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Analysis in Brief
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Comparing Activity and Fruit and Vegetable Consumption by Weight Status Among Children and Youth

Introduction

In Canada, research based on self-reported data indicates that the prevalence of being overweight among children and youth is rising.[1, 2] This increase has also been noted using directly measured height and weight information. In 1978–1979, results from the Canada Health Survey indicated that 15% of children and youth age 2 to 17 were either overweight or obese.[3] In 2004, the Canadian Community Health Survey (CCHS) indicated that 26% of Canadian children and youth age 2 to 17 were either overweight or obese.[3] This represents a relative increase of 73% over 25 years.

Physical and sedentary activities, and fruit and vegetable consumption, have been linked to the weight status of children and youth.[3–5] For example, research based on international data from the 2001–2002 Health Behaviour in School-Aged Children Survey (HBSC) showed that a higher frequency of physical activity in youth (age 11 to 16) was associated with lower odds of being overweight in 29 of the 33 countries studied, including Canada.[4] A significant positive relationship was also found between television viewing time and being overweight.[4] For Canadian students, there were no significant findings for the relationship between fruit or vegetable consumption and body mass index (BMI) classification.[5] Findings from a study using 2004 CCHS data showed that consuming fewer fruits and vegetables was associated with being overweight or obese among children and youth age 2 to 17.[3] This study, based on measured height and weight data, also showed that spending more time in sedentary activities was linked to being overweight or obese among children and youth. Weekly hours of leisure-time physical activity were not associated with being either overweight or obese for children age 6 to 11; however, being inactive was associated with obesity among boys age 12 to 17.[3] The relationships between lifestyle practices and weight status are not always clear, and may differ depending on age group, sex or definition of variables involved.

Many studies such as these have explored the factors related to overweight and obesity among children and youth. However, few studies have examined to what extent lifestyle behaviours differ between overweight and non-overweight groups for various populations of interest. Janssen et al. (2004) examined the prevalence of different dietary habits and leisure-time activities of youth (age 11 to 16) by weight status using data from the HBSC.[5] Results showed that physical activity levels were lower and television viewing times higher among overweight and obese youth compared to normal weight youth;

results for fruit and vegetable consumption were not conclusive.[5] Of note, this HBSC survey relied on self-reported measures of height and weight in the calculation of BMI.[5] Self-reported measures have been shown to under-report body mass in youth[3] and adults.[6]

Building on the work done by Janssen et al. (2004), and taking into account findings of previous studies on the 2004 CCHS data, this Analysis in Brief (AiB) compares the prevalence of lifestyle behaviours by weight status and sex using measured height and weight data for children and youth from the 2004 CCHS. The lifestyle behaviours examined include fruit and vegetable consumption, types and frequency of physical activity and screen time–related activities (watching television, playing video games and using the computer). These lifestyle behaviours are considered separately as well as in combination, which is referred to as multiple asset behaviours. The full range, or distribution, of behaviours from low to high levels is examined. However, emphasis is placed on the positive or "asset" levels of each of the behaviours; being active, reporting low screen time and consuming fruit and vegetables five times or more each day.

Data Source and Definitions

Data from Statistics Canada's 2004 CCHS is used to compare physical activity patterns, sedentary behaviours and fruit and vegetable consumption for children and youth. Parents responded on behalf of children age 6 to 11, whereas youth age 12 to 17 answered for themselves.[7] In the remainder of this analysis, the term "reported" is used for both self-reported and parent-reported responses. The measures used in this analysis are described below. For more information on the data source and methods, see Appendix A.

Weight Status

Measured height and weight values were used to generate the BMI [weight (kg) / height $(m)^2$] of respondents. For this analysis, overweight includes both overweight and obese categories and non-overweight includes both normal and underweight.[i] Children and youth are categorized as overweight or non-overweight using the age- and sex-specific cut-off points defined by Cole et al.[8, 9]

Physical Activity

For children, total activity is an estimate of the total number of hours per week spent engaged in physical activities. Organized and unorganized physical activities, both in and out of school, are recorded and used to categorize responses into three groups: less than 7 hours per week, 7 to 14 hours and more than 14 hours of activity per week. For the purposes of analysis, responses of over seven hours of activity a week, or approximately one hour a day, are categorized as active for children. For youth, this report uses the cut-offs for physical activity defined by Statistics Canada.[9] The frequency of activity is based on the average number of times per month youth reported taking part in a physical activity lasting more than 15 minutes. Twelve times or more per month is categorized as regular frequency.[9] Total activity levels combine both frequency and duration of several types of physical activity. Youth are categorized as being active if they expend 3.0 kcal/kg/day or more,[9] which is roughly equivalent to walking one hour every day.[10]

i. For this AiB, overweight includes both overweight and obese categories. The smaller sample size of the obese category, in particular, limits examining behaviours of obese groups by age group and sex.

Hence, for both children and youth, once a threshold of approximately one hour per day of activity is reached, the individual is categorized as active. Being active is regarded here as an asset behaviour.

Sedentary Behaviour

For this analysis, sedentary activity is based on the number of hours that children and youth spend engaged in screen time–related activities: using a computer, watching television or playing video games. For children, daily sedentary activity is recorded. For youth, screen-time activities outside of school time are summarized for the week, with separate questions asked about television, video games and computer time. Canadian guidelines recommend replacing up to 90 minutes of sedentary activities with physical activities each day; a recommended daily limit of sedentary activity is not suggested.[11, 12] In the *Youth Nutrition and Physical Activity Guidelines for Out-of-School Time (OST) Programs*, the Harvard School of Public Health Prevention Research Centre suggests keeping sedentary activities to no more than two hours a day outside of school time.[13] For the purpose of this analysis, children who reported engaging in screen time–related activities for 2 hours or less per day and youth who reported engaging in 14 hours or less per week (less than 2 hours per day on average) were considered to have low screen time. Low screen time is referred to here as an asset behaviour.

