

# BMJ Open Assessment of health-related quality of life and psychological well-being of children and adolescents with obesity enrolled in a New Zealand community-based intervention programme: an observational study

Yvonne C Anderson,<sup>1,2</sup> Lisa E Wynter,<sup>1</sup> Katharine F Treves,<sup>1</sup> Cameron C Grant,<sup>3,4,5</sup> Joanna M Stewart,<sup>6</sup> Tami L Cave,<sup>2</sup> Trecia A Wouldes,<sup>7</sup> José G B Derraik,<sup>2,8</sup> Wayne S Cutfield,<sup>2,4,8</sup> Paul L Hofman<sup>2,4</sup>

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For numbered affiliations see end of article.

## Correspondence to

Dr. Yvonne C Anderson;  
[yvonne.anderson@tdhb.org.nz](mailto:yvonne.anderson@tdhb.org.nz)

## ABSTRACT

**Objective** To describe health-related quality of life (HRQOL) and psychological well-being of children and adolescents at enrolment in a multidisciplinary community-based obesity programme and to determine association with ethnicity. This programme targeted indigenous people and those from most deprived households. Further, this cohort was compared with other populations/normative data.

**Methods** This study examines baseline demographic data of an unblinded randomised controlled clinical trial. Participants (recruited from January 2012–August 2014) resided in Taranaki, New Zealand, and for this study we only included those with a body mass index (BMI)  $\geq$ 98th percentile (obese). HRQOL and psychological well-being were assessed using the Pediatric Quality of Life Inventory (PedsQL V.4.0™) (parent and child reports), and Achenbach's Child Behavior Checklist (CBCL)/Youth Self Report (YSR).

**Results** Assessments were undertaken for 233 participants (45% Māori, 45% New Zealand European, 10% other ethnicities, 52% female, 30% from the most deprived household quintile), mean age 10.6 years. The mean BMI SD score (SDS) was 3.12 (range 2.01–5.34). Total PedsQL generic scaled score (parent) was lower (mean=63.4, SD 14.0) than an age-matched group of Australian children without obesity from the Health of Young Victorians study (mean=83.1, SD 12.5). In multivariable models, child and parental generic scaled scores decreased in older children ( $\beta=-0.70$  and  $p=0.031$ ,  $\beta=-0.64$  and  $p=0.047$ , respectively). Behavioural difficulties (CBCL/YSR total score) were reported in 43.5% of participants, with the rate of emotional/behavioural difficulties six times higher than reported norms ( $p<0.001$ ).

**Conclusions** In this cohort, children and adolescents with obesity had a low HRQOL, and a concerning level of psychological difficulties, irrespective of ethnicity. Obesity itself rather than ethnicity or deprivation appeared to contribute to lower HRQOL scores. This study highlights

## Strengths and limitations of this study

- This study is the first to report health-related quality of life (HRQOL) in children and adolescents with obesity in New Zealand.
- To our knowledge, there are very limited data regarding ethnicity and HRQOL. Due to the high participation rate from Māori, we were able to evaluate the impact of ethnicity on HRQOL.
- Due to the lack of New Zealand HRQOL data, comparisons have been made with population groups of varying age ranges, which may have affected results.
- The study participants were a referred cohort, which means our findings are not representative of the general population. The data from the Victorian cohort were collected in 2000, and the differences noted may have been impacted by the difference in dates of data collection.
- Mean body mass index SD score for the Victorian cohort identified as obese was not available, which would be important if it was considerably lower than the Whānau Pakari participants.
- There were no adjustments for multiple comparisons in our statistical analyses; due to the inflated likelihood of type 1 errors, our findings (particularly from exploratory analyses) need to be interpreted accordingly.

the importance of psychologist involvement in obesity intervention programmes.

**Trial registration number** Australian NZ Clinical Trials Registry ANZCTR 12611000862943; Pre-results.

## INTRODUCTION

Obesity in childhood and adolescence is known to be associated with weight-related

comorbidities.<sup>1</sup> Indigenous populations often have higher rates of obesity compared with non-indigenous counterparts where this information has been collated.<sup>2,3</sup> In New Zealand, approximately 11% of New Zealand children aged 2–14 years are classed as obese, with Māori (New Zealand's indigenous population) being 1.6 times more likely to be in the obese range compared with non-Māori counterparts.<sup>3</sup> In addition, children living in households in the most socioeconomically deprived quintile for New Zealand are five times more likely to be in the obese range than children living in the least deprived areas.<sup>3</sup> In the USA, while rates of children with obesity are not readily available for American Indian populations, rates of type 2 diabetes mellitus (a known weight-related comorbidity) are higher.<sup>2</sup>

