Obesity in Canadian children

Your excellent articles on obesity in Canadian children ignored caloric intake as the major factor in this problem.[1,2] Canadians obviously have a sedentary lifestyle. Like Ross Andersen,[2] we decry the decline in physical education in our school system because early habits form lifelong patterns of behaviour. However, the exercise factor must pale when compared with the massive caloric intake we "enjoy" in Canada. Although regular physical activity is an integral component of a healthy lifestyle, it is much less effective than dietary caloric restriction in helping to maintain a negative energy balance and lose weight. We are not far behind the world-leading Danes in terms of the amount of food we consume (3780 cal/d v. 2921 cal/d).

Consistent with trends in overweight and obesity, most data suggest that energy intake has increased over the past several decades and is a major contributor to the increase in average body weight. Beginning in childhood, we eat more frequently, we eat to the point of saturation and we eat more calorie-dense foods.

A recent study concluded that energy availability increased by 15% between 1970 and 1994, on the basis of per capita energy-availability estimates from the US Department of Agriculture.[3] The study also found that Americans are eating more meals outside the home, relying more heavily on convenience foods and consuming larger portions. When caloric intake is being determined, frequency of eating, the caloric density of the food and the quantity of food eaten must be considered.

Caloric restriction reduces oxidative DNA damage,[4] and overeating may underlie this society's epidemic of cancer.[5] Other pandemic diseases of Western society, such as stroke and heart disease, are also affected by caloric intake. Although exercise and caloric intake both affect health, increasing caloric intake is probably the more serious public health problem.

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Mark Tremblay and Douglas Willms have analyzed data from 3 Canadian surveys and drawn conclusions about secular trends in the relation between body mass index and age.[1] Unfortunately, the samples they used are not random. In order for results to be generalized to the population at large, analyses must take sampling weights into account. The variances estimated from unweighted regression analyses underestimate the variance in the population, and more reliable variances are generally now computed using bootstrap methodology.[2]

These methodologic issues have important implications for the authors' findings. Although their results might provide some information about body mass index in Canadian children, there is no guarantee that they are representative of results for the country as a whole.

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Mark Tremblay and Douglas Willms have reported that the prevalence of overweight increased from 15% in 1981 to 35.4% in 1996 among Canadian boys aged 7–13 years and from 15% to 29.2% among Canadian girls aged 7–13 years.[1] The prevalence of obese children tripled over that period, from 5% in 1981 to 16.6% for boys in 1996 and from 5% in 1981 to 14.6% for girls in 1996.[1] The values reported by the authors are interesting in that they clearly show an increase in overweight and obesity over time; however, it must be kept in mind that overweight and obesity were arbitrarily defined as the 85th and 95th percentiles respectively of the 1981 Canada Fitness Survey sample.

It was recently proposed that definitions of overweight and obesity corresponding to the health-related cut-offs used in adulthood (25 kg/m^2 and 30 kg/m^2 respectively) be developed for children and youth.[2] These cut-offs were recently derived using LMS regression by passing a line through the adult cut-off values at age 18 years for a large international sample.[3] Theoretically, these values may be more comparable to the established adulthood cut-offs than arbitrarily defined percentile cut-offs and could also be used as a yardstick for international comparisons. The prevalences of overweight and

Table 1: Prevalence of overweight and obesity among Canadian children aged 7 to 13 years, calculated using 2 methods

	Prevalence (%) calculated by method 1*		Prevalence (%) calculated by method 2†	
	Overweight	Obesity	Overweight	Obesity
1981 Canada Fitness Survey				
Boys	15.0	5.0	10.6	2.0
Girls	15.0	5.0	13.1	1.7
1996 National Longitudinal Study of Children and Youth				
Boys	35.4	16.6	32.6	10.2
Girls	29.2	14.6	26.6	8.9

*Arbitrary definitions of overweight and obesity were used, which were the age- and sex-specific 85th and 95th percentiles of the 1981 Canada Fitness Survey.[1]

†The derived cut-offs for overweight and obesity, based on LMS regression from the adult health-related definitions of 25 kg/m^2 and 30 kg/m^2, were used.[3]

obesity calculated using the adult health-related definitions are lower than the arbitrarily defined values of 15% and 5% (Table 1). In fact, the prevalence of obesity is less than half of 5% in both boys and girls. The prevalences of obesity in the 1996 National Longitudinal Study of Children and Youth are also somewhat lower than those reported by Tremblay and Willms.

The trends for overweight and obesity among Canadian children determined using the new health-related international cut-offs are the same as those reported by Tremblay and Willms, but use of these cut-offs will better allow comparisons to be made between countries and between children and adults.

I thank Cora Craig and her colleagues at the Canadian Fitness and Lifestyle Research Institute for providing data from the 1981 Canada Fitness Survey, and Lecily Hunter of the National Longitudinal Study of Children and Youth Project, Special Surveys Division, Statistics Canada, for providing data analyses on the National Longitudinal Study of Children and Youth master file.

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[The authors respond:]

We believe that there is little to be gained by arguing with Roland Auer and colleagues about whether diet or physical inactivity is the most important variable leading to obesity in Canadian children: together these factors determine caloric balance and therefore both are important. We advocated both healthy nutrition and physical activity throughout our paper.[1] The "massive caloric intake we 'enjoy'" is a problem only if we do not counter it with a proportional increase in physical activity. The comment by Auer and colleagues that "most data suggest that energy intake has increased over the past several decades" is perhaps based on selective information.[2,3] Also, increasing energy expenditure produces multiple physiological and psychological benefits beyond maintaining caloric balance[4,5] and these effects should not be ignored. Finally, significant problems exist in assessing physical activity and energy intake, and current techniques are clearly inadequate. The leap of faith required to accept "energy availability"[6] as a legitimate surrogate for energy intake is large.

In response to Murray Finkelstein, in our study we used data derived from stratified random samples of the Canadian population.[1] The sample designs, which are typical of surveys conducted by Statistics Canada, oversampled respondents in the smaller provinces, such that reasonably accurate estimates of provincial statistics can be obtained. Our analyses used the design weights provided by Statistics Canada, which take into account the stratified sampling design as well as potential bias due to nonresponse.[7] Finkelstein's point regarding sampling variances may be valid, however, in that the sample of children for the National Longitudinal Study of Children and Youth was clustered within families, with up to 2 children sampled within each family. In our subsample, for example, about 40% of the children were members of a sibling pair. We estimated the sampling variances using hierarchical linear models to achieve more accurate estimates of the standard errors and found that they increased by only about 5% when within-family clustering was taken into account. We agree that this more complex approach is preferable, but note that its use has no appreciable effect on our results or conclusions. The bootstrap method suggested by Finkelstein is computationally intensive and has some undesirable properties. For surveys such as these, which are derived from stratified samples and where individuals are clustered within higher level units such as families or schools, approaches based on balanced repeated replications provide a simple, robust approach to estimate sampling variances[8] and are generally preferable to bootstrap techniques.[9]

We estimated secular changes in the prevalence of overweight and obesity using well-established guidelines.[10–12] Peter Katzmarzyk suggests using new guidelines to define overweight and obesity[13] that were published after our paper had been submitted to *CMAJ*. We agree with Katzmarzyk about the