Fruit and Vegetable Consumption

The number of times per day[ii] children and youth consume fruit, vegetables and both combined are grouped into categories: less than three times a day, three to less than five times and five times or more. The number of times a day is considered here as a proxy for the approximate number of servings a day. Analyses categorize the consumption of fruit and vegetables five times or more a day as an asset behaviour. Consuming at least five daily servings is consistent with the recommendations of *Eating Well With Canada's Food Guide*—both the version in effect when the 2004 CCHS data was collected[14] and the current edition[iii, 15]—as well as other programs[16, 17] and research.[18] For age- and sex-specific recommendations, see the complete reference.

Multiple Assets

This analysis defines asset behaviours for children and youth as follows:

- Participating in one hour or more of physical activity per day, or seven or more hours per week;
- Spending 2 hours or less per day, or 14 hours or less per week, engaged in screen-time activities (television, computer, video games); and
- Consuming fruit and vegetables five times or more each day.

ii. Fruit and vegetable consumption could be reported for a weekly or even monthly frequency by respondents. Therefore, times "per day" may not be a whole number but a fraction based on the monthly or weekly value.

iii. In February 2007, Health Canada released a new food guide that recommended different servings of fruit and vegetables per day based on both age and sex. The new guide recommends that children age 4 to 8 consume five servings per day and that children age 9 to 13 consume six servings per day. This guide also recommends that 14- to 18-year-old girls consume seven servings per day and that 14- to 18-year-old boys consume at least eight servings of fruit and vegetables daily.

A multiple-assets variable is derived that combines these behaviours and categorizes children and youth into groups with zero, one, two and three asset behaviours.

Analyses outlined in this AiB estimate proportions of children and youth reporting different levels of physical and sedentary activity and fruit and vegetable consumption, in isolation and combination, stratified by sex and weight status. Proportions are compared between weight-status groups using tests comparing the difference between ratios and incorporating a sampling weight specific to the respondents who allowed the measurements of their height and weight to be taken, and using bootstrap variance estimation procedures. Analyses are based on approximately 3,000 children age 6 to 11, and 4,000 youth age 12 to 17, for whom measured height and weight data is available.

Results

This section presents results of analyses of each of the lifestyle behaviours separately, followed by findings for multiple asset behaviours. The following research questions are addressed:

1. Among children and youth, what is the prevalence of reporting multiple assets, as well as each asset behaviour individually?
2. Do lifestyle behaviours differ between overweight and non-overweight children and youth?
3. Are differences in activity and fruit and vegetable consumption between weight-status groups observed for both girls and boys?

Table 1 Prevalence of Asset Behaviours Among Children and Youth, 2004

	Children (Age 6 to 11)	Youth (Age 12 to 17)
Physically Active	84%	43%
Low Screen Time	64%	39%
Fruit and Vegetables ≥5 Times per Day	40%	34%
All Three Asset Behaviours	24%	8%

Source
Canadian Community Health Survey, Cycle 2.2 (Nutrition), 2004, Statistics Canada.

Comparing Physical Activity

Among children, 84% are categorized as active, and 43% of youth are active approximately one hour per day (Table 1). As previously noted, activity is measured in a different manner for youth; therefore, levels are not directly comparable.

For children, no differences are observed when comparing physical activity between weight-status groups, as shown in Appendix B. Whether activity occurs during school time, or whether it is organized or unorganized activity outside of school time, there are no significant differences in children's activity levels by weight status. This is the case for both girls and boys with one exception. Overweight girls are more likely to report three hours or more per week of activity during free time at school (for example, at recess) compared to non-overweight girls.

Similarly for youth, there are no significant differences by weight status when looking at types of activity, activity frequency and total activity. Further, there are no significant differences in physical activity by weight status for girls and boys, with one exception as shown in Appendix C. Overweight girls are more likely to report playing basketball for more than one hour per occasion compared to non-overweight girls.

Comparing Sedentary Behaviour

Analyses of screen-time activities show that 64% of children and 39% of youth report two hours or less of screen time per day (Table 1). Screen time is a distinguishing factor between weight-status groups for both children and youth. Low screen time is more commonly reported by non-overweight groups, while overweight groups are significantly more likely to be engaged in screen-time activity for longer periods, as highlighted in Appendix B for children and Appendix C for youth.

In particular among children, two hours or less of screen time is reported by about half (52%) of overweight children, versus over two-thirds (69%) of the non-overweight group. Further, overweight children are significantly more likely to report longer periods of screen time. For example, overweight girls and boys are significantly more likely to watch three or more hours of television per day than their non-overweight peers. Overweight boys are also significantly more likely to use a computer for an hour or more a day compared to non-overweight boys.

For youth, 32% of overweight youth reported being engaged in screen-time activities 14 hours a week or less, or approximately 2 hours a day or less. This is significantly lower than the 41% of non-overweight youth (Appendix C). Comparing specific screen-time activities by weight status and sex among youth, significant differences are seen for time spent playing video games and total screen time for boys, whereas only differences in time spent watching television are significant among girls.