Globally, indigenous populations that have experienced historical trauma secondary to colonisation are over-represented in socioeconomic household deprivation, and both experience the resultant health disparities.<sup>2</sup> The social determinants of health, such as poverty, limited educational attainment and critically the loss of a traditional diet, all contribute to the impact on these population groups in terms of health and well-being.<sup>2</sup> Overweight and obesity in adolescence have been shown to be strongly associated with medical complications, including an increase in cardiovascular mortality in adulthood.<sup>4</sup> Emerging evidence suggests that obesity also affects the emotional health and well-being of children and adolescents, commonly referred to as health-related quality of life (HRQOL).<sup>5</sup> However, little is known about the HRQOL of indigenous children and adolescents, especially as it pertains to weight. Previous research has found that Sami (the indigenous people of Sweden) children experience lower HRQOL in some domains compared with Swedish children in general.<sup>6</sup> In relation to HRQOL as it pertains to weight, and the impact of ethnicity, it is acknowledged that information about the relationship between HRQOL and weight may not have transferability from one cultural context to another, given differing perceptions of body image cross-culturally.<sup>7,8</sup>

Quality of life is a broad construct that encompasses various aspects pertaining to health and well-being.<sup>9</sup> The assessment of HRQOL is increasingly recognised as a necessary component of health and well-being evaluation, assessing physical, emotional and social health dimensions.<sup>10,11</sup> Measurement of HRQOL has been shown to have utility in paediatric healthcare settings encompassing numerous chronic health conditions<sup>12–14</sup> and in the assessment of health in young adults.<sup>9</sup>

Obesity during childhood is associated with impaired HRQOL. In one US study, 106 children and adolescents with severe obesity attending an obesity clinic reported significantly lower HRQOL than 401 healthy weight comparison children recruited through private practice paediatrician offices and health clinics, and similar HRQOL to 106 children and adolescents undergoing chemotherapy for cancer.<sup>15</sup> The HRQOL of 9–12-year-old children enrolled in an Australian community-based

longitudinal study was significantly lower among those with obesity versus those without obesity, with the differences not as marked as in the US study, but more likely to represent those of children with obesity not being seen in a specialised clinic setting.<sup>16</sup> Pooled results from 22 cross-sectional and population-based studies report that children and adolescents with obesity have reduced overall HRQOL compared with normal weight counterparts, with 12 of these studies demonstrating an inverse relationship between overall HRQOL and weight status.<sup>5</sup> Potential factors contributing to HRQOL in child and adolescent populations with obesity include treatment seeking versus community counterparts, gender, age and weight-related comorbidities.<sup>5</sup>

Alongside, and likely to be contributing to lower HRQOL, children and adolescents with obesity are at increased risk of behavioural and emotional difficulties. In addition to differences in HRQOL, studies have found concerning levels of internalising (anxiety/depression, social withdrawal and somatic complaints) and externalising behaviours (delinquency and rule-breaking behaviours) in children and adolescents with obesity.<sup>17,18</sup> Others have identified higher rates of depression, behavioural problems and low self-esteem in adolescents with obesity attending obesity clinics compared with affected counterparts in the community.<sup>19</sup> Children who are overweight and obese have also been shown to be at risk for psychosocial difficulties such as body image concerns, and emotional, social and school difficulties.<sup>20</sup>

Currently there are no published data on the HRQOL of children and adolescents with obesity in New Zealand. To our knowledge, there has only been quality of life data published on oral quality of life as it relates to dental caries,<sup>21</sup> and Type 1 diabetes in New Zealand.<sup>14</sup> In addition, there is an absence of cross-cultural evaluation of obesity and HRQOL. In this study, we aimed to describe the HRQOL (parent and child reports) and behavioural and emotional problems of children and adolescents with obesity at enrolment in a multidisciplinary obesity intervention programme. In addition, we compared this cohort to other populations or to normative data, and also examined potential ethnic differences between indigenous and non-indigenous children and adolescents. It was hypothesised that obesity is associated with lower HRQOL in New Zealand children and adolescents with obesity.

## METHODS

Children and adolescents were recruited into 'Whānau Pakari', a community-based, unblinded randomised controlled trial of a multidisciplinary obesity intervention programme,<sup>22</sup> based in Taranaki (New Zealand). This region has a population of 23 139 children aged 0–15 years, of whom 81% identify as New Zealand European, 28% as Māori and 1% as other ethnicity.<sup>23</sup> Eligibility was defined by residence in Taranaki, being aged 4.8–16.8

years, and either in obese (body mass index (BMI)  $\geq 98^{\text{th}}$  centile) or overweight (BMI  $> 91^{\text{st}}$  centile) categories with weight-related comorbidities.<sup>24</sup> However, only obese participants were included in the study reported here. Referrals were received between January 2012 and August 2014 from a wide range of health professionals (including paediatricians, primary care providers and public health nurses), Māori health workers, school counsellors and self-referrals. This study examines elements of the baseline demographic data.

