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Research articles

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Trends in weight change among Canadian adults

Heather M. Orpana, Mark S. Tremblay and Philippe Finès

Abstract

Objectives

Longitudinal analyses were used to examine the rate of change of self-reported weight among adults over two-year intervals from 1996/1997 to 2004/2005, and to determine if the pace at which Canadians' weight is changing has slowed down or accelerated. Associations between weight change and sex, age group and body mass index (BMI) category are also examined.

Data sources

The data are from the 1996/1997 through 2004/2005 National Population Health Survey.

Analytical techniques

Average weight changes over two-year intervals were calculated by sex, age group and BMI category. Linear regression was used to determine if the rate of weight change was stable, increased or decreased over time.

Main results

From 1996/1997 to 2004/2005, Canadian adults gained, on average, 0.5 to 1 kg per two-year period. Although people aged 18 to 64 continued to gain weight, the amount gained decreased significantly in the most recent interval, 2002/2003 to 2004/2005. This downturn is due, in part, to a significant decrease in the proportion of men gaining weight during that period. However, among people who gained weight, the amount gained in two years increased over the entire eight-year period.

Keywords

body mass index, body weight, longitudinal studies, obesity, overweight, weight gain

Authors

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Consistent with trends in other countries,[1,2] the prevalence of obesity has been rising in Canada. From 1978/1979 to 2004, the percentage of Canadian adults who were obese rose from 14% to 23%.[3] The increasing prevalence of obesity is a major public health concern, as excess weight has been associated with type 2 diabetes, cardiovascular disease, psychosocial difficulties, osteoarthritis, and premature mortality.[4]

Cross-sectional data about the prevalence of obesity, however, do not provide information about rates of weight change among individuals. Longitudinal data are needed for insight about patterns of change that are behind the increase in obesity in Canada. For instance, a recent longitudinal study showed that almost a third of Canadians whose weight had been in the acceptable range in 1994/1995 became overweight in the following eight years, and about a quarter of those who had been overweight became obese.[5]

As an extension to that analysis, an understanding of obesity requires information about the rate at which individuals are gaining (or losing) weight. Longitudinal studies in the United States have demonstrated that, in

<div style="text-align:center">**Methods**</div>

Data source

This analysis is based on data from five cycles (cycles 2 to 6) of the National Population Health Survey (NPHS), conducted by Statistics Canada from 1996/1997 to 2004/2005. Every two years since 1994/1995, the NPHS has collected data about health status, health behaviours and other determinants of health. The survey is representative of the household residents in all provinces in 1994/1995. It excludes the territories, Indian reserves, Crown Lands, health care institutions, and residents of Canadian Forces bases and some remote areas in Ontario and Quebec. Although the NPHS also has an institutional component covering residents of long-term care institutions such as nursing homes, that sample was not analyzed in this article.

In 1994/1995, 20,095 household residents were selected to be members of the NPHS longitudinal panel. Of these, 86.0% agreed to participate, yielding a sample of 17,276. Response rates in subsequent cycles were 92.8% in 1996/1997; 88.3% in 1998/1999; 84.8% in 2000/2002; 80.5% in 2002/2003; and 77.4% in 2004/2005. More detailed descriptions of the NPHS design, sample and interview procedures are available in other papers and reports.[6]

Data were collected primarily through computer-assisted personal interviews in 1994/1995, and primarily through computer assisted-telephone interviews thereafter. To rule out the potential impact of collection mode on the results, only data from 1996/1997 to 2004/2005 were analyzed. Telephone interviews comprised over 96% of all interviews in 1996/1997 and 1998/99; over 98% in 2000/2001 and 2002/2003; and more than 99% in 2004/2005.

Analytical techniques

The sample for this analysis consisted of people who were aged 10 to 60 in 1994/1995. Individuals were included in this analysis if they had reached age 18 by the beginning of a given interval (starting in 1996/1997), and were excluded if they were 65 or older at the end of a given interval. For instance, a respondent who was 62 in 1996 would have been included in the 1996/1997-to-1998/1999 interval, but excluded thereafter. Records for women who were pregnant at the beginning or the end of an interval were excluded for that interval.

For the first interval (1996/1997 to 1998/1999), there were 9,387 respondents aged 18 to 64 at the beginning and end; 318 cases were missing data on weight; and 203 women were excluded because they were pregnant. Thus, the sample size for the first interval was 8,866 cases. For the second, third and fourth intervals, there were 8,689, 8,098, and 7,517 respondents aged 18 to 64 at the beginning and end of the interval. Of these, 220, 160, and 139 cases, respectively, were missing data on weight, and 156, 152,

and 139 women were excluded because of pregnancy. The resulting samples were 8,313, 7,786, and 7,239. Additionally, for analyses using body mass index (BMI), cases with missing height were excluded: 7, 6, 12 and 8 cases for the first, second, third and fourth intervals, respectively.