Comparing Fruit and Vegetable Consumption

Forty percent of children and 34% of youth report consuming fruit and vegetables five times or more each day (Table 1). For children, as shown in Appendix B, there are no significant differences in overall fruit and vegetable consumption by weight group, with 40% of both groups reporting five times or more per day. When looking separately at fruit consumption and vegetable consumption, differences in patterns by weight status are observed for vegetable consumption levels. Overweight children are significantly more likely to eat vegetables less than once per day, and less likely to report eating them from one up to two times per day, compared to non-overweight children. This difference is found among boys but not girls.

For youth, more variations in fruit and vegetable consumption by weight status are observed than are found for children. Significant differences are observed between weight groups for fruit and vegetable consumption, both separately and in combination (Appendix C). In particular, eating fruit and vegetables five or more times a day is reported by 27% of overweight youth, significantly less than the 37% of non-overweight youth who report the same level. This difference by weight status is found for girls but is not significant among boys. For girls, a significant difference is also observed for vegetable consumption of two times or more per day, where overweight girls are less likely to report this level. For boys, a significant difference is observed for eating fruit; overweight boys are less likely to report eating fruit from one up to two times a day.

Comparing Multiple Assets

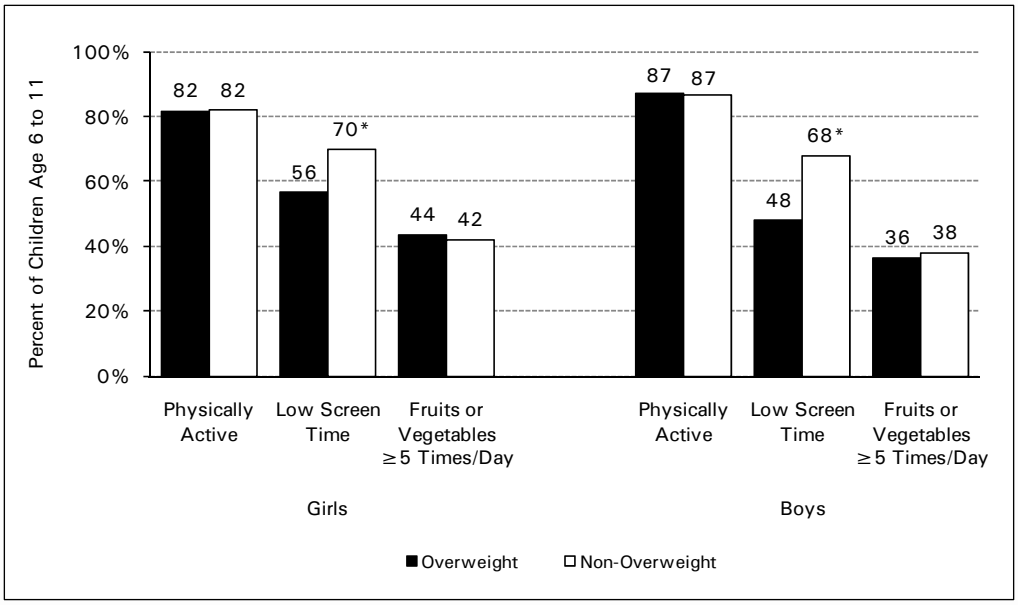
Among children, 84% are active approximately one hour or more per day, 64% report low screen time and 40% consume fruit and vegetables five times or more each day. What proportion of children report all three behaviours? Roughly one in four (24%) children report all three asset behaviours, and 5% of children report none, as shown in Appendix D.

Overweight children are significantly more likely to have no asset behaviours compared to non-overweight children (Appendix B). Although not quite significant using a p-value of 0.05, overweight children also tend to have lower rates of reporting all three behaviours compared to the non-overweight group (20% versus 26%; p-value = 0.06). Among overweight boys, 16%[iv] report all three asset behaviours, compared to 26% of the non-overweight group—a significant difference not present for girls.

Among youth, analyses show that 43% are considered active, 39% have low screen time (14 hours or less per week) and 34% report eating fruit and vegetables five times or more each day (Table 1). However, only 8% of youth report all three behaviours, whereas 26% report none of the three (Appendix E). There are no significant differences in reporting multiple assets between weight groups for youth overall (Appendix C). In analyses by sex for youth, significant differences are observed. Among overweight girls, 35% report no asset behaviours, compared to 23% of non-overweight girls. Overweight boys are significantly less likely to report all three assets compared to their non-overweight peers.

iv. Coefficient of variation of 16.6% to 33.3%; estimate subject to high variability, interpret with caution.