### Assessments

Participants underwent a baseline assessment at home, which included taking anthropometric measurements, a medical history and weight-related physical examination, dietary history, physical activity questionnaire and completion of psychometric questionnaires. Questions pertaining to family structure, developmental history, presence/absence of headaches, difficulty getting to sleep and presence/absence of breathing pauses were all included in the weight-related medical history. Randomisation into six monthly assessments and advice or the intervention arm occurred if the participants indicated willingness to make healthy lifestyle change.<sup>22</sup> The intervention consisted of weekly sessions delivered by a multidisciplinary team for 12 months including physical activity, dietary advice and psychology sessions (e.g., self-esteem, the importance of sleep, how to make and persist with healthy lifestyle change).

### Measures

BMI percentile and SD score (SDS) were calculated using UK Cole normative data<sup>25</sup> with the KIGS auxology software (Pfizer Endocrine Care™). Socioeconomic deprivation was measured at the household level using the New Zealand Deprivation Index 2006.<sup>26</sup> This area-level deprivation index is a well-validated measure of socioeconomic deprivation in New Zealand, which is derived from national census data on nine socioeconomic characteristics.

Quality of life was measured using the Pediatric Quality of Life Inventory (PedsQL), which has been specifically designed to evaluate HRQOL in children and adolescents. The PedsQL questionnaire has both parent-proxy and child self-report versions, which take approximately 5 min to administer. It consists of a 23-item Generic Core Scale that assesses problems over the preceding month related to Physical, Emotional, Social and School functioning.<sup>11 13</sup> The reliability of this instrument has been demonstrated in ages 2–16 years as excellent ( $\alpha=0.89$  child;  $0.92$  parent report) with acceptable construct validity, in a large population survey in the USA ( $n=10241$ ), with white, Hispanic/Latino, black/African American, Asian/Pacific Islander, American Indian and Native Alaskan participants.<sup>27</sup> A meaningful cut-off to identify those at risk of impaired HRQOL has been proposed as one SD below the population mean.<sup>27</sup> Individual questions for each area are reverse scored and

linearly transformed into a 0–100 scale, where higher scores indicate better HRQOL.

The existence of behavioural difficulties was assessed using Achenbach's Child Behavior Checklist (CBCL) ages 1.5–5 and ages 6–18 (parent report) and Youth Self Report (YSR) for ages 11–18.<sup>28</sup> The CBCL/YSR generate ratings of behavioural, emotional and social problems. The CBCL can be completed by parents, caregivers or others who see children in family contexts, or by the young person themselves in the case of the YSR. When the young person completed the YSR, no parent CBCL report was obtained in order to reduce the burden of assessment on the family. Subscale scores for the YSR and the CBCL are calculated for a number of behavioural and psychological problems such as aggressive behaviour, and somatic complaints. Subscales are then combined to obtain overall T-scores for *internalising* and *externalising* problems. Aggregate scores that represent *normal*, *borderline* or *clinical* behaviour are based on quartiles from a normative sample.<sup>28</sup> The normative data for the CBCL/YSR have been derived from the 1999 National Survey of Children, Youth and Adults, a US population survey of 2029 children and adolescents of four ethnic groups (60% Latino white, 20% African American, 12% Mixed other and 9% Latino), of mixed socioeconomic status (33% 'upper', 16% 'lower'), equal gender split and ranging in age from 6 to 18 years.<sup>29</sup>

### Data analyses

PedsQL scores from the children and adolescents enrolled in this study were compared with three populations using two-sample t-tests. These comparison populations were:

1. A predominantly normal weight cohort of children from the Taranaki region ( $n=42$ ) with a long-term chronic condition (Type 1 diabetes), with a mean age of 11.5 years (range 2–17 years), who were predominantly of New Zealand European (71%) or Māori (19%) ethnicity, and with representation from all levels of household deprivation.<sup>14</sup> This cohort was used as they were resident in the same region as Whānau Pakari participants, and the only group of New Zealand children for which published HRQOL data using PedsQL exists. Recruitment period was May–July 2013.
2. A cohort of Australian children ( $n=63$ ) from the Health of Young Victorians Study (follow-up data collected in 2000), who were identified as having obesity (from the total cohort of  $n=1456$ ).<sup>16</sup> We used Australian data due to the lack of New Zealand data available.
3. A cohort of Australian children from the above study (follow-up data collected in 2000), identified as having normal weight ( $n=1099$ , from the total cohort of  $n=1456$ ). The children in the entire Health of Young Victorians cohort were aged 10.4 years (range 9–12 years), with representation from all quintiles of socioeconomic disadvantage, but ethnicity of participants was not reported.<sup>16</sup> Given

that developmental stage may be a contributing factor to HRQOL scores,<sup>5 30</sup> the Whānau Pakari cohort comparison was limited to 9–12 years (n=91).

