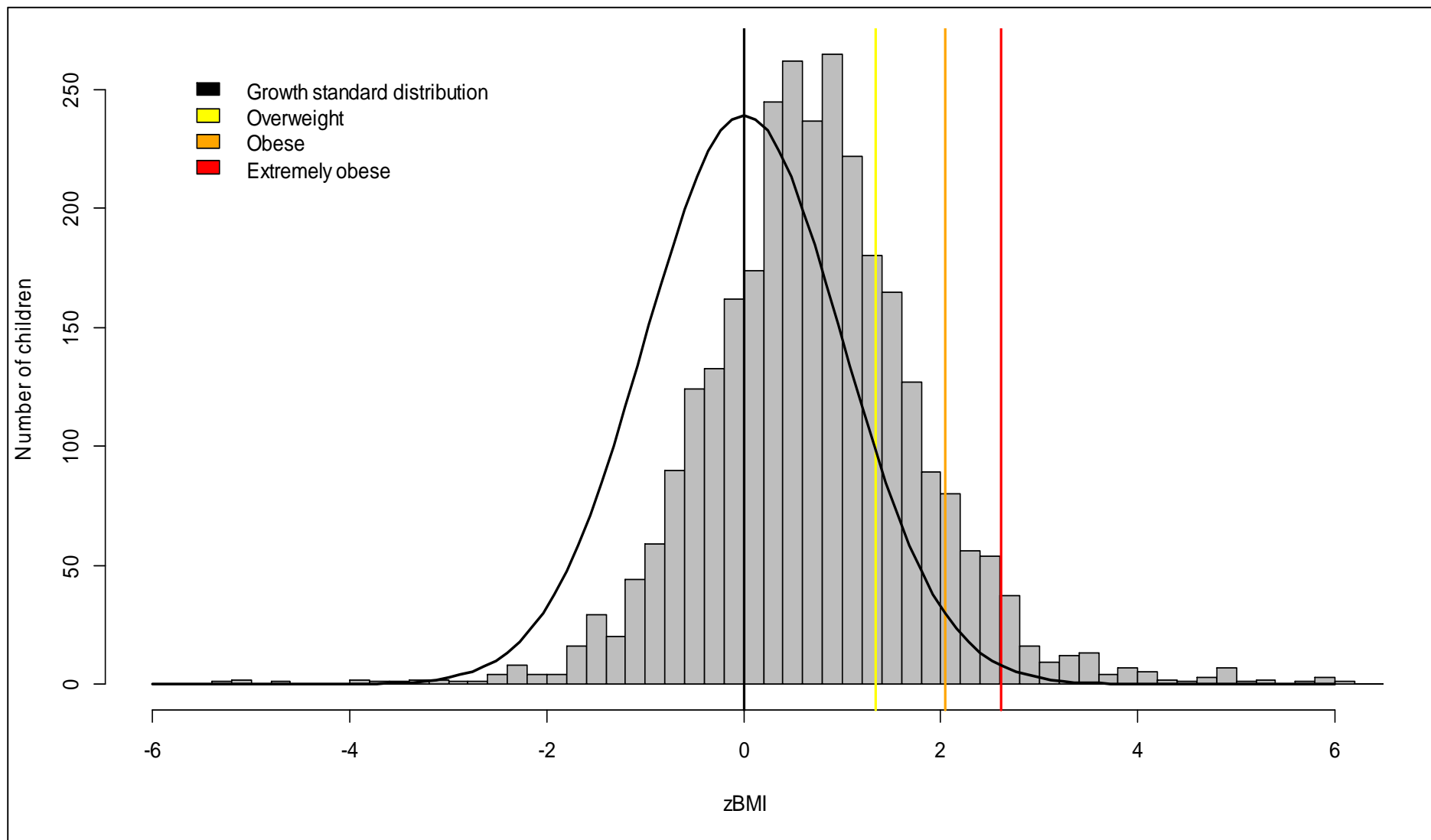


Table 3 provides a breakdown of the number of children assessed as obese during 2013 and 2014. The number of children that would have been required to be referred if the target had been in place is also displayed.

Table 3: Number of obese children in the Lakes DHB area and the number of children that would have required referral to meet the child obesity health target

	2013			2014		
	Total number of height and weight assessments	Number of obese and extremely obese children	Number required to be referred for assessment and to nutrition and physical activity programs (95% of obese children)	Total number of height and weight assessments	Number of obese and extremely obese children	Number required to be referred for assessment and to nutrition and physical activity programs (95% of obese children)
Number of children	1377	143	136	1472	149	142

