Children who become active

- *Overweight children aged 8 to 11 were less active than those aged 4 to 7.*
- *For overweight/obese children, a relatively high number of hours in physical education class was predictive of becoming physically active.*
- *Overweight/obese children who were frequent TV viewers had low odds of adopting and maintaining an active lifestyle.*

Abstract

Objectives

This article examines factors associated with children aged 4 to 11 becoming and remaining active, and how this differed according to their weight.

Data source

The data are from the National Longitudinal Survey of Children and Youth: cycle 1 (1994/95) for the cross-sectional analysis, and cycles 1, 2 and 3 (1994/95 to 1998/99) for the longitudinal analysis.

Analytical techniques

Estimates of physical activity levels in 1994/95 among acceptable-weight and overweight/obese children are presented by age, sex and selected activities (TV viewing, playing computer/video games, and hours of physical education at school). Logistic regression models were constructed for children who were inactive in 1994/95, focusing on the selected activities as predictors of adopting and maintaining an active lifestyle.

Main results

Factors associated with children adopting and maintaining an active lifestyle differed, depending on their weight. For overweight/obese children, but not for acceptable-weight children, a relatively high number of physical education hours was predictive of becoming physically active, while frequent TV viewing lowered the odds.

Key words

exercise, obesity, physical fitness, physical education and training, sports, television

Author

Claudio E. Pérez (613-951-1733; Claudio.Perez@statcan.ca) is with the Health Statistics Division at Statistics Canada, Ottawa, Ontario, K1A 0T6.

Claudio E. Pérez

The prevalence of overweight and obesity among Canadian children has climbed dramatically in recent years,[1-4] mirroring trends in many other countries[5] and among adults.[2] Estimates of the increase in the prevalence of overweight (including obesity) among boys range from a doubling to a tripling in the 15 years leading up to 1996; estimates for girls range from a 60% increase to a doubling. Increases in obesity alone are even sharper.[1,2]

Overweight children experience physical and psychological health problems during childhood.[6] They are also at risk of developing various chronic conditions in later life, because they are more likely than other children to become overweight adults.[7]

Assessing children's pastimes

The National Longitudinal Survey of Children and Youth (NLSCY) contains questions about pursuits that might be associated with children's level of physical activity, including television viewing, computer/video game use, and time spent in physical education (PE) classes at school.

To determine the child's television viewing habits, a parent (usually the mother) was asked two questions: "About how many days a week on average does the child watch TV or videos at home?" and "On those days, how many hours on average does he/she spend watching TV or videos?" Children watching more than 14 hours per week (2 hours a day) were identified as *frequent TV viewers*.

The parent was asked, "In the last 12 months, outside of school hours, how often has the child played computer or video games?" Possible answers were: most days, a few times a week, about once a week, about once a month, and almost never. Children who were reported to have played "most days" or "a few times a week" were considered *frequent computer or video game users*.

To determine time spent in physical education (PE) class, the principal of the child's school was asked:

- "It is first necessary to collect information regarding the length of the school's instructional cycle and the length of the school year. By instructional cycle we mean the number of days which make up one complete rotation through all regularly taught topics. For example, some schools run on a four-day instructional cycle. Overall, how long is one cycle of instruction in this student's home room class? (Specify the number of days)."
- "For the most recent full cycle of instruction, please estimate how much class time this student spent on physical education (specify the number of minutes per cycle)."

Based on the distribution of responses, children who spent an average of 18 or more minutes a day in physical education class were considered to have a *high number of physical education hours*.

This rise in the prevalence of overweight among children has been attributed to changes not only in eating habits, but also in levels of physical activity.[8,9] In response, Health Canada has published guidelines that call for children to devote more time to active pastimes and less to sedentary pursuits.[10-12] The logic is clear—less time in sedentary diversions frees up hours to increase energy expenditure, ideally in activities like sports. Such activities may improve fitness, and in turn, generate interest in other physical activities.

However, research reveals differences in psychological and other predictors of physical activity according to children's body mass index (BMI).[13,14] It is possible, therefore, that active and sedentary pursuits may also vary as predictors of adopting an active lifestyle among children in different weight categories. For example, overweight children who view mandatory activity such as physical education classes as work rather than fun may not be motivated by the same factors as acceptable-weight children who regard physical activity more positively.

This analysis focuses on two groups of inactive children who were aged 4 to 11 in 1994/95: those who were of acceptable weight and those who were overweight or obese. It examines how three factors—television viewing, computer/video game use, and physical education classes—affected the odds that these children would adopt and maintain a physically active lifestyle over the next four years (see *Assessing children's pastimes*). The data are from the first three cycles of the National Longitudinal Survey of Children and Youth (NLSCY) (see *Definitions*, *Methods* and *Limitations*).