Exploratory analyses of the PedsQL data examined potential associations between a number of sociodemographic and clinical parameters with parental and child's generic scaled scores separately, using simple linear regressions and one-way analysis of variance. Further, multivariable models were used to examine possible associations between either parental or child's generic scaled score and important confounding factors, namely age, sex, ethnicity and socioeconomic deprivation.

CBCL and YSR T-scores were used. One-tailed one-sample proportion tests were used to compare the rates of participants classified as borderline clinical or clinical in each CBCL/YSR subscale to the normative data (i.e., expected to be ≤7% of the population). Exploratory analyses using generalised linear regression models also examined the likelihood of displaying behavioural and emotional problems (i.e., having CBCL/YSR scores in the borderline or clinical ranges) in association with certain demographic parameters, adjusting only for source of test scores (i.e., parent or youth). A similarly constructed multivariable model was also run adjusting for age, sex, ethnicity and socioeconomic deprivation. These results are provided as relative risks (RR) and respective 95% CIs. Data were analysed in Minitab V.16 (Pennsylvania State University, State College, Pennsylvania, USA) and SAS V.9.4. All statistical tests (except one-sample proportion tests) were two-tailed. Significance level was maintained at  $p < 0.05$ , with no adjustments for multiple comparisons.

## RESULTS

After exclusion of six participants who were in the overweight category, enrolled participants (n=233) had a mean age of 10.6 years (range 4.8–16.8 years), 52% were females and the sample was predominantly either of Māori (45%) or New Zealand European (45%) ethnicity. Nearly a third (30%) resided in households among the most deprived quintile (compared with 15% among the population of Taranaki).<sup>26 31 32</sup> Forty-two per cent of Māori participants were from the most deprived quintile of household deprivation, compared with 20% of New Zealand European participants ( $p < 0.001$ ). BMI SDS at enrolment was 3.12 (SD 0.57, range 2.01–5.34 SDS). Demographics of family and medical history have been previously reported for the total cohort.<sup>33</sup> In brief, among our 233 participants, living arrangements included a two-parent household for half of the participants (n=119, 52%), one-parent household (mother) for 38% (n=87), one-parent household (father) for 4% (n=10) and other arrangement for 6% (n=14). Headaches were prevalent in 32% (n=75), 32% of participants had difficulties getting to sleep (n=75), 20% had breathing pauses (n=47) and 9% had developmental concerns (n=20).

### Quality of life

The PedsQL scores of our study's participants and those of another study population in Taranaki are shown in [table 1](#). There was a moderately positive correlation between overall quality of life scores derived from child compared with parental reports ( $r = 0.55$ ;  $p < 0.001$ ). However, for all three PedsQL measures, parents scored their children's HRQOL as being lower than that reported by the participants themselves ([table 1](#)).

**Table 1** Unadjusted Pediatric Quality of Life Inventory total generic scaled scores, as well as psychosocial and physical scaled scores (out of 100) for Whānau Pakari participants compared with other Taranaki children with Type 1 diabetes (predominantly normal weight)<sup>14</sup>

	Whānau Pakari	Type 1 diabetes
Location	Taranaki, New Zealand	Taranaki, New Zealand
Source	This study	Mills <i>et al</i> <sup>14</sup>
n	233	42
Age range (years)	4.8–16.8	2–17
<b>Child</b>		
Total generic scaled score	72.2±16.2 (70.1 to 74.3)*	74.6±15.3
Psychosocial scaled score	69.4±18.6 (67.0 to 71.8)*	71.2±17.1
Physical scaled score	76.9±16.7 (74.8 to 79.1)*	80.8±15.3
<b>Parent</b>		
Total generic scaled score	65.1±16.0 (63.0 to 67.1)	75.9±13.4†
Psychosocial scaled score	64.1±17.3 (61.9 to 66.3)	73.7±13.1†
Physical scaled score	66.3±20.3 (63.6 to 68.9)	79.9±17.9†

Whānau Pakari data are mean ± SD (95% CI of the mean), while other data are mean ± SD.

\* $p < 0.001$  for a difference between child and parental scores

† $p < 0.001$  for comparison with Whānau Pakari.