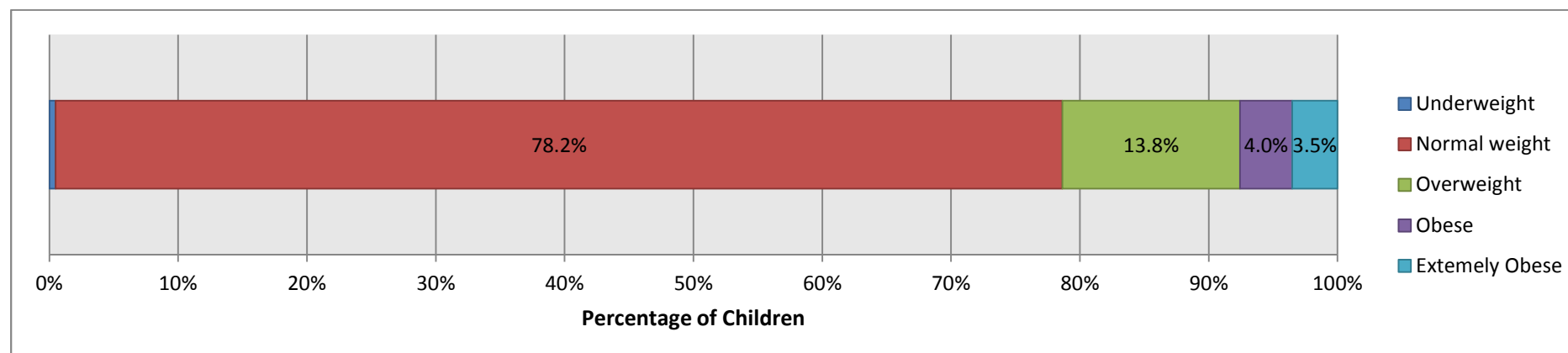
5 Bay of Plenty District Health Board Area

In the Bay of Plenty DHB area 21.4% of four-year-old children checked in 2013 and 2014 were overweight, obese or extremely obese (Figure 11). This is 2.4 times higher than what is expected for a population similar to the growth standard population. The proportion of extremely obese children is 9 times higher than what is expected from the growth standard.

Key findings for the 2013 and 2014 B4SC cohort:

- 18.7% of girls and 23.9% of boys are overweight, obese, or extremely obese
- 43.3% of Pacific children are overweight, obese, or extremely obese, compared with 29.7% of Maori, 16.3% of NZ European, and 13.1% of Asian children (Pacific children are a small population group, n=141)
- The proportion of overweight, obese, and extremely obese children increases with deprivation. In deprivation quintile 5 areas 29.4% of children are overweight, obese or extremely obese.

Figure 11: Body size of children in the Bay of Plenty DHB area (n=4880)



The population distribution of zBMI (Figure 12) follows the same pattern as Lakes DHB area. The entire distribution is shifted to the right of the WHO growth standard population. This indicates that reducing obesity requires a focus on interventions that reach the entire population. Intervention focusing on only treatment of obese children will do little to shift the distribution back towards the growth standard.

Figure 12: Distribution of zBMI scores for children in the Bay of Plenty DHB area checked during 2013 and 2014 (n=4880)