Average weight change for the four two-year intervals from 1996/1997 to 2004/2005 was calculated for men and women. To reduce the effect of outliers, individuals who gained or lost more than 25 kg were given a value of 25 kg. For the first interval, 28 cases of weight loss and 23 cases of weight gain were truncated at 25 kg; for the second interval, 32 and 31 cases; for the third interval, 27 cases of weight loss and 42 cases; and for the fourth interval, 30 cases each of weight loss and weight gain were truncated.

To determine whether the rate of change in body weight was increasing or decreasing over time, multiple linear regression was conducted using a person-period dataset, predicting two-year weight differences from time, time squared, sex, age group and BMI category at the beginning of the interval. Age group and BMI category were time-varying covariates. Records for individuals missing data on any variable for a given interval were excluded, but this accounted for less than 4% of records for any interval. As well, if respondents had complete data for another interval, the record for that interval was retained in the analysis. Thus, for the regression model, the sample was 8,866 records for the 1996/1997 to 1998/1999 interval; 8,313 for the 1998/1999 to 2000/2001 interval; 7,786 for the 2000/2001 to 2002/2003 interval; and 7,239 records for the 2002/2003 to 2004/2005 interval.

To clarify patterns underlying observed differences in weight change, the proportion of people gaining weight, losing weight or remaining stable (no change in reported weight), as well as mean gain among those who gained weight and mean loss among those who lost weight, were calculated for each two-year interval. Confidence intervals for the sex-specific prevalences of weight gain, weight loss and weight stability were calculated and prevalences were compared to determine if they differed significantly over time. To test for the association between time and weight gain or weight loss, a linear regression was performed only on records where an individual experienced a gain or loss.

In order to take the complex survey design of the NPHS into account, the bootstrap method was used to generate confidence intervals of the estimates for all analyses. Bootstrap weights for individuals were applied to each record for an individual.[7] Significance was set at $p < 0.05$, and the weights for the longitudinal square file were used to weight the records to reflect the Canadian household population in 1994/1995. All analyses were conducted in SAS 9.

general, adults gain weight up to ages 55 to 60, after which they start to lose weight.[8-10] Few studies have examined rates of weight change in a representative sample of Canadians. Analyses of data from the 1981 Canada Fitness Survey and the 1988 follow-up, the Campbell Survey of the Well-being of Canadians, demonstrated that body mass index (BMI) was relatively stable over the period between the surveys, but the researchers did not estimate the rate of change.[11] Another study based on the same data estimated that in families of at least two people, the weight change from 1981 to 1988 was a gain of 2.9 kilograms (kg) for fathers and a gain of 3.5 kg for mothers.[12] However, both these studies examined only two points in time, and so could not determine whether rates of weight gain were changing or remaining stable.

The purpose of this analysis, which is based on longitudinal data from the National Population Health Survey (NPHS), is to examine two-year changes in the self-reported weight of the Canadian adult household population from 1996/1997 to 2004/2005, and to determine if the rate of change has been speeding up, slowing down, or has remained stable (see *Methods*, *Definitions* and *Limitations*).

Rate of gain slowing

Canadians continue to gain weight, but indications are that the pace has slowed down. Over the two years from 1996/1997 to 1998/1999, the average self-reported weight of people aged 18 to 64 rose 0.96 kg for men and 0.86 kg for women (Chart 1). During the 2000/2001-to-2002/2003 interval, average gains were higher: 1.12 kg for men, and 1.02 kg for women. Over the next two years from 2002/2003 to 2004/2005, Canadians' weight continued to rise, but the average amount gained was less: 0.74 kg for men and 0.57 kg for women. Regression results (Appendix Table A) indicate that this pattern of weight gain is statistically significant. Thus, while Canadian adults were still gaining weight, they were gaining significantly less than in the earlier periods.