Figure 1 Asset Behaviours by Weight Status, Children Age 6 to 11, 2004



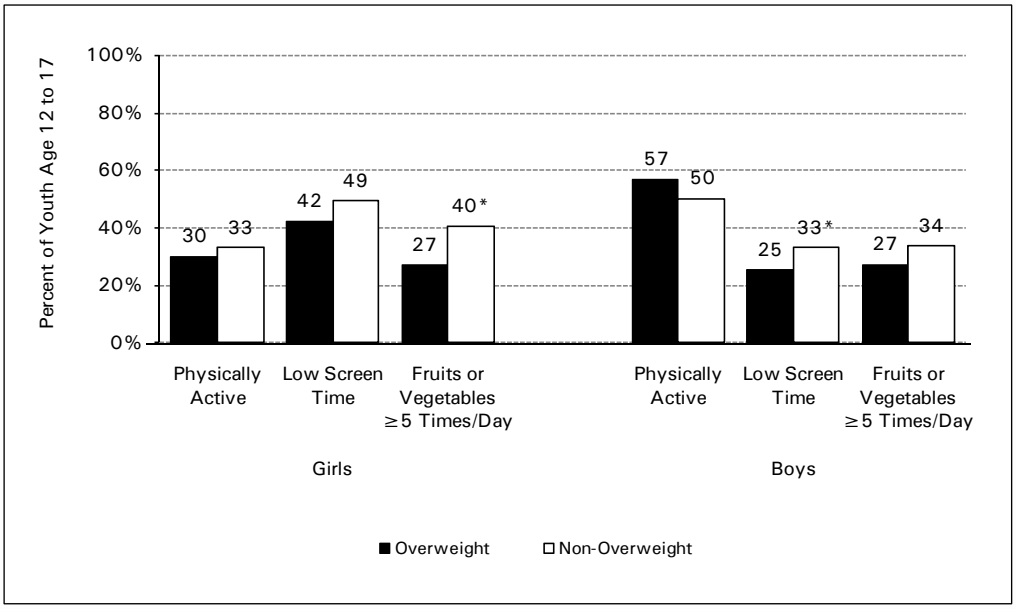
Note

* Significantly different than overweight group at $p < 0.05$.

Source

Canadian Community Health Survey, Cycle 2.2 (Nutrition), 2004, Statistics Canada.

Figure 2 Asset Behaviours by Weight Status, Youth Age 12 to 17, 2004



Note

* Significantly different than overweight group at $p < 0.05$.

Source

Canadian Community Health Survey, Cycle 2.2 (Nutrition), 2004, Statistics Canada.

Summary of Results

As highlighted in figures 1 and 2, sedentary behaviour, measured by screen time, is a distinguishing factor for both children and youth overall. However, among youth, other behaviour differences and inconsistencies between girls and boys also emerge. The research questions outlined in the introduction are answered in detail below to summarize the findings.

Among children and youth, what is the prevalence of reporting multiple assets, as well as each asset behaviour individually?

- 84% of children and 43% of youth are physically active for an hour a day or more.
- 64% of children and 39% of youth report engaging in screen-time activities (computer, television or video games) for two hours or less each day.
- 40% of children and 34% of youth report eating fruit and vegetables five times or more each day.
- 24% of children and 8% of youth have all three asset behaviours.

Do lifestyle behaviours differ between overweight and non-overweight children and youth?

- Physical activity does not differ significantly by weight status for children or youth.
- Low levels of screen time are more common among non-overweight groups compared to overweight groups—a difference more pronounced for children than youth.
- Overweight youth are less likely to eat fruit and vegetables five or more times per day compared to non-overweight youth. This difference is not seen for children.
- The rate of reporting multiple assets differs by weight status for children, where overweight children are less likely to report all three—a difference not observed for youth overall.

Are comparisons of asset behaviours by weight status consistent for both girls and boys?

- Among children, differences by weight status in asset behaviours follow the same pattern for girls and boys.
  - There is no difference by weight status in reporting being physically active or eating fruit and vegetables five times or more per day for children. In addition, engaging in two hours or less of screen-time activities is more common among both non-overweight girls and boys compared to their overweight peers.
  - However, overweight boys are significantly less likely to report the three multiple assets than non-overweight boys—a significant difference not observed for girls.
- Among youth, differences in asset behaviours between weight groups are generally not the same for girls and boys.
  - Overweight girls are significantly less likely than non-overweight girls to report eating fruit and vegetables five or more times a day; this is not the case for boys.
  - Non-overweight boys are more likely to report low levels of screen time compared to overweight boys—a significant difference not found for girls.

Discussion

Canadian studies have examined the factors related to obesity and have shown various results based on the age and sex of the population of interest and the manner in which variables were defined.[3, 4, 5, 19] One study based on CCHS 2004 data for children and youth age 2 to 17 showed that fruit and vegetable consumption and sedentary behaviour were associated with being overweight or obese—but lower physical activity was not associated with overweight or obesity for children age 6 to 11 or girls age 12 to 17.[3] Another study of school children age 11 to 17 found no associations between dietary behaviours and overweight.[5] However, in a study of adults, low fruit and vegetable consumption and physical inactivity were both associated with the prevalence of obesity, while relationships with other factors, including income and marital status, differed for men and women.[19] Lifestyle behaviours may differ across the life course and by sex; this further adds to the complexity of understanding the characteristics linked to overweight and obesity.

As opposed to looking at factors associated with obesity outcomes, this Analysis in Brief compares the prevalence of various activity and dietary habits by weight status for populations stratified by age group and sex. Findings in other research based on self-reported height and weight of youth age 11 to 16 found that sedentary activity appeared higher and physical activity appeared lower among overweight and obese youth compared to the normal weight group for both girls and boys, although statistical differences were not examined.[5] Differences in dietary habits by weight status in this population were less clear.[5] This AiB, based on measured height and weight data, shows similar findings when comparing differences in sedentary activity by weight status. However no differences between overweight and non-overweight groups are found for physical activity, and instead results show significant differences in fruit and vegetable consumption among girls in particular.

CPHI analysis highlights that differences in activity patterns between overweight and non-overweight children and youth are seen in sedentary activity, as measured by screen-time activities, and not in physical activity. There are no differences by weight status in physical activity types, frequency or duration by weight status for children or youth overall. In contrast, longer periods of both computer use and television watching are more common among overweight groups of children and youth compared to non-overweight groups. Yet, not all activities can be easily captured in survey questionnaires. Research has also examined energy expended for more informal activities such as standing, doing chores and playing instruments.[20] In addition, a systematic review of studies of populations younger than 19 found that, compared to directly measured activity, self-reported measures over-estimate physical activity in both girls and boys.[21] Future studies could seek to use directly measured data where available, and include a range of formal and informal activities, to gain a more complete understanding of energy expenditure.