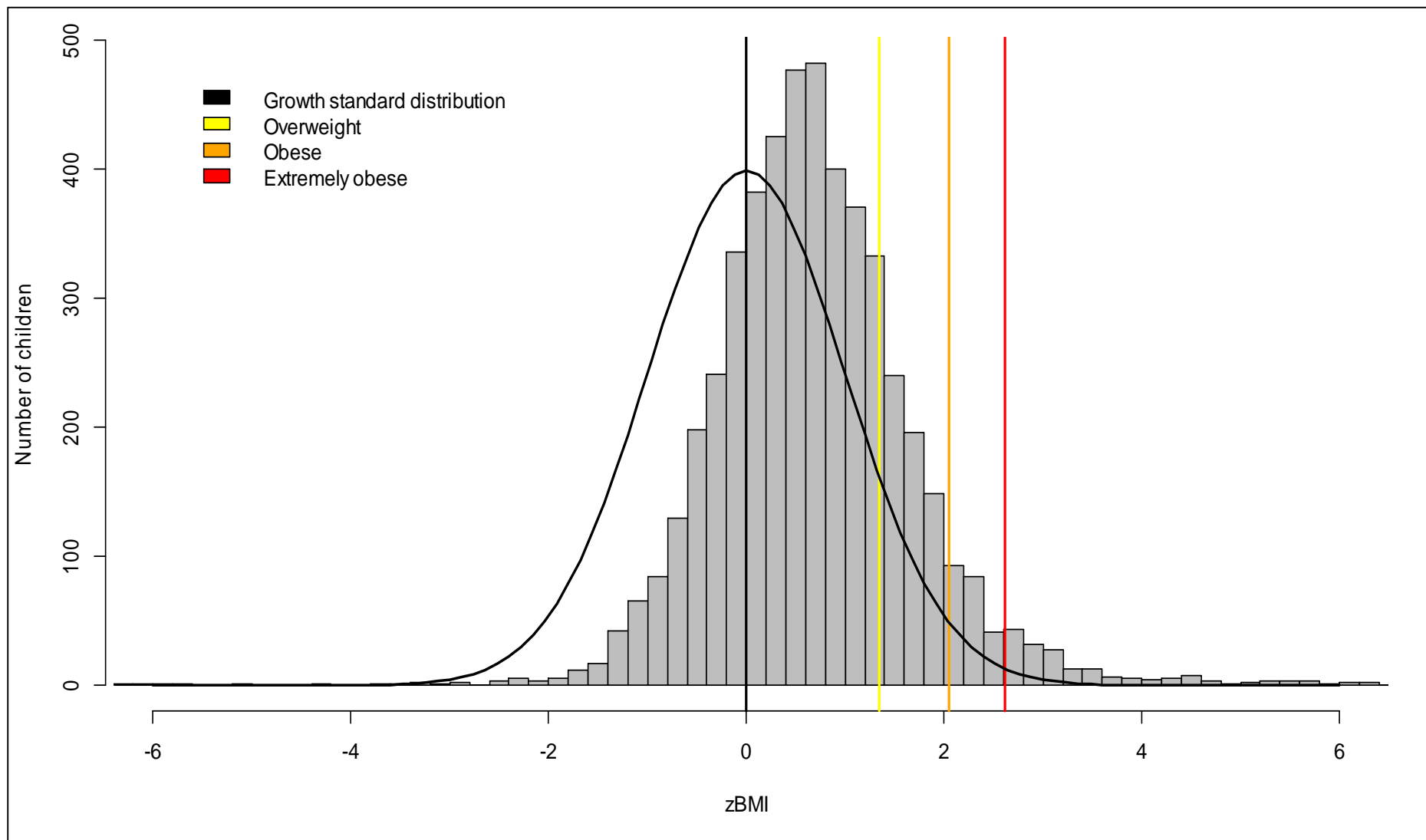


Table 4 provides a breakdown of the number of children assessed as obese during 2013 and 2014. The number of children that would have been required to be referred if the target had been in place is also displayed.

Table 4: Number of obese children in the Bay of Plenty DHB area and the number of children that would have required referral to meet the child obesity health target

	2013			2014		
	Total number of height and weight assessments	Number of obese and extremely obese children	Number required to be referred for assessment and to nutrition and physical activity programs (95% of obese children)	Total number of height and weight assessments	Number of obese and extremely obese children	Number required to be referred for assessment and to nutrition and physical activity programs (95% of obese children)
Number of children	2291	165	157	2589	204	194

6 Statistics by Local Authority

Figure 13 displays, by local authority area, the number of children that were identified as overweight, obese and extremely obese in 2013 and 2014. As expected, the greatest numbers of these children are in the areas with the largest populations. Figure 14 displays the proportion of children in each body size category for each local authority. It shows that Opotiki and Kawerau have a very high proportion of children who are overweight or obese. When making decisions about the allocation of resources and effort to prevent obesity, the number of affected children in each local authority area as well as the relative percent affected in each local authority area should be taken into consideration.

Figure 13: Number of children, by local authority, identified as overweight, obese or extremely obese by the B4SC programme in 2013 and 2014

