Adolescent obesity and physical inactivity

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Abstract

Globally, obesity and physical inactivity are two health issues affecting young people. In New Zealand, the most current statistics indicate that 33.6% of 11 to 14 year olds, and 27% of 15 to 18 year olds, are considered overweight or obese.1,2 Despite these high prevalence levels, only 38% of young people aged 13 to 17 years in New Zealand are considered physically inactive.3

Future effort needs to be directed towards enhancing the existing national surveys to ensure a comprehensive and valid surveillance system of adolescent obesity and inactivity is conducted on a regular basis. This would involve the development of age, sex, and ethnic specific body mass index cut-off thresholds to define overweight and obesity, validation of an adolescent questionnaire that examines physical activity from a broad perspective, and development of physical activity recommendations for youth based on international best practice.

Although the main focus of this paper is on obesity and physical inactivity, diet is also a key determinant of obesity. Therefore, to provide an accurate assessment of factors associated with youth obesity in New Zealand, surveillance of diet must occur concurrently with that of obesity and physical activity.

The development of accurate measurement tools is critical for (1) determining obesity and inactivity trends, (2) identifying at-risk groups, (3) tracking progress toward national health priorities, and (4) evaluating the efficacy of interventions targeting obesity and physical inactivity. Furthermore, attention needs to be directed towards identifying correlates of inactivity and obesity to help inform the development of comprehensive multisectorial, multisetting, prevention, and management initiatives.

The worldwide prevalence of overweight and obesity among the adult population is reaching epidemic proportions, and evidence indicates children and adolescents are following in this trend. Obesity and physical inactivity are two interrelated health issues with a cyclic relationship. That is, physical inactivity plays a key role in the development and management of obesity, while obesity often impacts negatively on an individual’s level of physical activity.

Obesity is a complex phenomenon that is influenced by genetic, behavioural, and environmental factors. A positive balance between energy expenditure and energy intake is a possible underlying cause of obesity. The increase in obesegenic living environments (i.e. environments that encourage sedentary pursuits, energy saving activities, and excessive consumption of high density, high fat food) has likely supported this positive energy balance. Current evidence supports an association between sedentary activities such as television viewing and obesity during childhood and adolescence.4
The financial burden of obesity and physical inactivity is substantial. It is estimated that obesity health care expenditure in New Zealand is NZ$303 million per annum. Further estimates indicate a saving of NZ$25 million per year could result from a 5% increase in physical activity levels and that $160 million each year could be saved if all New Zealanders were to become physically active to levels that afford health benefits.

As well as economic burden, obesity and physical inactivity have a significant impact on an individual’s health and quality of life. Obesity and physical inactivity are two risk factors for a number of lifestyle related conditions including type 2 diabetes, coronary heart disease, hypertension, and some types of cancers.

By general consensus, participating in a minimum of 30 minutes of moderate intensity physical activity on most days of the week reduces the likelihood of developing these morbidities, and additional activity produces further health benefits. These findings are well summarised in the 1996 US Surgeon General’s Report on Physical Activity. Despite the benefits conferred by regular activity, physical inactivity in New Zealand ranks behind smoking as the second highest modifiable risk factor for poor health, and is associated with 8% of total deaths.

Targeting child and adolescent obesity is a health priority for several reasons. First, severe childhood obesity is associated with a diverse range of morbidities including orthopaedic problems, sleep disorders, menstrual abnormalities, insulin resistance, and psychological issues of early discrimination and victimisation. As well, persistence of obesity can lead to further long-term complications (including cardiovascular disease), and all cause mortality. Second, children and adolescents with severe obesity are at greater risk of obesity persisting into adulthood. Specifically, compared to childhood obesity status, adolescent obesity is a stronger predictor of adulthood obesity.

In addition to preventing obesity, the promotion of physical activity at an early age is beneficial for a number of reasons. Physical activity has been found to track over time, and there is increasing evidence that regular physical activity among young people is associated with improvements in various health outcomes including blood lipid profile, blood pressure, body composition, glucose metabolism, bone strength, psychological health and the maintenance of normal growth and development.

Recently developed New Zealand health policy documents highlight the need to address obesity and physical inactivity. For example, the Healthy Action – Healthy Eating Report, and the New Zealand Health Strategy state that obesity and physical inactivity are two of top four health priorities for New Zealand. Despite well-developed national policy documents, the national prevalence of obesity and physical inactivity for New Zealanders (especially New Zealand youth) is not clear.