**Table 2** Unadjusted Pediatric Quality of Life Inventory total generic scaled scores, as well as psychosocial and physical scaled scores (out of 100) for Whānau Pakari participants aged 9–12 years, compared with children and adolescents of two reference populations with a matching age range<sup>14 16</sup>

	Whānau Pakari	Normal weight	Obese
Location	Taranaki, New Zealand	Victoria, Australia	Victoria, Australia
Source	This study	Williams <i>et al</i> <sup>16</sup>	Williams <i>et al</i> <sup>16</sup>
n	91	1099	63
Age range (years)	9–12	9–12	9–12
<b>Child</b>			
Total generic scaled score	69.0±15.9 (65.7 to 72.3)‡	80.5±12.2***	74.0±14.2*
Psychosocial scaled score	65.8±18.4 (61.9 to 69.6)†	77.7±14.1***	72.1±14.1*
Physical scaled score	74.9±15.7 (71.6 to 78.2)‡	85.7±12.4***	77.5±17.9
<b>Parent</b>			
Total generic scaled score	63.4±14.0 (60.5 to 66.3)	83.1±12.5***	75.0±14.5***
Psychosocial scaled score	61.5±15.1 (58.4 to 64.7)	77.6±14.5***	73.9±15.3***
Physical scaled score	66.7±17.7 (63.0 to 70.3)	87.8±14.3***	76.3±17.6**

\*p<0.05, \*\*p<0.01 and \*\*\*p<0.001 for comparison with Whānau Pakari

†p<0.05 and ‡p<0.001 for a difference between child and parental scores

Whānau Pakari data are mean±SD (95% CI of the mean), while other data are mean ± SD.

The Whānau Pakari participants reported similar HRQOL scores to Taranaki youth who were predominantly normal weight but with a chronic condition<sup>14</sup> (table 1). However, youth with obesity in Whānau Pakari had consistently lower HRQOL scores than normal weight Australian children (p<0.001; table 2), and a community sample with obesity.<sup>16</sup> Whānau Pakari parents reported that their children had lower HRQOL than those reported by the parents of all three of the comparison groups (p<0.001; tables 1 and 2).

Exploratory analyses showed consistent associations between child and parent total generic scaled scores, and certain sociodemographic and clinical parameters, indicating worse overall quality of life with participants who had breathing pauses (p=0.0439 child and p<0.001 parent, respectively), reported difficulty getting to sleep (p=0.019 and p<0.001), history of headaches (p=0.023 and p=0.022), developmental problems (p<0.001 and p<0.001), and a father being identified as the sole/primary caregiver as opposed to children living in two-parent families (p=0.010 and p=0.031). In multivariable models, there was evidence that child and parental generic scaled scores decreased in older children ( $\beta=-0.70$  and p=0.031,  $\beta=-0.64$  and p=0.047, respectively), but there were no apparent associations with sex, ethnicity or household deprivation within our cohort.

### Child Behaviour Checklist

Of the total cohort for this study, 232 participants/parents completed the CBCL/YSR. The median CBCL/YSR total score was 58 (IQR 15.0). The distribution of participants' scores is shown in figure 1.

Just over half of the participants had CBCL/YSR total scores in the normal range (56.5%), while the remaining 43.5% had scores in the borderline clinical (15.5%) and

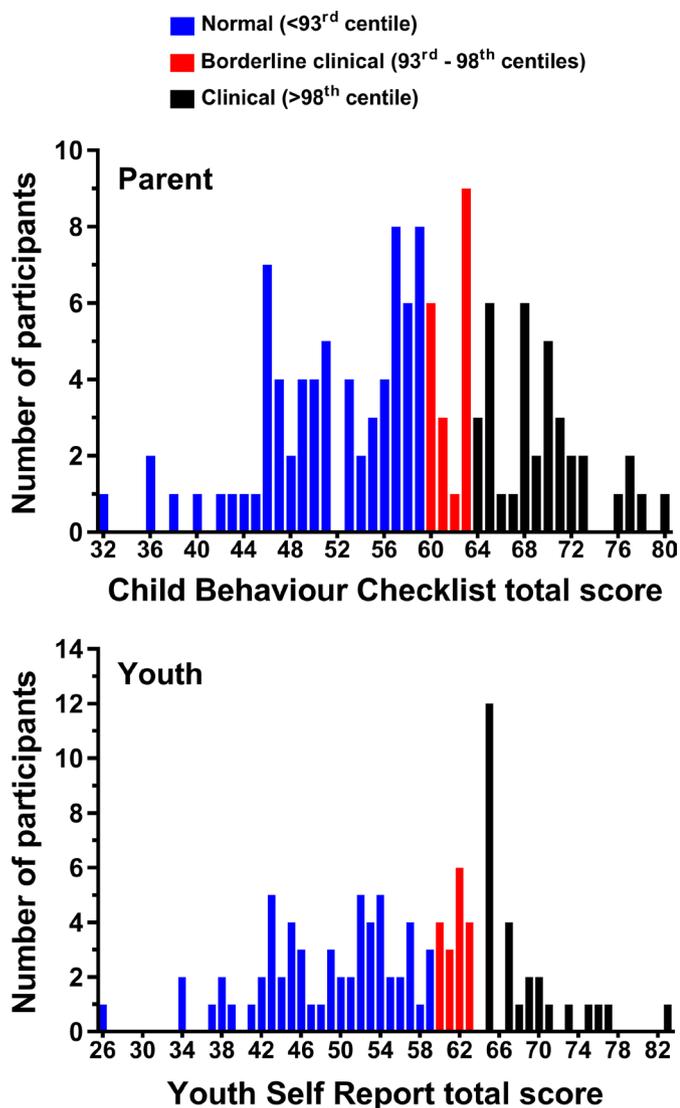
clinical (28.0%) ranges (figure 1 and table 3). From US normative data previously described, the overall proportion of population falling into the borderline clinical or clinical range is  $\leq 7\%$ .<sup>29</sup> This means that children in our study had a prevalence of emotional and behavioural problems that was more than six times higher (p<0.001) than normative populations.