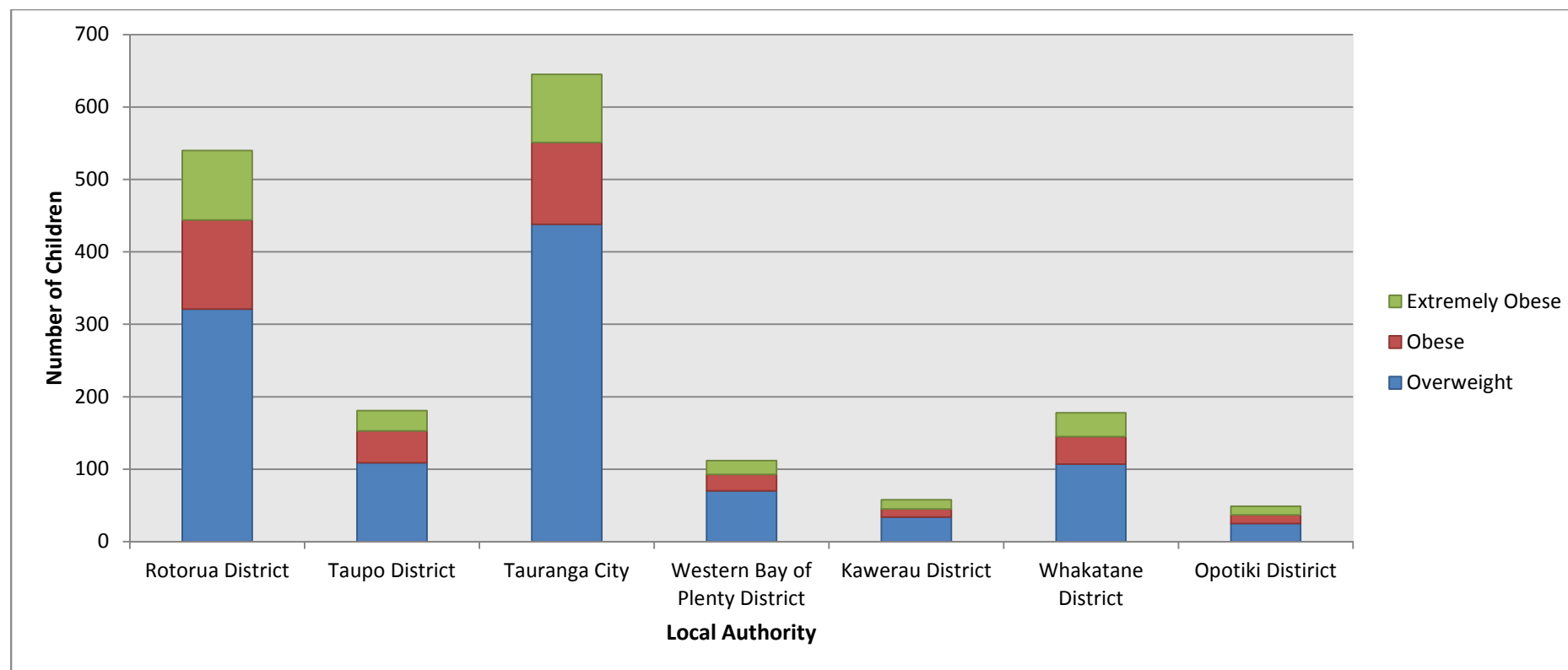
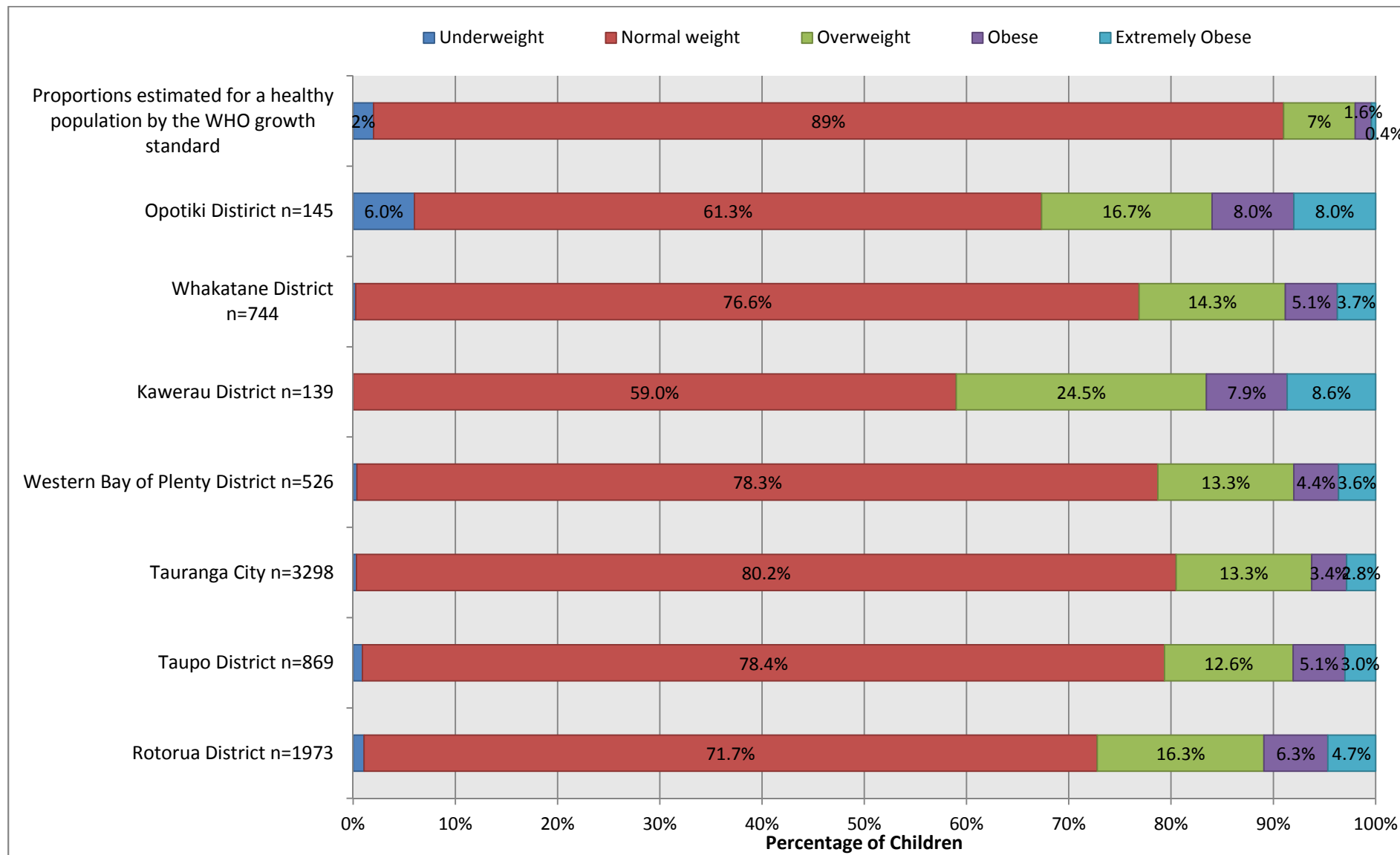


Figure 14: Body size of children in each local authority and compared to the WHO growth standard



7 Summary

The B4SC database provides a unique view of child weight status in four-year-olds. It has enabled a detailed analysis of child weight at a local level that was previously not possible with the available data. Key summary findings for the Toi Te Ora area are:

- All geographic areas and population subgroups have a higher proportion of children who are overweight, obese, or extremely obese compared with the WHO growth standard population.
- Maori have the greatest number of children who are overweight, obese, or extremely obese. NZ European is the ethnic group with the next greatest number of children in this group.
- Obesity is associated with neighbourhood deprivation. For both Maori and NZ European children assessed by the B4SC program, the highest proportions of overweight and obese children are in communities in deprivation quintile five areas.
- For the B4SC 2013-14 population a higher proportion of boys compared with girls are overweight or obese.
- The entire BMI distribution is shifted to the right of where it is expected to be according to the WHO growth standard. This suggests that risk factors for an increased body weight in four-year-old children affect the whole population and are therefore likely to be environmental rather than related to lifestyle choices of a smaller sub-group of the population, such as those identified as obese.