The purpose of this paper is two-fold. First, the question ‘Are New Zealand youth obese and physically inactive?’ will be examined and methodological flaws of current research highlighted. Second, future research directions based on identified gaps within New Zealand youth obesity and physical activity research will be presented. The focus of this paper is on adolescents (aged 13–17 years old). Thus, the epidemiological evidence presented has been extracted from available data to ensure the focus is predominantly on people of this age range.
New Zealand obesity trends

Before examining the obesity trends, it is important to understand the measures of adiposity utilised in population level epidemiological research. Field measures of adiposity including body mass index (BMI), skinfolds, and girth measures are commonly used as screening tools because of their practicality, ease of implementation, cost effectiveness, and low participant and researcher burden compared to laboratory based measures.¹⁶

Although the International Obesity Task Force recommend BMI as an appropriate measure to use in epidemiological studies,¹⁷ several limitations of this method need to be considered. The most significant issue is that currently no agreed BMI cut-off thresholds exist to classify a child or adolescent as obese or overweight.

To date, different studies have used different cut-off thresholds based on different growth reference charts. This lack of consensus makes between-country comparisons difficult. Recently, however, the International Obesity task Force (ITOF) proposed international age-and sex-specific BMI cut-off thresholds based on pooled BMI data from six countries.¹⁷ Such definitions help develop international applicability and therefore ensure comparability of obesity rates between countries, however, they are still arbitrary and do not account for ethnic groups not considered in the population sample.

Ethnicity is an important factor when considering BMI definitions of overweight and obesity because the same BMI value does not correspond to the same percent body fat (%BF) across different population groups.¹⁸,¹⁹ Differences in the %BF–BMI relationship may exist due to differences in body build variables such as slenderness, muscularity, and trunk-to-leg-length ratio.¹⁹

Recent New Zealand research indicates at the same BMI value, female children (aged 5–14 years) of Pacific Island and Maori descent have a lower percent fat mass compared to their New Zealand European peers.²¹ In another study using a larger sample size, however, no clinically significant difference in the relationship between BMI and body composition was found between young children (5–10.9 years) of Maori, Pacific Island, or European descent.²² Thus, further research clarifying the BMI - %BF relationship according to ethnicity among the New Zealand youth population is warranted.

Because of New Zealand’s ethnically diverse population some New Zealand researchers advocate the development ethnic specific BMI cut-off thresholds. There are, however, several difficulties that arise when applying ethnic specific cut-off points, especially in a country like New Zealand where ethnic intermarriage is increasing, and with each generation reporting concurrent increases in proportion of children with a mixed ethnic background.²³

First, ethnicity is based on self-identity and not necessarily a genetic link. Second, in population level research identifying an individuals’ ethnicity by means other than self-identity is difficult and not necessarily practical. As body build may account for a large proportion of the variation in the BMI–%BF relationship,¹⁹ adjusting BMI cut-offs according to frame size (rather than ethnicity) may provide a more accurate criterion to base BMI cut-offs upon.²⁴ Applying frame size based cut-off points, however, may be practically applied within a clinical setting, but not necessarily
within population level research due to the measures required to ascertain frame size (i.e. ankle and wrist girths).

Three national surveys have examined New Zealand youth obesity levels. The 1989 Life in New Zealand Survey, and the 1997 National Nutrition Survey examined obesity prevalence levels in youth aged 15 to 18 years old. Recently, the 2002 Child Nutrition Survey was conducted and provided a snapshot of the nutritional status (including BMI data) of children aged between 5 and 14 years old. No single survey has examined overweight and obesity among all adolescents.

Based on New Zealand ethnic-specific BMI cut off points, the National Nutrition Survey found 27% of 15 to 18 year olds were considered overweight or obese (see Table 1). Between 1989 and 1997 obesity levels rose from 3% to 12.6% in males, and from 2% to 5.3% in females. Therefore, over an 8-year period, obesity levels increased by 300% for males, and a 160% increase for females. This comparison may under represent the true increase in overweight and obesity because the 1989 LINZ Survey used a lower BMI cut-off value (30 kg/m²) to define obesity among individuals of Maori and Pacific Island descent, compared to the 1997 NNS (32 kg/m²). Additionally, the New Zealand Child Nutrition Survey found 23% of children aged between 11 and 14 years old were overweight and a further 10.6% were obese.