Most "inactive"

In 1994/95, according to the NLSCY, about a third (37%) of children aged 4 to 11 met the criterion to be considered "physically active" (Table 1). Specifically, a parent judged him or her to be "moderately more" or "much more" active than other children of the same age and sex (see *Measuring physical activity and weight in children*). According to this definition, the proportion of children who were physically active did not differ significantly by weight: 38% of acceptable-weight children were physically active; the figure among those who were overweight/obese was 34%.

Associations between physical activity and the sex of a child are well known. To some extent, these associations may be due to gender differences in the social importance placed on sports, as well as to physiological differences between boys and girls.[15] Consistent with other research,[16-22] results of this analysis show that, in 1994/95, a significantly lower percentage of girls than boys were physically active: 34% versus 39% (Table 1). The gap was particularly pronounced among overweight/obese children, with 30% of the girls being active, compared with 38% of the boys.

Although other studies have shown that older children tend to be less active than their younger counterparts,[18,23,24] according to the measure used for this analysis, acceptable-weight children aged 10 or 11 were just as likely as those aged 4 or 5 to be active. By contrast, results for overweight/obese children

agree with the literature, in that a higher percentage of 4- and 5-year-olds than 8- to 11-year-olds were physically active.

Impact of TV varies

Television viewing has repeatedly been found to be associated with overweight and obesity among children.[6,16,25,26] Not only is it a sedentary pastime, but it also provides opportunities for snacking and exposure to advertising that may affect children's food choices.[15,27]

The association between hours of TV viewing and physical activity is less clear and may vary among different groups of children. For example, US studies reveal that boys watch more television than do girls, but boys are also more likely to participate in sports.[20] Analysis of the NLSCY data found that acceptable-weight children who watched at least two hours of TV a day were not as likely to be physically active as were those who spent less time in front of a set: 34% of frequent viewers were physically active, compared with 39% of those who watched less TV. Among heavier

Measuring physical activity and weight in children

Determining levels of physical activity among children is particularly difficult. Questionnaires pertaining to children have not been tested and validated to the same degree as questionnaires for adults,[28] and recall bias is a problem.[29] Measures of caloric expenditure exist, but have their limitations[28] and are beyond the scope of the National Longitudinal Survey of Children and Youth (NLSCY).

The NLSCY asked a parent (usually the mother), "In your opinion, how physically active is the child compared with other children the same age and sex?" The choice of responses was: much more, moderately more, equally, moderately less, or much less. For this analysis, a *physically active* child was one reported to be "moderately more" or "much more" active than other children of the same age and sex; otherwise they were considered *inactive*. The children examined in the longitudinal analysis were all inactive in 1994/95 (cycle 1) according to this definition and either remained inactive in the next two cycles or became active by cycle 2 and remained active in cycle 3. Children who did not fit one of these patterns (for instance, became active in cycle 2 and inactive in cycle 3) were out of scope for the longitudinal analysis.

This definition is conservative, as only children deemed to be at least "moderately more" active than other children are classified as "physically active." Those rated "equally" active (the vast majority) were grouped with the "inactive," on the premise that most children are not active enough for optimal growth and development.[4]

The definition of "becoming active" is also conservative. To "become active," a child who was inactive in cycle 1 had to meet the criterion to be classified as "active" in both subsequent cycles. This was to ensure that the child had truly adopted an active lifestyle, and that it was not a short-lived spike in activity.

In an attempt to validate the longitudinal outcome of "becoming active," the body mass index (BMI) of children who started off overweight or obese was calculated for cycles 1 and 3. This was done separately for children who became active and those who remained inactive. When age and sex differences between the newly active and inactive children were controlled, both groups' BMIs dropped. However, the inactive children's average BMI fell from 22.5 to 21.2, while that of newly active children fell from 22.3 to 20.1, a significantly greater decline (data not shown), which suggests that this measure of physical activity, although not directly comparable with other measures, is a meaningful concept with tangible results.

BMI was derived from the child's weight and height as reported by the parent, using the formula BMI = (weight in kg)/(height in m)^2. Respondents were identified as being *overweight/obese* according to the age- and sex-specific BMI cut-offs defined by Cole et al.[30]

	***Overweight/Obese* is BMI greater than or equal to:**	
	Boys	**Girls**
Age (years)		
4.0	17.55	17.28
4.5	17.47	17.19
5.0	17.42	17.15
5.5	17.45	17.20
6.0	17.55	17.34
6.5	17.71	17.53
7.0	17.92	17.75
7.5	18.16	18.03
8.0	18.44	18.35
8.5	18.76	18.69
9.0	19.10	19.07
9.5	19.46	19.45
10.0	19.84	19.86
10.5	20.20	20.29
11.0	20.55	20.74

For example, a 7-year-old boy measuring 120 cm (3 feet 11 inches) in height would have to weigh at least 25.8 kg (56.9 pounds) to be considered overweight.