The same fruit and vegetable consumption questions are asked of both children and youth, and differences between age groups in fruit and vegetable consumption are much smaller than differences in physical and sedentary activity. Further, observed differences between children and youth responses may also be influenced by parents participating in responses for children and not for youth. A study of child and parent responses of Grade 5 children in Nova Scotia in 2003 showed that relationships between activity and weight

status were more consistent for parents' responses, which the report suggested were more accurate than children's self-reports.[22] The study also illustrated that children who over-reported activity and under-reported watching television, compared to parents' responses, were more likely to be overweight or obese.[22]

Although direct comparisons between prevalence of behaviours for children and youth are not made due to differences in how questions are asked or how parents respond on behalf of their children, findings in this analysis note that being active and having low levels of screen time are more commonly reported for children than youth. Consistent with this, a recent report based on 2006 data of Canadian students in grades 6 to 10 showed that there was a general decline in physical activity with increasing grade level, while computer use tended to increase.[23]

This analysis, highlighting sedentary behaviour differences between weight groups, suggests that there may be value in not only increasing physical activity but also reducing sedentary behaviour, as measured here by screen-time activities. The notion of addressing both physical and sedentary activity is reflected in new guidelines for promoting a physically active lifestyle by the Public Health Agency of Canada (PHAC). The guidelines recommend that children and youth try to gradually increase time currently spent on physical activity to accumulate at least 90 minutes of physical activity per day, and decrease the amount of time spent on sedentary activities such as watching television and sitting at a computer.[11, 12] Specific recommended limits on daily sedentary activity are not provided. Further research on guidelines for sedentary activity levels may be beneficial for promoting and monitoring healthy behaviours. Recently, there has been progress in the implementation of initiatives related to childhood obesity and inactivity in Canada. For a more detailed discussion on program and policy activities in Canada, 10 such initiatives in 2007 are summarized in the commentary "Major Initiatives Related to Childhood Obesity and Physical Inactivity in Canada."[24]

Dietary behaviours have also been under review. In February 2007, Health Canada released a revised version of *Eating Well With Canada's Food Guide*, which recommends that children age 4 to 8 consume five servings of fruit and vegetables per day, children age 9 to 13 consume six servings each day, 14- to 18-year-old girls consume seven servings per day and 14- to 18-year-old boys consume eight servings of fruit and vegetables daily.[15] Programs such as the *5 to 10 a Day* promotion by the Canadian Cancer Society and Heart and Stroke Foundation[25] and the Quebec government's *0-5-30* program[17] encourage people to aim for the minimum of five servings of fruit and vegetables per day. Results in this analysis show that fruit and vegetable consumption five times or more per day becomes a distinguishing factor between overweight and non-overweight youth and in particular for girls, a difference not seen for children. Future studies may benefit from using age- and sex-based cut-offs recommended in Canada's Food Guide, incorporating other food groups from the guide and studying eating habits separately and in combination.

Although this analysis does not explore possible social, economic and geographic factors that may be related to availability of different types of foods, these factors are also relevant. For example, a report based on data from a 2006 survey of grade 6 to 10 students in Canada showed that fruit and vegetable consumption is more commonly

reported by young people from more affluent families.[23] Furthermore, social and economic factors, not examined in this analysis, may also help explain the observed differences in fruit and vegetable consumption and sedentary behaviour by weight status. An American study showed that sedentary behaviour and physical activity were related to obesity for girls and boys age 10 to 16. However, when controlling for socio-economic status and ethnicity of respondents, physical activity was still significantly associated with weight status for boys while sedentary behaviour was not. For girls, neither physical activity nor sedentary behaviour was significantly associated with weight status.[26]

Analyses look at whether the behaviour differences by weight status that are observed for girls are also observed for boys and vice versa. Analyses in this AiB do not directly compare prevalence of behaviours between girls and boys. Results show that significant differences in screen time between weight groups are independent of sex for children. For youth, only boys differ by weight status in reporting low levels of screen time, whereas eating fruit and vegetables five times or more a day is a distinguishing factor only for girls.

In addition to exploring significant differences in behaviour patterns between weight-status groups, this analysis is novel in that it looks at behaviours in combination. Results show that reporting multiple assets (one hour or more of physical activity, two hours or less of screen time and consuming fruit and vegetables five times or more per day) differs by weight status among boys, for both children and youth. Monitoring rates of reporting multiple behaviours may provide further insight to populations reporting healthy lifestyles, as opposed to focusing on prevalence of single lifestyle practices in isolation. Future analyses may also explore factors associated with reporting multiple beneficial or asset behaviours, as well as how clusters of various behaviours are linked to weight. For example, one study showed that coordinated school programs promoting both diet and activity behaviours are associated with a significantly lower prevalence of obesity than schools with healthy menu programs alone.[27]

Although multiple behaviours are discussed, interactions between behaviours are not explored in this analysis. Research on adult behaviours and weight status based on 2007 CCHS data examines interconnections between physical activity, sedentary behaviour and fruit and vegetable consumption in relationship with weight.[28] The study showed that television and computer time were linked to lower physical activity and fruit and vegetable consumption.[28] However, longer television time was still associated with obesity, even taking the other behaviours into account.[28] Gaps still remain in understanding the interrelationships between lifestyle behaviours in children and youth, how these behaviours may differ by sex, across the life course and in relationship to the social, economic and physical environments in which they live.