Both the National Nutrition Survey and the Child Nutrition Survey found that a disproportionate number of Maori and Pacific peoples were considered overweight and obese compared to New Zealand European and Other children. This may in part be due to the universal BMI definition used to define an individual as overweight or obese. This universal definition does not take into account body composition differences noticed among different ethnic groups within New Zealand. For example, Maori and Pacific Island females, on average, have a higher proportion of lean muscle mass at a similar BMI than New Zealand European females.

The prevalence of youth overweight and obesity in New Zealand is similar to other countries. Results from countries including Australia, the United States, Great Britain, United Kingdom, and Brazil indicate that between 11 and 44% of youth are considered overweight or obese. In contrast, lower prevalence levels (around 7%) have been documented in Russia, China, and Finland.

In addition to the high levels noticed in many countries, studies indicate the prevalence levels are on the increase and that the greatest changes have occurred at the higher BMI values. Also, similar to Maori and Pacific Island populations in New Zealand, specific ethnic minority groups including American Indians, Mexicans, and Hispanic and African Americans are at an increased risk of being overweight or obese.

The global picture of youth obesity is clear. Obesity is a growing issue and is a health threat to the adolescent population and the future adult population. New Zealand is no exception, with high prevalence levels compared to some westernised countries.
### Table 1. Adolescent obesity levels

<table>
<thead>
<tr>
<th>Place</th>
<th>Survey</th>
<th>Age (years) / no. of children</th>
<th>Date of survey</th>
<th>% OW + OB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>Nationally representative surveys</td>
<td>10-18 / not stated</td>
<td>1975</td>
<td>3.7</td>
</tr>
<tr>
<td></td>
<td>National Research of Health and Nutrition</td>
<td>10-19 / 13,715</td>
<td>1989</td>
<td>7.7</td>
</tr>
<tr>
<td></td>
<td>Nationally representative surveys</td>
<td>10-18 / not stated</td>
<td>1997</td>
<td>12.6</td>
</tr>
<tr>
<td>China</td>
<td>China Health and Nutrition Surveys</td>
<td>10-18 / not stated</td>
<td>1991</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10-18 / not stated</td>
<td>1997</td>
<td>6.2</td>
</tr>
<tr>
<td>East Germany</td>
<td>Not stated</td>
<td>11-14 / 798</td>
<td>1992/93</td>
<td>8.92</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11-14 / 957</td>
<td>1995/96</td>
<td>12.82</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11-14 / 950</td>
<td>1998/99</td>
<td>15.85</td>
</tr>
<tr>
<td>Finland</td>
<td>Adolescent Health and Lifestyle Survey</td>
<td>12,14,16,18 / 2832</td>
<td>1977</td>
<td>3.17</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12,14,16,18 / 8219</td>
<td>1999</td>
<td>7.64</td>
</tr>
<tr>
<td>Great Britain</td>
<td>British Standards Institute Survey</td>
<td>11-16 / 3784</td>
<td>1977/87</td>
<td>6.8</td>
</tr>
<tr>
<td></td>
<td>National Diet and Nutrition Survey</td>
<td>11-16 / 776</td>
<td>1997</td>
<td>18.95</td>
</tr>
<tr>
<td>New Zealand</td>
<td>Life In New Zealand Survey</td>
<td>15-18 / 676</td>
<td>1989</td>
<td>5†</td>
</tr>
<tr>
<td>New Zealand</td>
<td>National Nutrition Survey</td>
<td>15-18 / not stated</td>
<td>1997</td>
<td>27</td>
</tr>
<tr>
<td>New Zealand</td>
<td>Child Nutrition Survey</td>
<td>11-14/1119</td>
<td>2003</td>
<td>33.6</td>
</tr>
<tr>
<td>Russia</td>
<td>Russian Longitudinal Monitoring Survey</td>
<td>10-18 / not stated</td>
<td>1992</td>
<td>11.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10-18 / not stated</td>
<td>1998</td>
<td>8.5</td>
</tr>
<tr>
<td>UK</td>
<td>The Health Survey for England</td>
<td>13-15 / 756</td>
<td>1996</td>
<td>44.3</td>
</tr>
<tr>
<td>United States</td>
<td>NHES</td>
<td>12-17 / 6710</td>
<td>1963-1970</td>
<td>15.15</td>
</tr>
<tr>
<td></td>
<td>NHANES I</td>
<td>12-17 / 1911</td>
<td>1971-1974</td>
<td>17.3</td>
</tr>
<tr>
<td>United States</td>
<td>Youth Risk Behaviour Survey</td>
<td>13-16 / 13,601</td>
<td>2001</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td></td>
<td>13-16 / 15,214</td>
<td>2003</td>
<td>28.9</td>
</tr>
</tbody>
</table>