Even though the models for acceptable-weight and overweight/obese children were constructed separately, the degree of overweight/obesity was also taken into account by indicating if the child was in the lower quartile of the BMI distribution of overweight/obese children (BMI $\leq$ 19.81 or not). For consistency between models, a similar variable was derived for those of acceptable weight (BMI $\leq$ 14.34 or not).

Table 1
Percentage of acceptable-weight and overweight/obese children aged 4 to 11 who were physically active, by selected characteristics, household population, Canada excluding territories, 1994/95

	Total†	Acceptable weight	Overweight/ Obese
		% physically active‡	
Both sexes	**37**	**38**	**34**
Boys	39*	40*	38*
Girls§	34	36	30
Age group			
4 or 5§	37	38	38
6 or 7	35	36	34
8 or 9	35	38	29*
10 or 11	38	41	26*
Frequent TV viewer			
Yes	32*	34*	31
No§	37	39	32
Frequent computer/video game user			
Yes	38	40	34
No§	36	38	34
High number of physical education hours			
Yes	38*	40	32*
No§	33	37	23
Missing/Not applicable	37*	38	37*

Data source: *1994/95 National Longitudinal Survey of Children and Youth, cross-sectional file*
Note: *Based on 8,419 acceptable-weight and 4,067 overweight/obese children*
† Includes children with missing BMI values.
‡ Parent considers child "moderately more" or "much more" active than other children of same age and sex.
§ Reference category
** Significantly different from reference category (p < 0.05)*

children, the percentage who were physically active did not vary with TV viewing time.

The relationship between physical activity and playing computer or video games has received less attention than that with television. Another NLSCY-based study (of children aged 7 to 11) found that like TV viewing, computer/video game use was associated with overweight and obesity.[31] However, in this analysis of NLSCY data, no statistically significant association between computer/video game use and physical activity was apparent, regardless of weight.

Physical education class

Another opportunity for children to be active is during physical education (PE) at school. According to the NLSCY results, time spent in PE class was significantly associated with being physically active, but only for heavier children. Close to a third (32%) of overweight/obese children who had a high number of PE hours (averaging 18 or more minutes a day) were physically active, compared with 23% who spent less time in PE. Among acceptable-weight children, the proportions who were physically active did not differ significantly with PE time (40% versus 37%).

Four years later

Most research on physical activity among children is based on cross-sectional data, so it is difficult to discern causal relationships. With longitudinal data from the NLSCY, it is possible to establish at least temporal associations between various factors and the adoption and maintenance of an active lifestyle. By the rather strict criterion used in this analysis, just 38% of acceptable-weight and 34% of overweight/obese 4- to 11-year-olds were "physically active" in 1994/95. The remaining 62% who were of acceptable weight

Table 2
Adjusted odds ratios for adopting and maintaining physical activity† by 1998/99, by selected characteristics, household population aged 4 to 11 in 1994/95, Canada excluding territories

	Weight in 1994/95			
	Acceptable‡		Overweight/Obese§	
	Adjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval
Frequent TV viewer				
Yes	0.97	0.61, 1.53	0.38*	0.18, 0.80
No††	1.00	...	1.00	...
Frequent computer/video game user				
Yes	0.65	0.38, 1.13	1.19	0.58, 2.44
No††	1.00	...	1.00	...
High number of physical education hours				
Yes	0.88	0.47, 1.63	2.64*	1.10, 6.33
No††	1.00	...	1.00	...
Missing/Not applicable	0.67	0.34, 1.32	1.25	0.42, 3.67

Data source: *1994/95 to 1998/99 National Longitudinal Survey of Children and Youth, longitudinal file*
Note: *Adjusted for child's BMI quartile, sex, age, household income, general health, activity limitations, asthma, self-confidence, participation in organized and unorganized sports, physician consultations, living arrangements; parent's education, activity limitations, smoking status; proximity of parks/playgrounds; neighbourhood safety.*
† Parent considers child "moderately more" or "much more" active than other children of same age and sex.
‡ Based on 2,233 acceptable-weight children who were inactive in 1994/95 and either remained inactive in 1996/97 and 1998/99 (1,937) or became active in 1996/97 and remained active in 1998/99 (296).
§ Based on 1,121 overweight/obese children who were inactive in 1994/95 and either remained inactive in 1996/97 and 1998/99 (999) or became active in 1996/97 and remained active in 1998/99 (122).
†† Reference category
** Significantly different from reference category (p < 0.05)*
... Not applicable

and 66% who were overweight/obese were "inactive." These inactive children were traced over the next four years to determine which ones had become "active" by 1996/97 and remained "active" in 1998/99, and the factors associated with this change in behaviour. Among overweight/obese children not classified as active in 1994/95, 11% had become active by 1996/97 and remained so two years later. The corresponding proportion for acceptable-weight children was 13%.