Conclusion

The prevalence of healthy behaviours, and differences in behaviour patterns by weight status, appear to vary by age group and sex. Screen time is the behaviour difference that surfaced most consistently when comparing behaviours among overweight and non-overweight groups of children and youth by age and sex. Differences in dietary habits between overweight and non-overweight groups are not evident among children but are more pronounced for youth, and in particular for girls. Physical activity patterns did not appear to differ by weight status, although research cited demonstrates that inactivity is associated with obesity among certain populations of youth as well as adults. This may suggest that tailored approaches that focus on promoting particular behaviours for girls and boys at different ages may be beneficial.

A population health approach seeks to address determinants related to health outcomes and their interactions, and to apply multiple strategies and encourage collaboration across sectors and levels. Consistent with this approach, future research could move beyond the surveillance of healthy and less healthy behaviours and further explore multiple behaviours related to healthy weight, as well as their interactions, in order to promote clusters of healthy behaviours or prevent multiple unhealthy ones. In addition, further research could explore the factors that influence lifestyle behaviours and accessibility of foods within the context of where children and youth live, learn and play.

Appendix A: Methods and Limitations

This Analysis in Brief is based on the Statistics Canada Canadian Community Health Survey (CCHS), Cycle 2.2 on nutrition. The CCHS 2.2 targets persons of all ages living in private dwellings in the 10 provinces, excluding residents in the territories, on Indian Reserves or Crown lands and in institutions, as well as full-time members of the Canadian Forces and residents of certain remote regions. Collection took place between January 2004 and January 2005 with a response rate of 76.5%.[7] Measured height and weight were obtained for about 60% of the overall sample.[7] Response rates to measured height and weight sections were higher for children and youth, 66% and 71%, respectively.[3] Based on the 2004 measured data, the mean BMI is 18 for children and 22 for youth, with 26% and 29%, respectively, classified as overweight according to the age- and sex-specific cut-offs.[8, 9] For adults 18 and over, BMI cut-offs of 25 and 30 are used to categorize respondents as overweight and obese, respectively, while for individuals under 18, age- and sex-specific cut-offs are used to determine weight status.

Specific sample weights and bootstrap weights are used for the purpose of analyses of measured height and weight variables. Tests comparing differences between proportions employing bootstrap variance estimation techniques are used to compare lifestyle behaviours by weight status groups. Analysis is further stratified by age group (children and youth) and sex.

One of the limitations of this analysis is due to the type of questions and possible response categories available. Because of the manner in which survey questions were asked, analyses are limited to using number of times a day fruit and vegetables are consumed as a proxy for the number of servings per day, which may not be accurate. Further, fruit and vegetable consumption is limited in that this variable does not encompass concepts of food density or caloric intake.

The smaller sample size of the obese category limits examining behaviours of obese groups by age group and sex. Therefore, the obese respondents are combined with all overweight respondents. It may be beneficial in future analyses to more closely examine behavioural differences between obese and overweight groups. Similarly, analyses could also split the non-overweight group into both normal and underweight respondents.

Appendix B: Prevalence of Behaviours by Weight Status, Children Age 6 to 11, 2004

	Children Age 6 to 11		All Children		Boys		Girls	
			Overweight	Non-Overweight	Overweight	Non-Overweight	Overweight	Non-Overweight
Physical Activity	Activity in Free Time at School	< 1 hour/week	14	16	14E	12	15E	20
		1 to 2 hours	27	29	24	24	30	35
		≥ 3 hours	58	55	62	64	55	45
	Class Time Activity	< 1 hour/week	28	27	26	29	31	25
		1 to 2 hours	56	59	59	56	52	61
		≥ 3 hours	16	14	15E	15	17E	13
	Organized Activity Outside School	< 1 hour/week	46	44	40	39	51	49
		1 to 2 hours	30	30	30	31	31	30
		≥ 3 hours	24	26	30	30	18	21
	Unorganized Activity Outside School	< 1 hour/week	23	18	19E	17	27	21
		1 to 2 hours	29	31	25	25	32	36
		≥ 3 hours	49	51	56	58	42	43
	Total Physical Activity	< 7 hours/week	16	16	13E	13	18	18
		7 to 14 hours	44	42	38	38	49	47
		≥ 14 hours	41	42	49	49	33	35
Screen Time	Television/ Video Games	< 1 hour/day	16	26	18E	26	13E	27
		1 to 2 hours	52	51	48	52	56	50
		≥ 3 hours	32	23	34	23	31	23
	Computer	Never	22	24	20	22	24	27
		≤ 1 hour/day	52	57	51	59	53	54
		> 1 hour	26	19	28	19	23	19
	Total Screen Time	≤ 2 hours/day	52	69	48	68	56	70
		> 2 to 4 hours	30	20	33	22	27	18
		> 4 hours	18	11	19E	10	16E	12
Fruit and Vegetables	Fruit	< 1 time/day	32	28	36	30	27	27
		1 to less than 2	60	61	55	62	66	61
		≥ 2 times	8E	10	F	8	7E	12
	Vegetables	< 1 time/day	18	13	24	14	13E	12
		1 to less than 2	38	46	34	48	42	44
		≥ 2 times	43	41	42	39	45	44
	Total Fruit and Vegetables	< 3 times/day	19	19	24	18	14	19
		3 to less than 5	41	41	40	44	42	39
		≥ 5 times	40	40	36	38	44	42
Assets	Asset Behaviours	Zero assets	8E	4	F	5E	7E	4E
		1 asset	28	23	28	23	28	24
		2 assets	44	46	47	47	41	46
		All 3 assets	20	26	16E	26	24E	26

Notes

Shading indicates significant differences between weight-status groups at $p < 0.05$.