8 Data Tables

8.1 Toi Te Ora – Public Health Service Area

Table 5: Number of children for each body size

	2013							2014						
	Underweight	Normal weight	Overweight	Obese	Extremely obese	Total number of records	Mean zBMI	Underweight	Normal weight	Overweight	Obese	Extremely obese	Total number of records	Mean zBMI
Total	21	2800	539	172	136	3668	0.70	32	3110	566	193	160	4061	0.70
Gender														
Girls	11	1390	231	68	46	1746	0.60	20	1573	238	93	66	1990	0.60
Boys	10	1410	308	104	90	1922	0.79	12	1537	328	100	94	2071	0.79
Ethnicity														
Maori	14	939	257	87	83	1380	0.93	13	1072	250	107	104	1546	0.91
NZ European	3	1536	229	63	32	1863	0.56	13	1700	264	66	38	2081	0.56
Pacific		60	29	8	16	113	1.28	2	67	19	8	8	104	0.97
Asian	3	140	9	6	2	160	0.21	3	144	17	5	4	173	0.32
Deprivation Quintile														
1	1	404	72	19	16	512	0.63	4	477	75	21	10	587	0.54
2		526	79	18	11	634	0.56	4	517	79	25	11	636	0.53
3	7	506	83	29	15	640	0.59	8	593	78	24	17	720	0.58
4	4	579	105	39	30	757	0.73	6	697	132	46	39	920	0.73
5	9	777	198	64	63	1111	0.85	10	818	201	76	82	1187	0.89

Table 6: Proportion of children for each body size

	2013							2014						
	Underweight	Normal weight	Overweight	Obese	Extremely obese	Total number of records	Mean zBMI	Underweight	Normal weight	Overweight	Obese	Extremely obese	Total number of records	Mean zBMI
Total	0.6%	76.3%	14.7%	4.7%	3.7%	3668	0.70	0.8%	76.6%	13.9%	4.8%	3.9%	4061	0.70
Gender														
Girls	0.6%	79.6%	13.2%	3.9%	2.6%	1746	0.60	1.0%	79.0%	12.0%	4.7%	3.3%	1990	0.60
Boys	0.5%	73.4%	16.0%	5.4%	4.7%	1922	0.79	0.6%	74.2%	15.8%	4.8%	4.5%	2071	0.79
Ethnicity														
Maori	1.0%	68.0%	18.6%	6.3%	6.0%	1380	0.93	0.8%	69.3%	16.2%	6.9%	6.7%	1546	0.91
NZ European	0.2%	82.4%	12.3%	3.4%	1.7%	1863	0.56	0.6%	81.7%	12.7%	3.2%	1.8%	2081	0.56
Pacific	0.0%	53.1%	25.7%	7.1%	14.2%	113	1.28	1.9%	64.4%	18.3%	7.7%	7.7%	104	0.97
Asian	1.9%	87.5%	5.6%	3.8%	1.3%	160	0.21	1.7%	83.2%	9.8%	2.9%	2.3%	173	0.32
Deprivation Quintile														
1	0.2%	78.9%	14.1%	3.7%	3.1%	512	0.63	0.7%	81.3%	12.8%	3.6%	1.7%	587	0.54
2	0.0%	83.0%	12.5%	2.8%	1.7%	634	0.56	0.6%	81.3%	12.4%	3.9%	1.7%	636	0.53
3	1.1%	79.1%	13.0%	4.5%	2.3%	640	0.59	1.1%	82.4%	10.8%	3.3%	2.4%	720	0.58
4	0.5%	76.5%	13.9%	5.2%	4.0%	757	0.73	0.7%	75.8%	14.3%	5.0%	4.2%	920	0.73
5	0.8%	69.9%	17.8%	5.8%	5.7%	1111	0.85	0.8%	68.9%	16.9%	6.4%	6.9%	1187	0.89

8.2 Lakes District Health Board

Table 7: Number of children for each body size

	2013							2014						
	Underweight	Normal weight	Overweight	Obese	Extremely obese	Total number of records	Mean zBMI	Underweight	Normal weight	Overweight	Obese	Extremely obese	Total number of records	Mean zBMI
Total	13	1013	208	81	62	1377	0.73	16	1083	224	87	62	1472	0.72
Gender														
Girls	7	492	82	38	16	635	0.64	9	561	95	45	23	733	0.62
Boys	6	521	126	43	46	742	0.81	7	522	129	42	39	739	0.83
Ethnicity														
Maori	11	447	116	44	40	658	0.88	4	450	122	50	40	666	0.92
NZ European	1	443	78	26	15	563	0.60	10	510	81	31	14	646	0.55
Pacific		26	5	3	6	40	1.14	2	21	9	1	3	36	0.88
Asian	1	39	2	4		46	0.16		37	3		2	42	0.20
Deprivation Quintile														
1	1	169	29	9	7	215	0.60	4	185	20	9	1	219	0.45
2		164	31	3	5	203	0.58		168	24	10	4	206	0.54
3	3	116	22	14	5	160	0.68	4	154	24	7	5	194	0.59
4	4	215	43	25	13	300	0.77	3	218	63	26	13	323	0.79
5	5	344	81	29	31	490	0.83	5	355	93	35	38	526	0.91