Although the proportions of overweight/obese and acceptable-weight children becoming active are comparable, the factors associated with such a change in behaviour may differ between the two groups. In addition to the pastimes and activities that are the focus of this analysis (television viewing, computer/video game use, and PE hours), the effects of other variables were taken into account. Most of them pertain to the child: BMI level, age, sex, household income, general health, presence of asthma, activity limitation due to a chronic condition, level of self-confidence, participation in organized and unorganized sports, general practitioner consultations, living with two parents or not, proximity to parks and playgrounds, and neighbourhood safety. Some characteristics of the parent were also considered: level of education, smoking status, and activity limitation.

Definitions

The following *age groups* were established: 4 or 5, 6 or 7, 8 or 9, and 10 or 11.

Household income was determined according to total household income and the number of household members, as follows:

Household income group	People in household	Total household income
Lowest	1 to 4	Less than $10,000
	5 or more	Less than $15,000
Lower-middle	1 or 2	$10,000 to $14,999
	3 or 4	$10,000 to $19,999
	5 or more	$15,000 to $29,999
Middle	1 or 2	$15,000 to $29,999
	3 or 4	$20,000 to $39,999
	5 or more	$30,000 to $59,999
Upper-middle	1 or 2	$30,000 to $59,999
	3 or 4	$40,000 to $79,999
	5 or more	$60,000 to $79,999
Highest	1 or 2	$60,000 or more
	3 or more	$80,000 or more

The child's *general health* was determined by asking the parent: "In general, would you say the child's health is: excellent, very good, good, fair or poor?" The first three and last two categories were grouped.

To determine if the child had *asthma,* the parent was asked, "Has the child ever had asthma that was diagnosed by a health professional?" (Yes/No)

To determine if the child had an *activity limitation* due to a chronic condition, the parent was asked, "Does the child have any long-term conditions or health problems that prevent or limit his/her participation in school, at play, or in any other activity for a child of his/her age?" (Yes/No)

The school principal was asked how often the child demonstrated *self-confidence*. The possible answers were: never, rarely, sometimes, usually and always. If the response was "always," the child was considered to have a high level of self-confidence.

The parent was asked, "In the last 12 months, outside of school hours, how often has the child taken part in any sports that involved coaching or instruction?" The possible answers were: most days, a few times a week, about once a week, about once a month, and almost never. In the same way, the parent was asked if the child had "taken part in unorganized sports or physical activities." In both cases, "most days" and "a few times a week" were grouped to identify *frequent organized/unorganized sports players*.

To determine *physician consultations,* the parent was asked, "In the past year, how many times have you seen or talked on the telephone about the child's physical or mental health with a general practitioner, family physician?"

A derived family status variable grouped children according to the number of parents with whom he/she lived: with two; with one; and does not live with a parent. Parents include biological, adoptive, step, and foster parents. From these values, children were determined to be *living with two parents* or not.

The *parent's education* was categorized as: less than secondary graduation, secondary graduation, some postsecondary, or postsecondary degree/diploma.

The parent was asked, "At the present time do you smoke cigarettes daily, occasionally or not at all?" Daily and occasional smokers were categorized as *smokers*.

The parent was asked, "Because of a long-term physical or mental condition or a health problem, are you limited in the kind or amount of activity you can do in activities such as transportation to or from work or leisure time activities?" (Yes/No)

The parent was asked, "Do you strongly agree, agree, disagree, or strongly disagree with this statement about your neighbourhood?"

- There are good parks, playgrounds and play spaces in this neighbourhood.
- It is safe for children to play outside during the day.

In both cases, the answers were grouped into "strongly agree" versus the other responses.

Methods

Data source

The biennial National Longitudinal Survey of Children and Youth (NLSCY) is conducted by Statistics Canada and Human Resources Development Canada. The survey, which began in 1994/95, has longitudinal and cross-sectional components. It follows a representative sample of Canadian children aged newborn to 11 in all provinces and territories into adulthood.

From each randomly selected household, most often one child was selected, although in some cases, up to four children were chosen. A parent (usually the mother) completed a set of questions designed to provide socio-economic and general health information about him/herself and his/her spouse or partner and about the child, including the child's health and social environment. For some questions (for example, physical education classes), information was obtained from the principal of the child's school.