The classification of participants according to individual CBCL/YSR subscales (both parent report and youth report) are shown in table 3. Missing data on subscales for parent report are due to the absence of these subscales in the questionnaire for those aged 1.5–5 years. Based on CBCL/YSR findings, children and adolescents in our cohort were significantly more likely to display emotional and behavioural difficulties than those in the general population. Compared with normative data, the proportion of participants in borderline clinical or clinical ranges was considerably greater for all subscales (table 3).

Exploratory analyses showed a higher probability of behavioural and emotional problems (as per CBCL/YSR total scores) in those who experienced breathing pauses (RR 1.52, 95% CI 1.13 to 2.04) or displayed developmental problems (RR 1.59, 95% CI 1.11 to 2.27). Multivariable analyses showed that older age at assessment was associated with higher CBCL/YSR total scores (ie, worse scores) ( $\beta=0.89$ ; p=0.011), while males were more likely to display behavioural and emotional problems than females (RR 1.43, 95% CI 1.06 to 1.94).

### Ethnic comparisons

There were no differences between Māori and New Zealand European participants with obesity with respect to the child's reported overall PedsQL scores (p=0.09) or PedsQL psychosocial (p=0.14) scores, but Māori children reported higher PedsQL physical scores (80.1 vs 74.7,



**Figure 1** Frequency distribution of participants according to Achenbach's Child Behavior Checklist and Youth Self Report total scores.

respectively,  $p=0.019$ ). With respect to parental report, there were no ethnic differences in total quality of life ( $p=0.81$ ), psychosocial ( $p=0.76$ ) or physical ( $p=0.53$ ) scores. There were no differences between Māori and New Zealand European participants on CBCL/YSR total ( $p=0.25$ ), internalising ( $p=0.12$ ) or externalising ( $p=0.71$ ) scores.

## DISCUSSION

The main findings of this study were that children and adolescents with obesity in this region of New Zealand had lower HRQOL on parent report measures when compared with those with a chronic condition (i.e., diabetes that requires daily testing and treatment) and other samples with and without obesity. In addition, a large proportion (43.5%) obtained CBCL/YSR scores in the clinical and borderline range for experiencing psychological problems. The parent report quality of life

scores were not dissimilar to those described in children with obesity attending a specialist clinic, and were similar to children and adolescents diagnosed with cancer.<sup>15</sup> The degree to which HRQOL appeared to be affected in our cohort was not surprising, given that treatment-seeking parents of children with obesity are more likely to perceive their child as having a poorer HRQOL and more psychological difficulties when compared with parents of children with obesity in the community not seeking treatment.<sup>5,34</sup> Our cohort consisted of participants referred to an obesity intervention programme, so were not a true community-based sample. Nor were they directly comparable to a hospital outpatient clinic population given that Whānau Pakari was specifically designed to address barriers to access which exist for hospital-based outpatient clinical care, particularly for indigenous children.<sup>22</sup> Allowing for this not being a complete non-referred sample, the difference in HRQOL scores in our cohort compared with a large population-based study ( $n=10241$ ) of predominantly normal weight children aged 2–16 years (mean score 65.4 vs 81.3) is considerable.<sup>35</sup>

Differences between parent-proxy and child self-report on PedsQL questionnaires have been previously reported. A systematic review of the relationship between parents and children's HRQOL scores found better agreement among parents and chronically sick children than between parents and their healthy children.<sup>36</sup> It was argued that both parent and child reports should be obtained as they provide different perspectives. A further review noted differences in parent-child agreement in HRQOL across four different instruments.<sup>37</sup> The authors suggested that the disagreement was a consequence of varying individual beliefs about the child's health and well-being, rather than parent or child reports being wrong or right.<sup>37</sup> A Norwegian study reviewed this in relation to children and adolescents seeking treatment for obesity versus a community sample of children of any BMI.<sup>34</sup> Parents reported the quality of life of the children with obesity seeking treatment as lower than those in the community, which was not seen with the child self-report.<sup>34</sup> Pooled analyses however showed that paediatric HRQOL can be accurately predicted from parent proxy reports with moderate to strong linear relationships between the two methods of report.<sup>5</sup>