Chart 1
Average weight change (kilograms) over two years, by sex, household population aged 18 to 64, Canada excluding territories, 1996/1997 to 2004/2005
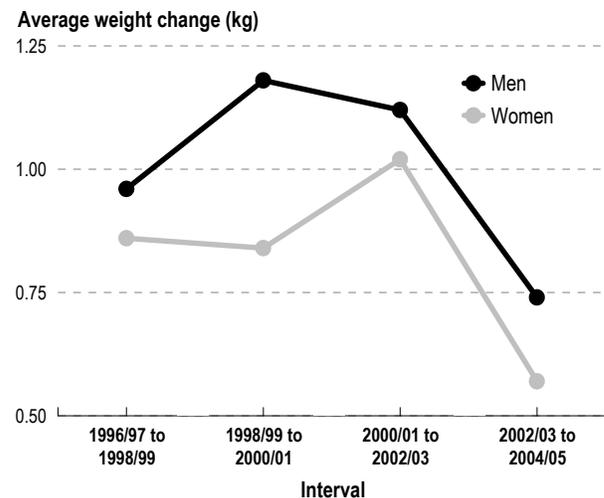
Source: *1996/1997 to 2004/2005 National Population Health Survey, longitudinal Health file*

Amount gained varies

Changes in weight were significantly associated with sex, age group and BMI (Appendix Table A).

Over the eight years from 1996/1997 to 2004/2005, the average self-reported weight of men and women in all age groups increased. However, in each two-year interval, people aged 18 to 33 reported significantly greater average gains than did 34- to 49-year-olds, and people aged 50 to 64 reported significantly smaller gains (Charts 2 and 3).

The decline in the average amount gained in the 2002/2003-to-2004/2005 interval applied to men and women in most age groups. The exception was men aged 18 to 33 who, on average, gained more weight in the last interval than in the preceding one.

An individual's BMI was associated with how much his or her self-reported weight changed in each two-year interval (Charts 4 and 5). On average, overweight people gained 0.8 kg less, and obese individuals, 1.9 kg less, than did people whose weight was in the acceptable BMI range (Appendix Table A). In fact, during most two-year intervals, people who were obese experienced a mean loss in self-reported weight.

Chart 2
Average weight change (kilograms) over two years, by age group at beginning of interval, male household population aged 18 to 64, Canada excluding territories, 1996/1997 to 2004/2005

Source: *1996/1997 to 2004/2005 National Population Health Survey, longitudinal Health file*

Chart 3
Average weight change (kilograms) over two years, by age group at beginning of interval, female household population aged 18 to 64, Canada excluding territories, 1996/1997 to 2004/2005
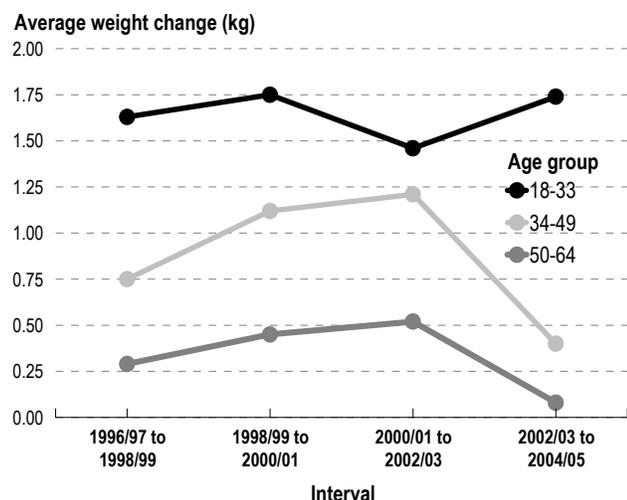
Source: *1996/1997 to 2004/2005 National Population Health Survey, longitudinal Health file*

Chart 4
Average weight change (kilograms) over two years, by BMI category at beginning of interval, male household population aged 18 to 64, Canada excluding territories, 1996/1997 to 2004/2005
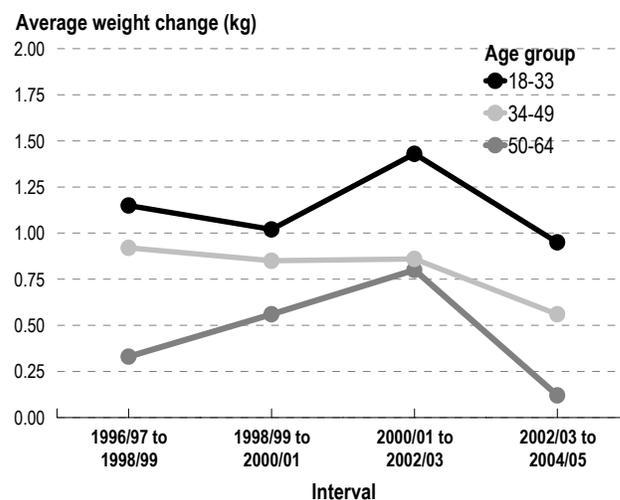
Source: *1996/1997 to 2004/2005 National Population Health Survey, longitudinal Health file*