In 1994/95 (cycle 1), a total of 15,579 households were selected to participate in the NLSCY. Of these, 13,439 responded, yielding an overall household response rate of 86.3%. The longitudinal response rates for 1996/97 and 1998/99 (cycles 2 and 3), based on the 16, 903 respondents in cycle 1, were 92% (15, 468 respondents) and 89% (15, 005 respondents), respectively.

This analysis was restricted to a subsample of children in the 10 provinces, who were aged 4 to 11 in 1994/95. The cross-sectional sample consisted of 14,226 children with known weight and height; the longitudinal subsample comprised 8,387 children for whom data were obtained in both cycles 2 and 3 (Appendix Tables A and B). Of those, 3,354 met the criteria to be included in the logistic regression models; that is, either they were not physically active in any cycle, or they had become active by cycle 2 and maintained that level of activity in cycle 3. Children with other activity trajectories were not in scope for the longitudinal analysis.

Analytical techniques

Respondents were divided into categories on the basis of their body mass index (BMI) in 1994/1995. Estimates of physical activity levels in 1994/95 were calculated for acceptable-weight and overweight/obese children by sex, age and frequency of involvement in three activities: watching television, playing video and computer games, and physical education classes.

The longitudinal analysis examined only the 4,732 children classified as being inactive in 1994/95 to determine which factors (measured in 1994/95) were significantly associated with becoming active by 1996/97 and continuing to be active in 1998/99. Children who were inactive at baseline, but who had become physically active two years later, and who continued to be active two years after that were contrasted with those who remained inactive throughout the period (1994/95 to 1998/99). Children who were of acceptable weight in 1994/95 were analyzed separately from those who were overweight or obese. The models included the sedentary/active pursuits on which the analysis focuses: TV viewing, computer/video game use, and physical education at school. Adjustments were made for the child's age, sex, household income, general health, the presence of asthma, activity limitations due to a chronic condition, depression, self-confidence, participation in organized and unorganized sports, living arrangements (with two parents or not), the presence of parks and playgrounds in the neighbourhood, whether it is safe to play outside, general practitioner consultations, and the educational attainment, smoking status and activity limitation status of the parent (Appendix Table C). Because the NLSCY was not designed to examine determinants of physical activity, the choice of control variables was limited. For example, it would have been preferable to adjust for the parent's physical activity level, but instead, smoking status was used as an indicator of the parent's health-related behaviour.

The data were weighted using cross-sectional or longitudinal weights, as appropriate, to represent the household population in Canada aged 4 to 11 in 1994/95. The statistical significance threshold was set at $p \leq 0.05$. To account for the complex sample design, significance testing and variance estimation were performed using the bootstrap technique.[32-34] In September 2003, revisions were made to the NLSCY weights. This analysis was based on weights prior to those revisions.

When the effects of these other variables were controlled, hours of television viewing, computer/video game use, and physical education did not significantly affect the odds that acceptable-weight children would adopt and maintain physical activity (Table 2).

For overweight/obese children, two of the factors were influential: time devoted to TV and PE class time. Overweight/obese children who watched more than two hours of television a day had significantly lower odds of becoming and remaining active, compared with those who spent less time watching TV. On the other hand, overweight/obese children who averaged at least 18 minutes a day in PE class in 1994/95 had much higher odds of becoming active by 1996/97 and remaining active in 1998/99, compared with those who had less time in such classes.

Limitations

The definition of the outcome—becoming physically active—used in this analysis is less than ideal (see *Measuring physical activity and weight in children*). It is not an empirical measure of energy output or even of time spent in physical activity. Rather, it is the subjective assessment made by a parent of the child's level of activity compared with that of other children of the same age and sex. Consequently, the results of this analysis may not be directly comparable with objective measures of physical activity.

Moreover, to be classified as "physically active," a child had to be judged at least "moderately more" active than his or her peers. It is likely that the parent's assessment would be based on her (most were mothers) observations of the child's friends. Thus, a different standard is used for each child. And because children may select their friends according to their level of physical activity, a very active child with active friends might be categorized as "equally" active, and therefore fall into the "inactive" category. At the same time, a relatively inactive child with even less energetic companions would be considered "active." Indeed, a cross-sectional tabulation reveals that, based on this conservative definition, only 48% of children who frequently participated in unorganized sports were classified as "physically active" in 1994/95. Using participation in organized and unorganized sports as the dependent variable in the longitudinal analysis (as opposed to the parent's perception of the child's level of activity relative to his or her peers) was not possible owing to substantial changes in the questions in subsequent survey cycles.

There was, however, consistency over time, in that the observations were made by the same person (parent). If this person, presumably close to the child, perceived a sustained change in activity, some change probably did occur. To further control for these perception and classification problems, frequency of participation in organized and unorganized sports in 1994/95 were used as control variables in the longitudinal analysis.