We observed that psychological difficulties were prevalent in our cohort. Our participants aged 11–18 years reported a mean total YSR score of 55.9 (SD 10.6), which is similar to a small non-clinical group of adolescents with obesity from Turkey ( $n=30$ ) with a total problem score of 58.2 (SD 7.7).<sup>19</sup> We have no national data for comparison with CBCL/YSR, but there is nothing to suggest that scores in the Taranaki region would be higher than those nationally, and there is no known biological or environmental reason for this cohort to have higher rates of mental health problems outside of their obesity. The absence of paediatric psychology services at the time of this study is a notable issue in the region (child and adolescent mental health services were available), and it

**Table 3** Proportion of participants with T-scores from Child Behaviour Checklist (CBCL)/Youth Self Report (YSR) falling into normal, borderline clinical and clinical ranges at baseline, as per parental and youth assessments

Assessment	CBCL/YSR subscale	n	Normal*	Borderline clinical†	Clinical‡
Parent	Anxious	128	110 (85.9%)§	8 (6.3%)	10 (7.8%)
	Withdrawn	128	92 (71.9%)§	26 (20.3%)	10 (7.8%)
	Somatic complaints	128	98 (76.6%)§	20 (15.6%)	10 (7.8%)
	Social difficulties	100	70 (70.0%)§	20 (20.0%)	10 (10.0%)
	Thought problems	100	80 (80.0%)§	7 (7.0%)	13 (13.0%)
	Attention difficulties	128	110 (85.9%)§	9 (7.0%)	9 (7.0%)
	Rule breaking	100	76 (76.0%)§	16 (16.0%)	8 (8.0%)
	Aggressive	128	102 (79.7%)§	18 (14.1%)	8 (6.3%)
	Internalising	128	68 (53.1%)§	22 (17.2%)	38 (29.7%)
	Externalising	128	72 (56.3%)§	24 (18.8%)	32 (25.0%)
	Total	128	71 (55.5%)§	19 (14.8%)	38 (29.7%)
Youth	Anxious	104	88 (84.6%)§	12 (11.5%)	4 (3.9%)
	Withdrawn	104	79 (76.0%)§	16 (15.4%)	9 (8.7%)
	Somatic complaints	104	79 (76.0%)§	15 (14.4%)	10 (9.7%)
	Social difficulties	104	84 (80.8%)§	11 (10.6%)	9 (8.7%)
	Thought problems	104	93 (89.4%)§	8 (7.7%)	3 (2.9%)
	Attention difficulties	104	81 (77.9%)§	15 (14.4%)	8 (7.7%)
	Rule breaking	104	86 (82.7%)§	16 (15.4%)	2 (1.9%)
	Aggressive	104	91 (87.5%)§	7 (6.7%)	6 (5.8%)
	Internalising	104	62 (59.6%)§	15 (14.4%)	27 (26.0%)
	Externalising	104	76 (73.1%)§	10 (9.6%)	18 (17.3%)
	Total	104	60 (57.7%)§	17 (16.4%)	27 (26.0%)

Data are n (%).

\* $<65$  which is below 93rd centile.

† $65-70$  which is 93–98th centile (apart from internalising/externalising/total  $60-63$ ).

‡ $>70$  which is 98th centile (apart from internalising/externalising/total  $>63$ ).

§ $p < 0.001$  for comparison with normative data (i.e., expected  $\leq 7\%$  of participants in borderline clinical or clinical ranges combined).

is unclear if this may contribute to these findings. The randomised clinical trial we are undertaking will be able to assess if the intervention can address the relationships between these variables over time.

Obesity in childhood is a major health concern in New Zealand, with the third highest prevalence of overweight and obesity in the Organisation for Economic Co-operation and Development.<sup>38</sup> Recent studies in this cohort of children and adolescents with obesity have found suboptimal eating behaviour,<sup>39</sup> suboptimal physical activity<sup>40</sup> and a high prevalence of weight-related comorbidities, including hypertension and obstructive sleep apnoea.<sup>33</sup> We were not surprised that breathing pauses were associated with poorer HRQOL and higher total scores on the CBCL/YSR. Breathing pauses in children and adolescents with obesity are associated with obstructive sleep apnoea,<sup>41</sup> and children and adolescents with obesity with this condition have reported lower HRQOL total scores than peers with obesity without the condition.<sup>15</sup> Moderate to severe obstructive sleep apnoea is associated with increased rates of aggressive behaviour, attention problems and internalising problems on the CBCL.<sup>42</sup>