OW=overweight; OB=Obese; *Defined overweight and obesity as a BMI ≥ 85th centile for BMI by age and sex based on reference data from international reference data [17]; †The OW+O was defined from a body mass index (BMI) equal or superior to the 85th percentile of the reference population of the NCHS; ‡Defined overweight as a BMI value 91st percentile and obesity as a BMI value 98th percentile on the 1990 BMI index reference curves for UK. §Defined overweight and obesity as a BMI ≥25kg/m² for New Zealand Europeans, and a BMI ≥26 for Maori and Pacific Island peoples; ¶Defined at risk of overweight and overweight as a BMI ≥85th percentile for BMI based on UK reference data; ¶¶Defined overweight and obesity as a BMI ≥85th percentile for BMI by age and sex based on reference data from National Health Examination Survey (NHES) II & III; **Defined at risk of overweight and overweight as a BMI ≥85th percentile for BMI by age and sex based on reference data from CDC growth charts; ††Obesity data only.
Physical activity

Physical activity is an important lifestyle behaviour that impacts positively on both the prevention and management of obesity. Before physical activity prevalence data are examined, it is important to understand the measures and definitions used in large-population physical activity research. A number of objective, and subjective methods exist to measure physical activity. Population research has relied heavily on subjective measures of physical activity such as questionnaires, (e.g. self report, proxy reports, interviews). Although questionnaires are cost effective, easy to implement, and have a low researcher and participant burden, issues of recall bias, social desirability, and deliberate misrepresentation may make interpretation difficult. Also, proxy reports which are often used, provide limited validity when measuring subjective matters such as physical activity.

A limitation of adolescent physical activity research is that currently no standardised physical activity recommendations exist for the adolescent population. The lack of such a recommendation impacts on the ability to define an individual as active versus inactive. Although physical activity guidelines have been proposed, several studies have examined different durations (e.g. 30 minutes per day, 60 minutes per day, 150 minutes per week), intensities (e.g. moderate, vigorous), frequencies (e.g. five days per week, every day), and type (e.g. incidental, transportation, school related, sport) of physical activity. This increases the difficulty in making between-country comparisons.

In New Zealand, physical activity data relating to age, sex, and ethnicity of adolescents have been collected through several surveys, including the New Zealand Health Survey, the Youth 2000 Survey, National Children’s Nutrition Survey, and the main physical activity monitoring system, namely, the Sport and Physical Activity Surveys.

Sport and Recreation New Zealand (SPARC) has been a world leader in examining New Zealand physical activity and inactivity trends by implementing the Sport and Physical Activity Survey (SPAS), a comprehensive physical activity surveillance system. To date, SPARC has carried out the SPAS at three time points, 1997/98, 1998/99, and 2000/01. The combined results of the three SPAS’s indicate that 37% of New Zealand adolescents aged 13 to 17 years are physically inactive (i.e. they did not participate in a minimum of 150 minutes of physical activity per week). Also, compared to Maori and Europeans, Pacific peoples, and people from other ethnic groups were considered least active.

By comparison, young people in New Zealand appear relatively active to their peers in countries such as Canada, and England. In contrast, only 31% of adolescents (Grades 9 through 12) in the United States were classified as ‘insufficiently active’ in 2001 which is similar to levels noticed in New Zealand. In Table 2, adolescent physical activity statistics from various countries are presented.