Given that the abilities and interests of boys and girls differ widely, particularly with regard to sports and physical activity, it would have been desirable to analyze the sexes separately. However, the small sample size available in the National Longitudinal Survey of Children and Youth (NLSCY) precluded such breakdowns. Similarly, children's interests tend to change as they enter adolescence, so an examination of the data by age group would have been useful, notably for the older children (10- and 11-year-olds at baseline) who, in the period covered by the survey, might have entered middle school or high school. But again, sample size did not permit such analyses.

The NLSCY was not specifically designed to measure predictors of physical activity, so information about many important variables was not collected: for example, athletic ability, parental activity levels, confidence about one's ability to participate in physical activities, and other psychological variables.

All the questions about the child were answered by proxy, most by the parent, but a few by the principal of the child's school. Some responses might have been different had the children answered on their own behalf.

Although research has shown that physical education time is generally overestimated when reported by the principal,[35] this should not greatly affect the grouping of respondents into those spending a "high" or "low" number of hours in physical education class. However, the variable assessing hours of physical education may be correlated with other characteristics of the school that were not included in the survey, but which may be associated with a child's likelihood of becoming physically active.

Weighting for the longitudinal file was done for respondents who answered in cycle 1 and in at least one of the next two cycles (some non-respondents in cycle 2 were converted to respondents in cycle 3). However, only those who answered in all three cycles were used in this analysis. This could bias the results if the excluded children differed systematically from those who were included.

Concluding remarks

The results of this analysis of data from the National Longitudinal Survey of Children and Youth demonstrate that physical education class time and television viewing were associated with the odds that inactive children would become active, but only for those who were overweight/obese. Thus, while it seems worthwhile to promote participation in PE classes and to discourage excessive TV viewing, the findings point to the importance of weight in the likelihood that children will benefit from specific activities.

These results are particularly important in an era when childhood obesity is increasing and, as researchers throughout North America have noted, physical education in schools has been cut substantially.[3]

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Appendix

Table A

Cross-sectional file sample sizes, acceptable-weight and overweight/obese household population aged 4 to 11, Canada excluding territories, 1994/95

	Total†			Acceptable weight			Overweight/Obese		
	Sample size	Estimated population		Sample size	Estimated population		Sample size	Estimated population	
		'000	%		'000	%		'000	%
Both sexes	14,226	3,129.0	100.0	8,419	1,909.1	100.0	4,067	844.3	100.0
Boys	7,230	1,599.1	51.1	4,273	967.9	50.7	2,038	437.5	51.8
Girls	6,996	1,529.9	48.9	4,146	941.2	49.3	2,029	406.8	48.2
Age group									
4 or 5	3,728	800.1	25.6	2,087	448.1	23.5	1.172	247.6	29.3
6 or 7	3,550	763.6	24.4	1,979	423.5	22.2	1,081	231.0	27.4
8 or 9	3,514	783.0	25.0	2,077	492.5	25.8	1,067	214.5	25.4
10 or 11	3,434	782.3	25.0	2,276	544.9	28.5	747	151.2	17.9
Frequent TV viewer									
Yes	3,287	669.5	21.4	1,902	397.3	20.8	1,048	203.0	24.0
No	10,387	2,351.0	75.1	6,377	1,482.3	77.6	2,896	616.0	73.0
Missing	552	108.6	3.5	140	29.5	1.5	123	25.2	3.0
Frequent computer/video game user									
Yes	3,414	738.7	23.6	2,045	451.9	23.7	1,035	216.9	25.7
No	10,542	2,343.2	74.9	6,369	1,456.4	76.3	3,025	626.4	74.2
Missing	270	47.1	1.5	5	F	F	7	F	F
High number of physical education hours									
Yes	2,726	590.5	18.9	1,695	382.2	20.0	741	140.8	16.7
No	2,341	481.5	15.4	1,410	296.6	15.5	716	144.4	17.1
Missing/Not applicable	9,159	2,057.0	65.7	5,314	1,230.4	64.4	2,610	559.1	66.2

Data source: *1994/95 National Longitudinal Survey of Children and Youth, cross-sectional file*
† Includes children with missing BMI values.
F Coefficient of variation greater than 33%

Table B

Longitudinal file sample sizes, acceptable-weight and overweight/obese household population aged 4 to 11 in 1994/95, Canada excluding territories