These observations are important, given the considerable prevalence of breathing pauses reported in this cohort with obesity,<sup>33</sup> and the wider impact of obstructive sleep apnoea on a child's health, cognitive and behavioural functioning.<sup>43</sup>

Strengths of this study are that it is the first to report HRQOL in children and adolescents with obesity in the New Zealand population. Due to the high participation rate from Māori, we were also able to undertake evaluation of the impact of ethnicity. What was interesting and important about our findings in terms of ethnicity was the lack of disparity in HRQOL scores. This was despite a larger proportion of Māori participants being from the most deprived quintile of households. It therefore appears that obesity itself rather than factors such as deprivation is the main identified factor in our participants contributing to lower HRQOL scores. This finding is in contrast to previous research in Fiji and Kuwait, where there was no meaningful negative association between increased weight and HRQOL in children aged 12–18 in Fiji, irrespective of ethnicity, or Kuwaiti nationals, aged 10–14 years.<sup>7 8</sup> The discrepancies in results may be explained

by this study reviewing a treatment-seeking group, rather than population-based sample, and the different cultural values assigned to body size in Fiji and Kuwait compared with New Zealand (a predominantly westernised society).

A limitation of this study, as with all HRQOL assessments, is the use of an assessment tool to extrapolate one's psychological health and well-being. Comparisons of our study have been made with population groups of varying age ranges, which may have affected results. Another limitation of this study is that this was a referred cohort, which means our findings are not necessarily representative of the general population, and therefore generalisability of findings to wider population groups is reduced. We compared our data with the Health of Young Victorians cohort from Australia, as this was the most comparable group we had access to. However, the data were collected in 2000, and the differences noted may have been impacted by the difference in dates of data collection. Mean BMI SDS for the Victorian cohort with obesity was not available, which would be important if it was considerably lower than the Whānau Pakari participants. Lastly, we made no adjustments for multiple comparisons in our statistical analyses, so that the findings (particularly from exploratory analyses) need to be interpreted accordingly.

In conclusion, this study highlights a lower HRQOL and a higher prevalence of psychological difficulties for this referred community-based group of children and adolescents with obesity compared with normative population data. No differences were found between Māori and New Zealand Europeans. This is despite Māori being represented in greater numbers in the more deprived households of the region compared with their non-Māori counterparts, suggesting that obesity itself rather than deprivation is the main contributor to lower HRQOL scores. This study highlights the importance of psychologist involvement and screening in the child and adolescent population with obesity as part of any multi-disciplinary team. Improvement in HRQOL should be considered a goal of all child and adolescent obesity intervention and management. Further research is required to ascertain how to maximise improvements in what is now recognised as an important health outcome.

#### Author affiliations

<sup>1</sup>Department of Paediatrics, Taranaki District Health Board, New Plymouth, Taranaki, New Zealand

<sup>2</sup>Liggins Institute, University of Auckland, Auckland, New Zealand

<sup>3</sup>Department of Paediatrics, Child and Youth Health, University of Auckland, Auckland, New Zealand

<sup>4</sup>Starship Children's Hospital, Auckland District Health Board, Auckland, New Zealand

<sup>5</sup>Centre for Longitudinal Research : He Ara Ki Mua, University of Auckland, Auckland, New Zealand

<sup>6</sup>Department of Epidemiology and Biostatistics, University of Auckland, Auckland, New Zealand

<sup>7</sup>Faculty of Medical and Health Sciences, University of Auckland, Auckland, New Zealand

<sup>8</sup>A Better Start, National Science Challenge, University of Auckland, Auckland, New Zealand

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**Contributors** YCA designed the study, was involved with data interpretation and drafted this manuscript. LEW recruited participants and undertook assessments and data entry. KFT provided psychologist oversight and analysis of patient data. CCG is secondary supervisor for the research team and assisted with the design of the study. JMS was involved in study design. TLC assisted with data entry and analysis. TAW was involved in interpretation of data. JGBD analysed the data and drafted the manuscript. WSC contributed to study design. PLH contributed to study design and supervises the research team. All authors critically revised the manuscript, gave final approval for the version to be published and are accountable for all aspects of the work.

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**Ethics approval** Ethics approval for the programme was granted by the New Zealand Health and Disability Ethics Committee (CEN/11/09/054). Written and verbal informed consents were obtained from all participants or their guardians. The trial was registered with the Australian New Zealand Clinical Trials Registry (ANZCTR: 12611000862943).

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**Data sharing statement** Anonymised and deidentified data will be made available to other investigators upon request. Interested readers should contact the senior author PH (p.hofman@auckland.ac.nz) to obtain the data.

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