Comparing physical activity data sets from different countries, however, is often difficult because of differences in measures and criterions for defining an individual as ‘sufficiently’ active. Adolescent data sets are no different. The New Zealand definition of being physically active for youth is less strict compared to definitions in other countries. For example, in Canada, young people are required to achieve energy expenditure =8kcal/kg body-weight per day (KKD). This equates to 1 hour of
moderate physical activity and 30 minutes of vigorous activity per day. Based on this definition, 65% of 13–17 year old Canadians are considered inactive.39

When countries have applied similar definitions of ‘physically active’ utilised by New Zealand, in fact, rates of inactivity are comparable. One such example in highlighted in the Health Survey for England. When the criterion employed changed from 60 mins of physical activity per day to 30 minutes per day, the level of inactivity decreased from 62.7% to 42.3%50 which is similar to the level noticed among New Zealand youth.3

Table 2. Adolescent physical inactivity levels

<table>
<thead>
<tr>
<th>Place</th>
<th>Survey title</th>
<th>Age</th>
<th>Date of survey</th>
<th>Percent</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada 49,52,53</td>
<td>Physical Activity Monitor</td>
<td>13-17</td>
<td>1995</td>
<td>64</td>
<td>Did not achieved Energy expenditure =8kcal/kg body weight per day (KKD)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>13-17</td>
<td>1998</td>
<td>66</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>13-17</td>
<td>1999</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>13-17</td>
<td>2000</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>England 50,54</td>
<td>Health Survey for England</td>
<td>13-15</td>
<td>1997</td>
<td>62.7</td>
<td>Did not participated in 60 minutes or more on at least 5 days</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1997</td>
<td>42.3</td>
<td>Did not participated in 30 minutes per day over the past 7 days</td>
</tr>
<tr>
<td></td>
<td>Health Survey for England</td>
<td>2-15</td>
<td>2002</td>
<td>25.5</td>
<td>Did not participated in 30 minutes per day over the past 7 days</td>
</tr>
<tr>
<td>New Zealand</td>
<td>Sport and Physical Activity Survey</td>
<td>13-17</td>
<td>1997-2001</td>
<td>38</td>
<td>Took part in &lt; 2.5hr of physical activity in the previous 7 days</td>
</tr>
<tr>
<td>United States</td>
<td>Youth Risk Behavior Survey</td>
<td>13-16</td>
<td>2001</td>
<td>35</td>
<td>Did not participate in sufficient vigorous physical activity</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2003</td>
<td>37.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2001</td>
<td>74</td>
<td>Did not participate in sufficient moderate physical activity</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2003</td>
<td>75.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2001</td>
<td>31.2</td>
<td>Did not participate in vigorous activity AND did had not participate in</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2003</td>
<td>33.4</td>
<td>moderate activity</td>
</tr>
</tbody>
</table>
Despite the difficulty in making direct comparisons between countries, several trends have emerged from the SPAS that are noticed worldwide. Three trends that emerged from the SPAS are (1) physical activity levels decrease from childhood to adolescence, (2) physical activity levels decrease during adolescence, and (3) females are more physically inactive than males (45% and 33% respectively).

Similar trends have been found for youth in England, Australia, and Canada. Data pertaining to the United States shows that participation in either moderate or vigorous activity decreases with increasing age, physical activity patterns generally decline most from ages 15 through 18, and then continue to decline from 18 to 29 years of age. As well, males compared to females, and Whites compared to their Hispanic and Black counterparts, participate in significantly higher levels of moderate and vigorous physical activity. For example, in a recent Canadian survey, physical activity levels were higher among children aged 5 to 12 years compared to youth aged 13 to 17 years.

The main advantage of the current SPARC physical activity surveillance system is that regular monitoring has taken place. Four limitations, however, exist which impact on the efficacy of this survey. First, the existing surveillance system has been based largely on parental proxy report. Proxy reports require an adult (aged 18 years or older; living in the same house as the child) to report on the child’s habitual activity levels. Proxy reports have little correlation with more direct measures of physical activity. Second, the Sport and Physical Activity survey has not been validated for the population under study. As well, the previous surveys carried out by SPARC have focused predominantly on sport and exercise rather than physical activity per se. Finally, the quantity of physical activity required to define a youth as physically active in the New Zealand survey is substantially lower compared to other countries and is not in line with proposed physical activity guidelines for children and adolescents.