	Acceptable weight			Overweight/Obese		
	Sample size	Estimated population		Sample size	Estimated population	
		'000	%		'000	%
Both sexes	**2,233**	**779**	**100.0**	**1,121**	**350**	**100.0**
Frequent TV viewer						
Yes	553	171	21.9	305	97	27.6
No	1,651	600	77.0	785	244	69.8
Missing	29	8[E1]	1.0[E1]	31	9[E2]	2.6[E2]
Frequent computer/video game user						
Yes	534	179	22.9	285	98	28.1
No	1,698	599	76.9	834	251	71.8
Missing	1	F	F	2	F	F
High number of physical education hours						
Yes	451	165	21.2	198	56	16.0
No	390	117	15.0	249	80	22.8
Missing/Not applicable	1,392	497	63.8	674	214	61.2
Body mass index						
Lower quartile	542	194	24.9	202	70	20.0
Upper three quartiles	1,691	584	75.1	919	280	80.0
Sex						
Boys	1,073	382	49.1	508	169	48.3
Girls	1,160	397	50.9	613	181	51.7
Age group						
4 or 5	606	196	25.2	308	100	28.7
6 or 7	525	177	22.7	274	85	24.2
8 or 9	533	202	26.0	309	102	29.2
10 or 11	569	204	26.2	230	63	17.9
Household income						
Lowest/Lower-middle	349	120	15.4	202	56	16.0
Middle	805	275	35.3	419	122	34.8
Upper-middle	829	273	35.1	409	139	39.6
Highest	361	112	14.3	91	34	9.6
General health						
Excellent/Very good/Good	2,190	765	98.2	1092	342	97.8
Fair/Poor	43	14	1.8	29	8[E2]	2.2[E2]
Limiting chronic condition						
Yes	98	33	4.3	1,066	18	5.0
No	2,135	745	95.7	55	333	95.0
Asthma						
Yes	282	101	13.0	177	56	15.9
No	1,951	677	87.0	944	295	84.1
High self-confidence						
Yes	254	83	10.7	112	32	9.2
No	913	315	40.4	496	157	44.8
Missing	1,066	380	48.9	513	161	46.0
Frequent organized sports player						
Yes	518	180	23.1	264	80	22.9
No	1,714	597	76.7	855	270	77.0
Missing	1	F	F	2	F	F
Frequent unorganized sports player						
Yes	1,295	426	54.7	661	203	58.1
No	937	352	45.2	458	146	41.8
Missing	1	F	F	2	F	F
Physician consultations in last year						
None	717	254	32.6	324	117	33.4
Once	525	176	22.6	261	80	22.8
Twice or more	989	348	44.8	535	153	43.8
Missing	2	F	F	1	F	F
Lives with two parents						
Yes	2,007	691	88.7	959	297	84.8
No	225	87	11.2	162	53	15.2
Parent's education						
Less than secondary graduation	361	137	17.6	186	62	17.7
Secondary graduation	502	152	19.6	268	74	21.3
Some postsecondary	620	208	26.7	337	105	30.1
Postsecondary degree/diploma	740	280	35.9	327	107	30.7
Missing	10	F	F	3	F	F
Parent smokes						
Yes	691	223	28.7	426	111	31.7
No	1,523	552	70.9	690	238	67.9
Missing	19	4	F	5	F	F
Parent restricted in activities						
Yes	121	39	5.1	75	23	6.6
No	2,102	737	94.7	1043	326	93.2
Missing	10	2	F	3	F	F
Parks/Playgrounds nearby						
Yes	604	239	30.7	297	128	36.5
No	1,596	530	68.0	813	216	61.8
Missing	33	10[E1]	1.3[E1]	11	F	F
Safe neighbourhood						
Yes	1,017	312	40.1	505	158	45.1
No	1,182	457	58.6	604	186	53.0
Missing	34	10[E1]	1.3[E1]	12	F	F

Data source: *1994/95 to 1998/99 National Longitudinal Survey of Children and Youth, longitudinal file*
E1 Coefficient of variation between 16.6% and 25.0%
E2 Coefficient of variation between 25.1% and 33.3%
F Coefficient of variation greater than 33.3%

Table C

Adjusted odds ratios for adopting and maintaining physical activity[†] by 1998/99, by selected characteristics, household population aged 4 to 11 in 1994/95, minimal and full models, Canada excluding territories