Table 8: Proportion of children for each body size

	2013							2014						
	Underweight	Normal weight	Overweight	Obese	Extremely obese	Total number of records	Mean zBMI	Underweight	Normal weight	Overweight	Obese	Extremely obese	Total number of records	Mean zBMI
Total	0.9%	73.6%	15.1%	5.9%	4.5%	1377	0.73	1.1%	73.6%	15.2%	5.9%	4.2%	1472	0.72
Gender														
Girls	1.1%	77.5%	12.9%	6.0%	2.5%	635	0.64	1.2%	76.5%	13.0%	6.1%	3.1%	733	0.62
Boys	0.8%	70.2%	17.0%	5.8%	6.2%	742	0.81	0.9%	70.6%	17.5%	5.7%	5.3%	739	0.83
Ethnicity														
Maori	1.7%	67.9%	17.6%	6.7%	6.1%	658	0.88	0.6%	67.6%	18.3%	7.5%	6.0%	666	0.92
NZ European	0.2%	78.7%	13.9%	4.6%	2.7%	563	0.60	1.5%	78.9%	12.5%	4.8%	2.2%	646	0.55
Pacific	0.0%	65.0%	12.5%	7.5%	15.0%	40	1.14	5.6%	58.3%	25.0%	2.8%	8.3%	36	0.88
Asian	2.2%	84.8%	4.3%	8.7%	0.0%	46	0.16	0.0%	88.1%	7.1%	0.0%	4.8%	42	0.20
Deprivation Quintile														
1	0.5%	78.6%	13.5%	4.2%	3.3%	215	0.60	1.8%	84.5%	9.1%	4.1%	0.5%	219	0.45
2	0.0%	80.8%	15.3%	1.5%	2.5%	203	0.58	0.0%	81.6%	11.7%	4.9%	1.9%	206	0.54
3	1.9%	72.5%	13.8%	8.8%	3.1%	160	0.68	2.1%	79.4%	12.4%	3.6%	2.6%	194	0.59
4	1.3%	71.7%	14.3%	8.3%	4.3%	300	0.77	0.9%	67.5%	19.5%	8.0%	4.0%	323	0.79
5	1.0%	70.2%	16.5%	5.9%	6.3%	490	0.83	1.0%	67.5%	17.7%	6.7%	7.2%	526	0.91

8.3 Bay of Plenty District Health Board

Table 9: Number of children for each body size

	2013							2014						
	Underweight	Normal weight	Overweight	Obese	Extremely obese	Total number of records	Mean zBMI	Underweight	Normal weight	Overweight	Obese	Extremely obese	Total number of records	Mean zBMI
Total	8	1787	331	91	74	2291	0.68	16	2027	342	106	98	2589	0.68
Gender														
Girls	4	898	149	30	30	1111	0.58	11	1012	143	48	43	1257	0.59
Boys	4	889	182	61	44	1180	0.78	5	1015	199	58	55	1332	0.77
Ethnicity														
Maori	3	492	141	43	43	722	0.96	9	622	128	57	64	880	0.91
NZ European	2	1093	151	37	17	1300	0.53	3	1190	183	35	24	1435	0.56
Pacific		34	24	5	10	73	1.35		46	10	7	5	68	1.01
Asian	2	101	7	2	2	114	0.23	3	107	14	5	2	131	0.36
Deprivation Quintile														
1		235	43	10	9	297	0.65		292	55	12	9	368	0.60
2		362	48	15	6	431	0.55	4	349	55	15	7	430	0.53
3	4	390	61	15	10	480	0.56	4	439	54	17	12	526	0.58
4		364	62	14	17	457	0.70	3	479	69	20	26	597	0.70
5	4	433	117	35	32	621	0.86	5	463	108	41	44	661	0.88

Table 10: Proportion of children for each body size

	2013							2014						
	Underweight	Normal weight	Overweight	Obese	Extremely obese	Total number of records	Mean zBMI	Underweight	Normal weight	Overweight	Obese	Extremely obese	Total number of records	Mean zBMI
Total	0.3%	78.0%	14.4%	4.0%	3.2%	2291	0.68	0.6%	78.3%	13.2%	4.1%	3.8%	2589	0.68
Gender														
Girls	0.4%	80.8%	13.4%	2.7%	2.7%	1111	0.58	0.9%	80.5%	11.4%	3.8%	3.4%	1257	0.59
Boys	0.3%	75.3%	15.4%	5.2%	3.7%	1180	0.78	0.4%	76.2%	14.9%	4.4%	4.1%	1332	0.77
Ethnicity														
Maori	0.4%	68.1%	19.5%	6.0%	6.0%	722	0.96	1.0%	70.7%	14.5%	6.5%	7.3%	880	0.91
NZ European	0.2%	84.1%	11.6%	2.8%	1.3%	1300	0.53	0.2%	82.9%	12.8%	2.4%	1.7%	1435	0.56
Pacific	0.0%	46.6%	32.9%	6.8%	13.7%	73	1.35	0.0%	67.6%	14.7%	10.3%	7.4%	68	1.01
Asian	1.8%	88.6%	6.1%	1.8%	1.8%	114	0.23	2.3%	81.7%	10.7%	3.8%	1.5%	131	0.36
Deprivation Quintile														
1	0.0%	79.1%	14.5%	3.4%	3.0%	297	0.65	0.0%	79.3%	14.9%	3.3%	2.4%	368	0.60
2	0.0%	84.0%	11.1%	3.5%	1.4%	431	0.55	0.9%	81.2%	12.8%	3.5%	1.6%	430	0.53
3	0.8%	81.3%	12.7%	3.1%	2.1%	480	0.56	0.8%	83.5%	10.3%	3.2%	2.3%	526	0.58
4	0.0%	79.6%	13.6%	3.1%	3.7%	457	0.70	0.5%	80.2%	11.6%	3.4%	4.4%	597	0.70
5	0.6%	69.7%	18.8%	5.6%	5.2%	621	0.86	0.8%	70.0%	16.3%	6.2%	6.7%	661	0.88