E: coefficient of variation of 16.6% to 33.3%; estimate subject to high variability, interpret with caution.

F: coefficient of variation in excess of 33.3%; estimate suppressed due to high sampling variability.

Source

Canadian Community Health Survey, Cycle 2.2 (Nutrition), 2004, Statistics Canada.

Appendix C: Prevalence of Behaviours by Weight Status, Youth Age 12 to 17, 2004

	Youth Age 12 to 17		All Youth		Boys		Girls	
			Overweight	Non-Overweight	Overweight	Non-Overweight	Overweight	Non-Overweight
Physical Activity	Basketball (per Occasion)	None	63	63	59	56	69	70
		≤1 hour	23	24	28	27	16	21
		>1 hour	14	13	13	17	15	9
	Biking (per Occasion)	None	57	54	48	45	68	63
		≤1 hour	32	34	37	38	26	30
		>1 hour	11	12	14	17	6E	7
	Activity Frequency	Infrequent	9	11	6E	8E	13E	14
		Occasional	16	17	11E	13	22	20
		Regular	75	72	83	78	64	66
	Total Physical Activity	Active	46	42	57	50	30	33
		Moderate	23	25	19	23	27	27
		Inactive	32	34	24	27	43	40
Screen Time	Television	≤5 hours/week	28	33	30	31	27	36
		6 to 14 hours	42	43	40	43	46	43
		≥15 hours	29	24	31	26	27	21
	Computer Time	≤5 hours/week	51	55	46	50	58	59
		6 to 14 hours	27	28	29	30	24	26
		≥15 hours	22	17	25	20	17	15
	Video Games	≤5 hours/week	43	48	21	28	73	69
		6 to 14 hours	38	36	49	44	24	27
		≥15 hours	F	16	28	30	4E	F
	Total Screen Time	≤14 hours/week	32	41	25	33	42	49
		15 to 34 hours	53	47	55	49	49	44
		≥35 hours	15	12	19	18	9E	6
Fruit and Vegetables	Fruit	<1 time/day	47	40	51	43	43	37
		1 to less than 2	43	51	39	48	49	53
		≥2 times	10	9	11E	8E	8E	9
	Vegetables	<1 time/day	21	18	21	21	21	15
		1 to less than 2	44	41	45	42	42	39
		≥2 times	36	42	34	37	37	46
	Total Fruit and Vegetables	<3 times/day	32	27	29	30	35	24
		3 to less than 5	41	36	44	37	38	35
		≥5 times	27	37	27	34	27	40
Assets	Asset Behaviours	Zero assets	29	25	25	26	35	23
		1 asset	42	40	45	41	37	39
		2 assets	24	26	24	24	24	28
		All 3 assets	F	9	5E	9	F	9

Notes

Shading indicates significant differences between weight-status groups at $p<0.05$.

E: coefficient of variation of 16.6% to 33.3%; estimate subject to high variability, interpret with caution.

F: coefficient of variation in excess of 33.3%; estimate suppressed due to high sampling variability.

Source

Canadian Community Health Survey, Cycle 2.2 (Nutrition), 2004, Statistics Canada.

Appendix D: Combinations of Asset Behaviours, Children Age 6 to 11, 2004

Number of Asset Behaviours	Physically Active	Five or More Fruit and Vegetables	Low Screen Time	Estimated Number of Children	Combination	Total Asset
0	No	No	No	118,977	5%	5%
1	No	No	Yes	117,606	5%	25%
	No	Yes	No	38,100	2%	
	Yes	No	No	409,552	18%	
2	No	Yes	Yes	82,703	4%	46%
	Yes	No	Yes	720,037	31%	
	Yes	Yes	No	246,919	11%	
3	Yes	Yes	Yes	559,038	24%	24%
			Total	2,292,931		

Source
Canadian Community Health Survey, Cycle 2.2 (Nutrition), 2004, Statistics Canada.

Appendix E: Combinations of Asset Behaviours, Youth Age 12 to 17, 2004

Number of Asset Behaviours	Physically Active	Five or More Fruit and Vegetables	Low Screen Time	Estimated Number of Youth 12–17	Combination	Total Asset
0	No	No	No	648,347	26%	26%
1	No	No	Yes	337,814	14%	41%
	No	Yes	No	238,477	10%	
	Yes	No	No	440,817	18%	
2	No	Yes	Yes	205,815	8%	26%
	Yes	No	Yes	225,536	9%	
	Yes	Yes	No	208,876	8%	
3	Yes	Yes	Yes	197,408	8%	8%
			Total	2,503,090		

Source
Canadian Community Health Survey, Cycle 2.2 (Nutrition), 2004, Statistics Canada.

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References

1. M. S. Tremblay and J. D. Willms, "Secular Trends in the Body Mass Index of Canadian Children," *Canadian Medical Association Journal* 163, 11 (2000): pp. 1429–1433.

2. J. D. Willms, M. S. Tremblay and P. T. Katzmarzyk, "Geographic and Demographic Variation in the Prevalence of Overweight Canadian Children," *Obesity Research* 11, 5 (2003): pp. 668–673.

3. M. Shields, *Nutrition: Findings From the Canadian Community Health Survey, Issue No. 1, Measured Obesity: Overweight Canadian Children and Adolescents* (Ottawa, Ont.: Statistics Canada, 2005), catalogue no. 82-620-MWE2005001.