	Weight in 1994/95							
	Acceptable[‡]				Overweight/Obese[§]			
	Minimal model[††]		Full model[‡‡]		Minimal model[††]		Full model[‡‡]	
	Adjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval
Frequent TV viewer								
Yes	0.90	0.58, 1.39	0.96	0.61, 1.53	0.35*	0.17, 0.73	0.38*	0.18, 0.80
No[§§]	1.00	...	1.00	...	1.00	...	1.00	...
Frequent computer/video game user								
Yes	0.70	0.42, 1.18	0.65	0.38, 1.13	0.98	0.49, 1.96	1.19	0.58, 2.44
No[§§]	1.00	...	1.00	...	1.00	...	1.00	...
High number of physical education hours								
Yes	0.93	0.51, 1.71	0.88	0.47, 1.63	2.83*	1.11, 7.24	2.64*	1.10, 6.33
No[§§]	1.00	...	1.00	...	1.00	...	1.00	...
Missing/Not applicable	0.89	0.52, 1.53	0.67	0.34, 1.32	1.52	0.65, 3.60	1.25	0.42, 3.67
Body mass index								
Lower quartile			1.10	0.69, 1.75			2.20*	1.04, 4.67
Upper three quartiles[§§]			1.00	...			1.00	...
Sex								
Boys[§§]			1.00	...			1.00	...
Girls			0.84	0.58, 1.22			0.50*	0.27, 0.91
Age group								
4 or 5[§§]			1.00	...			1.00	...
6 or 7			1.13	0.65, 1.95			0.46	0.20, 1.09
8 or 9			1.11	0.60, 2.03			0.31*	0.10, 0.94
10 or 11			0.90	0.50, 1.60			0.24*	0.06, 0.85
Household income								
Lowest/Lower-middle			0.23*	0.10, 0.52			0.41	0.12, 1.36
Middle			0.29*	0.17, 0.52			0.64	0.25, 1.66
Upper-middle			0.29*	0.17, 0.52			0.56	0.22, 1.43
Highest[§§]			1.00	...			1.00	...
General health								
Excellent/Very good/Good			1.18	0.26, 5.44			0.34	0.04, 2.68
Fair/Poor[§§]			1.00	...			1.00	...
Limiting chronic condition								
Yes			1.22	0.46, 3.24			0.22	0.04, 1.28
No[§§]			1.00	...			1.00	...
Asthma								
Yes			0.81	0.46, 1.43			0.21*	0.07, 0.58
No[§§]			1.00	...			1.00	...
High self-confidence								
Yes			0.93	0.52, 1.67			1.61	0.68, 3.80
No[§§]			1.00	...			1.00	...
Missing			1.37	0.76, 2.48			1.24	0.54, 2.83
Frequent organized sports player								
Yes			1.58*	1.05, 2.37			1.85	0.92, 3.74
No[§§]			1.00	...			1.00	...
Frequent unorganized sports player								
Yes			1.33	0.91, 1.95			0.81	0.43, 1.52
No[§§]			1.00	...			1.00	...
Physician consultations last year								
None[§§]			1.00	...			1.00	...
One			1.94*	1.16, 3.27			2.39*	1.06, 5.40
Two or more			1.92*	1.19, 3.08			1.10	0.53, 2.25

continued.....

Table C – concluded

Adjusted odds ratios for adopting and maintaining physical activity† by 1998/99, by selected characteristics, household population aged 4 to 11 in 1994/95, minimal and full models, Canada excluding territories

	Weight in 1994/95							
	Acceptable‡				Overweight/Obese§			
	Minimal model††		Full model‡‡		Minimal model††		Full model‡‡	
	Adjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval
Lives with two parents								
Yes			0.94	0.50, 1.78			0.46	0.18, 1.14
No§§			1.00	...			1.00	...
Parent's education								
Less than secondary graduation			0.78	0.44, 1.39			0.39	0.13, 1.22
Secondary graduation			1.26	0.73, 2.17			0.52	0.24, 1.13
Some postsecondary			1.05	0.65, 1.71			0.77	0.37, 1.59
Postsecondary degree/diploma§§			1.00	...			1.00	...
Parent smokes								
Yes			0.96	0.63, 1.48			1.25	0.65, 2.44
No§§			1.00	...			1.00	...
Parent restricted in activities								
Yes			3.09*	1.67, 5.71			0.17*	0.04, 0.80
No§§			1.00	...			1.00	...
Parks/Playgrounds nearby								
Yes			1.14	0.71, 1.86			0.88	0.46, 1.68
No§§			1.00	...			1.00	...
Safe neighbourhood								
Yes			0.97	0.63, 1.49			0.58	0.31, 1.11
No§§			1.00	...			1.00	...

Data source: *1994/95 to 1998/99 National Longitudinal Survey of Children and Youth, longitudinal file*
† PMK considers child "moderately more" or "much more" active than other children of same sex and age.
‡ Based on 2,233 acceptable-weight children who were inactive in 1994/95 and either remained inactive in 1996/97 and 1998/99 (1,937) or became active in 1996/97 and remained active in 1998/99 (296).
§ Based on 1,121 overweight/obese children who were inactive in 1994/95 and either remained inactive in 1996/97 and 1998/99 (999) or became active in 1996/97 and remained active in 1998/99 (122).
†† Adjusted for sex, age, household income and parent's education
‡‡ Adjusted for all variables listed
§§ Reference category
** Significantly different from reference category ($p < 0.05$)*
··· Not applicable