8.4 Local Authorities

Table 11: Number of children for each body size

	2013							2014						
	Underweight	Normal weight	Overweight	Obese	Extremely obese	Total number of records	Mean zBMI	Underweight	Normal weight	Overweight	Obese	Extremely obese	Total number of records	Mean zBMI
Rotorua District	10	683	159	64	47	963	0.79	11	729	162	59	49	1010	0.77
Taupo District	3	325	48	16	15	407	0.58	5	355	61	28	13	462	0.62
Tauranga City	6	1268	209	54	40	1577	0.60	5	1378	229	59	54	1725	0.65
Western Bay of Plenty District	0	164	29	5	9	207	0.72	2	248	41	18	10	319	0.70
Kawerau District	0	48	18	5	7	78	1.11	0	34	16	6	6	62	1.25
Whakatane District	0	260	64	19	14	357	0.88	2	313	43	19	19	396	0.71
Opotiki District	2	42	11	8	3	66	0.79	7	50	14	4	9	84	0.71

Table 12: Proportion of children for each body size

	2013							2014						
	Underweight	Normal weight	Overweight	Obese	Extremely obese	Total number of records	Mean zBMI	Underweight	Normal weight	Overweight	Obese	Extremely obese	Total number of records	Mean zBMI
Rotorua District	1.0%	71.0%	16.5%	6.7%	4.8%	962	0.79	1.1%	72.4%	16.1%	5.9%	4.6%	1007	0.77
Taupo District	0.7%	80.1%	11.8%	3.9%	3.5%	406	0.58	1.1%	77.0%	13.2%	6.1%	2.6%	461	0.62
Tauranga City	0.4%	80.4%	13.3%	3.4%	2.5%	1577	0.60	0.3%	79.9%	13.3%	3.4%	3.1%	1724	0.65
Western Bay of Plenty District	0.0%	79.2%	14.0%	2.4%	4.4%	207	0.72	0.6%	77.7%	12.9%	5.6%	3.1%	319	0.70
Kawerau District	0.0%	61.5%	23.1%	6.4%	9.0%	78	1.11	0.0%	55.7%	26.2%	9.8%	8.2%	61	1.25
Whakatane District	0.0%	73.5%	18.1%	5.4%	3.1%	354	0.88	0.5%	79.4%	10.9%	4.8%	4.3%	394	0.71
Opotiki District	3.0%	63.6%	16.7%	12.1%	4.6%	66	0.79	8.3%	59.5%	16.7%	4.8%	10.7%	84	0.71

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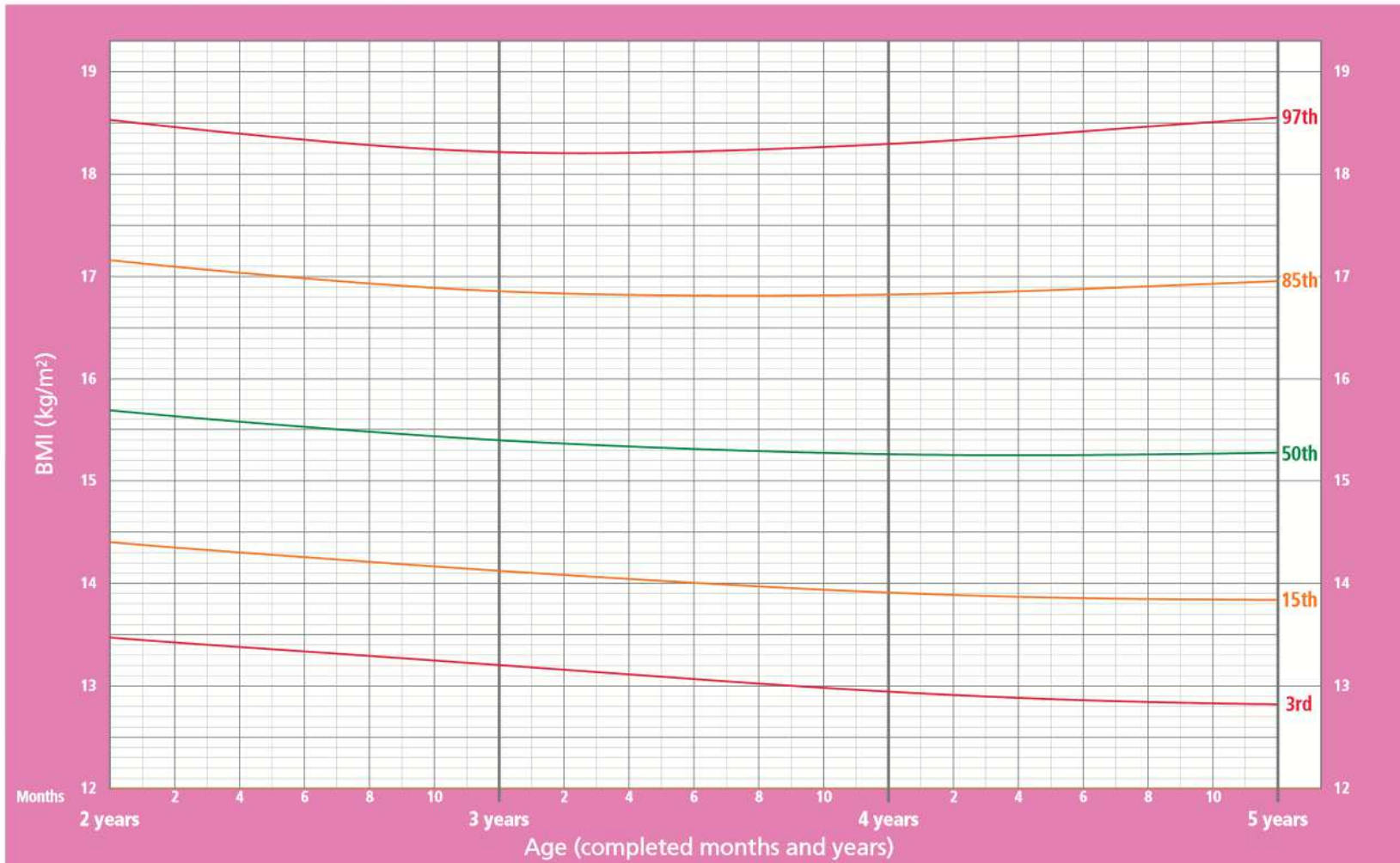
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Appendices