4. I. Janssen et al., "Comparison of Overweight and Obesity Prevalence in School-Aged Youth From 34 Countries and Their Relationships With Physical Activity and Dietary Patterns," *Obesity Reviews* 6, 2 (2005): pp. 123–132.

5. I. Janssen et al., "Overweight and Obesity in Canadian Adolescents and Their Associations With Dietary Habits and Physical Activity Patterns," *The Journal of Adolescent Health* 35, 5 (2004): pp. 360–367.

6. P. T. Katzmarzyk, "The Canadian Obesity Epidemic: An Historical Perspective," *Obesity Research* 10, 7 (2002): pp. 666–674.

7. Statistics Canada, *Canadian Community Health Survey (CCHS) Cycle 2.2 (2004): Nutrition: General Health and 24-Hour Dietary Recall Components User Guide* (Ottawa, Ont.: Statistics Canada, 2006).

8. T. J. Cole et al., "Establishing a Standard Definition for Child Overweight and Obesity Worldwide: International Survey," *British Medical Journal* 320, 7244 (2000): pp. 1240–1243.

9. Statistics Canada, *Canadian Community Health Survey (CCHS) Cycle 2.2 (2004): Nutrition: General Health File and 24-Hour Dietary Recall—Master and Share Files: Derived Variables Documentation* (Ottawa, Ont.: Statistics Canada, 2006).

10. C. Cameron, C. L. Craig and S. Paolin, *Local Opportunities for Physical Activity and Sport: Trends From 1999–2004* (Ottawa, Ont.: Canadian Fitness and Lifestyle Research Institute, 2005).

11. Public Health Agency of Canada, *Family Guide to Physical Activity for Children (6–9 Years of Age),* cited August 8, 2009, from <http://www.healthycanadians.ca/pa-ap/pdf/kids_family_guide_e.pdf>.

12. Public Health Agency of Canada, *Family Guide to Physical Activity for Youth 10–14 Years of Age*, cited August 8, 2009, from <http://www.phac-aspc.gc.ca/pau-uap/paguide/child_youth/pdf/yth_family_guide_e.pdf>.

13. Harvard School of Public Health, *Youth Nutrition and Physical Activity Guidelines for Out-of-School Time (OST) Programs* (2006), cited August 17, 2009, from <http://www.hsph.harvard.edu/prc/proj_YMCA_guidelines_june06.pdf>.

14. Health Canada, *Canada's Food Guides From 1942 to 1992* (Ottawa, Ont.: Government of Canada, 2007), cited June 11, 2008, from <http://www.hc-sc.gc.ca/fn-an/food-guide-aliment/context/hist/fg_history-histoire_ga-eng.php>.

15. Health Canada, *Eating Well With Canada's Food Guide* (Ottawa, Ont.: Health Canada, 2007).

16. Sport étudiant, *Un défi pour la consommation de fruits et légumes organisé par les écoles primaires* (Québec, Que.: Association régionale du sport étudiant de Québec et de Chaudière-Appalaches, 2008).

17. Agence de la santé et des services sociaux de la Capitale-Nationale, *5 portions de fruits et légumes par jour* (2008), cited January 2009, from <http://www.0-5-30.com/>.

18. D. Garriguet, *Overview of Canadians' Eating Habits* (survey conducted by Statistics Canada) (Ottawa, Ont.: Statistics Canada, 2004), catalogue no. 82-620-MIE.

19. M. Tjepkema, *Nutrition: Findings From the Canadian Community Health Survey, Issue No. 1, Measured Obesity: Adult Obesity in Canada* (Ottawa, Ont.: Statistics Canada, 2005), catalogue no. 82-620-MWE2005001.

20. J. A. Levine, "Non-Exercise Activity Thermogenesis (Neat)," *Nutrition Reviews* 62, 7 Pt. 2 (2004): pp. S82–S97.

21. K. B. Adamo et al., "A Comparison of Indirect Versus Direct Measures for Assessing Physical Activity in the Pediatric Population," *International Journal of Pediatric Obesity* 4 (2009): pp. 2–27.

22. F. Sithole and P. Veugelers, "Parent and Child Report of Children's Activity," *Health Reports* 19, 3 (September 2008): pp. 1–6, catalogue no. 82-003-XPE.

23. Public Health Agency of Canada, *Health Settings for Young People in Canada* (Ottawa, Ont.: PHAC, 2008).

24. M. S. Tremblay, "Major Initiatives Related to Childhood Obesity and Physical Inactivity in Canada: The Year in Review," *Canadian Journal of Public Health* 98, 6 (2007): pp. 457–460.

25. Canadian Cancer Society and Heart and Stroke Foundation, *5 to 10 a Day for Better Health* (2009), cited June 2009, from <http://www.5to10aday.com/>.

26. R. G. McMurray et al., "The Influence of Physical Activity, Socioeconomic Status, and Ethnicity on the Weight Status of Adolescents," *Obesity Research* 8, 2 (2000): pp. 130–139.

27. P. J. Veugelers and A. L. Fitzgerald, "Effectiveness of School Programs in Preventing Childhood Obesity: A Multilevel Comparison," *American Journal of Public Health* 95, 3 (2005): pp. 432–435.

28. M. Shields and M. Tremblay, "Sedentary Behaviour and Obesity," *Statistics Canada Catalogue Health Reports* 19, 2 (2008): pp. 1–12, catalogue no. 82-003-X.