Hence, the positive picture of New Zealand youth physical activity levels may largely be an artefact of the existing surveillance system, and, therefore helps explain the considerably lower prevalence levels of inactivity in New Zealand youth compared to youth in other countries. By building upon and overcoming these methodological flaws of the existing surveys, a more accurate and reliable picture of the health-related physical activity patterns of New Zealand youth will emerge.

Although the main focus of this paper is on obesity and physical inactivity, diet is also a key determinant of obesity. Despite epidemiological evidence indicating a stability, and in some instances a decrease in energy intake, such research also provides insight into the changes in eating patterns that have occurred simultaneously with the increasing rates of youth obesity. Specifically, there has been a shift towards consuming more energy intake from restaurants and fast food places compared to home sources of food, an increase in energy dense foods including pizza, cheeseburgers, and salty snacks, as well as a greater proportion of energy consumed from sugar added beverages.

When examining the link between dietary behaviours and obesity, recent research suggests particular eating patterns and sources of dietary intake are important factors associated with youth obesity. United States data indicate overweight youth consume a greater proportion of total energy intake from soft drink consumption compared to
their non-overweight peers. Skipping breakfast has also been associated with overweight cross sectionally, and with an increase in BMI among normal weight youth over time. Furthermore, a greater frequency of eating food purchased away from home was positively associated with change in BMI z-score during adolescence.

In terms of New Zealand specific data, the New Zealand Child Nutrition Survey provided an extensive examination of nutrition intake and dietary behaviours among New Zealand children aged 5 to 14 years old. Analysis of such data in relation to BMI are not yet published.

A difficulty in assessing the importance of lifestyle behaviours in the aetiology of obesity is that obesity occurs over time while many measures of lifestyle habits occur once the obese state has been reached. For instance, a recent study found that (over a 1-year period) skipping breakfast was associated with a decrease in BMI among overweight children, while normal weight peers who skipped breakfast gained weight over the same time period.

Thus to provide an accurate assessment of factors associated with youth obesity in New Zealand, surveillance of diet must occur concurrently with that of obesity and physical activity.

Where to now for New Zealand?

Youth obesity and inactivity are two growing health problems worldwide. Because obesity and physical inactivity have been identified in the top-four health priorities for New Zealand, as a country we need to monitor and characterise these risk factors in terms of prevalence, distribution, and secular trends. For this to occur, an enhancement of existing national surveys is required. Such surveillance is essential to identify at-risk groups, inform public health policy, develop appropriate and effective prevention and management initiatives, and track progress toward national health priorities.

In terms of youth obesity, the recent Child Nutrition Survey has overcome the paucity of data pertaining to obesity levels of young people aged 14 years and younger. Future research needs to ensure (1) regular monitoring of obesity levels among adolescents and adults, and (2) development of age, sex, and ethnic specific BMI cut-off thresholds to define overweight or obese.

In relation to physical activity, improving the current surveillance system would involve the validation of a youth physical activity questionnaire, establishing physical activity recommendations for youth based on international best practice, and incorporating a more holistic view of physical activity that includes health-related activity accumulated in activities such as active transportation and part-time work. Overcoming these issues will result in an enhanced physical activity monitoring system capable of providing an accurate and holistic assessment of youth physical activity levels.

Finally, attention needs to be directed towards identifying correlates of obesity and inactivity among different cultures and socioeconomic groups. Literature indicates numerous biological, behavioural, and environmental factors are linked to the development and maintenance of obesity. A systematic review found that risk factors for childhood obesity included parental fatness, social factors, birth weight,
timing of maturation, physical activity, dietary factors, and other behavioural and psychological factors. In terms of behavioural factors, time spent watching television,⁴ ⁶⁴–⁶⁶ and physical activity (inverse),⁶⁷–⁶⁹ eating lunch regularly⁷⁰ breakfast skipping,⁷¹ and quick service food purchases⁶² have all been associated with obesity status.

In New Zealand, however, no published research has examined such factors among New Zealand youth according to gender and ethnicity. Future research examining the factors associated with obesity and physical activity among New Zealand youth will provide a foundation of knowledge to inform the development of multisectoral, multisetting, and sustainable health promotion initiatives aimed at reducing the prevalence of obesity and inactivity among New Zealand youth.

But first we must have a real picture of the status of our adolescents in terms of both overweight/obesity and physical inactivity—only then will we have a basis on which to build effective interventions, and monitor the success of such interventions.

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