Appendix 1: World Health Organization BMI-for-age growth charts

BMI-for-age GIRLS

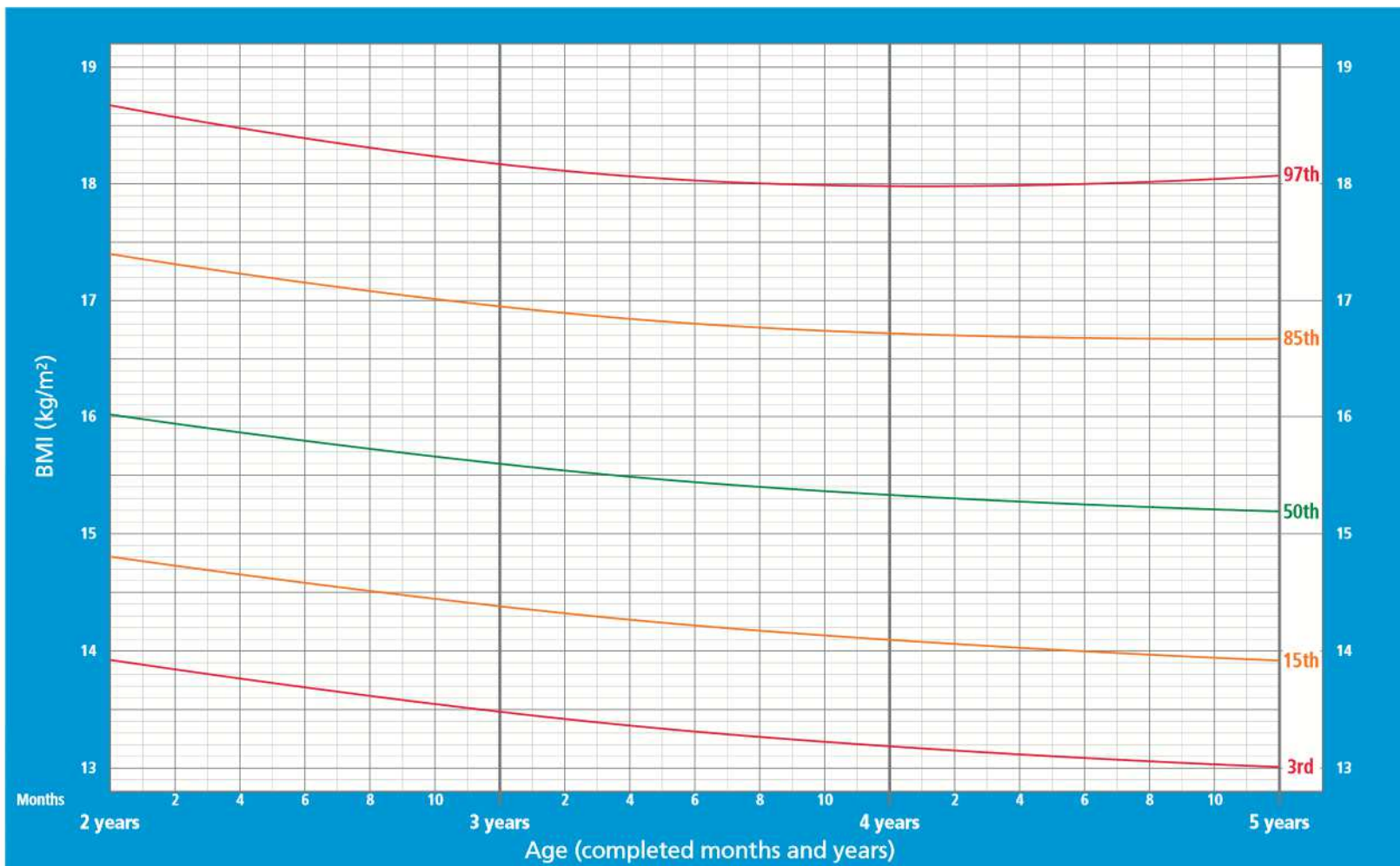
2 to 5 years (percentiles)



WHO Child Growth Standards

BMI-for-age BOYS

2 to 5 years (percentiles)



WHO Child Growth Standards