Chart 5
Average weight change (kilograms) over two years, by BMI category at beginning of interval, female household population aged 18 to 64, Canada excluding territories, 1996/1997 to 2004/2005

Source: *1996/1997 to 2004/2005 National Population Health Survey, longitudinal Health file*
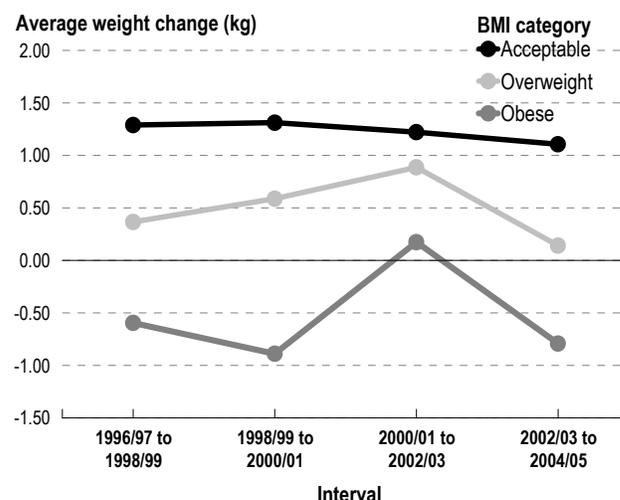
The decline in the average weight gain in the last two-year interval could reflect several processes: an increase in the number of people losing weight, an increase in the amount of weight lost, a decrease in the number of people gaining weight, a decrease in the amount of weight gained, or a combination of these factors. Further analyses were undertaken to examine which of these processes were behind the slowdown in the amount of weight gained.

ranging from 29% in the first three intervals to 32% in the last.

Those who gain, gain more

For the men who gained weight, the average amount rose from 4.56 kg in the first interval to 4.99 kg in the last, a statistically significant increasing trend (Table 1). The average gain among the women who gained weight varied, ranging from 4.39 kg 4.78 kg. A statistically significant trend of an increase in the amount gained among women was also observed.

Among the men who lost weight, there was no statistically significant trend in the amount lost, with the average ranging from 4.42 kg to 4.68 kg. By contrast, among the women who lost weight, the average loss rose significantly from 4.35 kg in the first interval to 4.91 kg in the last.

Thus, the overall decline in the average weight gain in the last interval (2002/2003 to 2004/05) appears to be driven by a combination of factors; that is, a smaller proportion of men gaining weight and greater losses among the women who lost weight.

A dynamic process

An important consideration in examining trends in weight change is that the same people did not gain,

Smaller percentage gaining

During each of the first three intervals, almost half of adults reported that they gained weight, but from 2002/2003 to 2004/2005, 44% of men and 46% of women did so (Table 1). For men, but not women, this was a significantly lower proportion than in all previous intervals.

As well, 32% of men reported a loss in weight from 2002/2003 to 2004/2005, a significantly higher percentage than in the first two intervals. Among women, the proportion losing weight did not differ significantly from one interval to another,

Table 1
Prevalence of weight change and average change (kilograms) over two-year interval, by sex, household population aged 18 to 64, Canada excluding territories, 1996/1997 to 2004/2005

| | Trend in mean weight change[†] | Interval | | | | | | | | | | | | | | |
| | | 1996/1997 to 1998/1999 | | | | 1998/1999 to 2000/2001 | | | | 2000/2001 to 2002/2003 | | | | 2002/2003 to 2004/2005 | | | |
		% Number		kg	sd	% Number		kg	sd	% Number		kg	sd	% Number		kg	sd
Men																	
Gain	(p < 0.05)	49	2,114	4.56	0.10	51	1,988	4.82	0.11	49	1,819	4.98	0.13	44[‡]	1,499	4.99	0.14
Loss	(not significant)	28	1,194	-4.56	0.18	27	1,109	-4.68	0.18	29	1,049	-4.42	0.17	32[§]	1,106	-4.61	0.17
Stable		23	969	--		22	855	--		22	815	--		23	792	--	
Women																	
Gain	(p < 0.05)	49	2,253	4.39	0.10	48	2,131	4.50	0.11	49	2,033	4.78	0.14	46	1,767	4.62	0.12
Loss	(p < 0.05)	29	1,342	-4.35	0.12	29	1,274	-4.54	0.13	29	1,206	-4.46	0.15	32	1,247	-4.91	0.20
Stable		22	994	--		22	956	--		22	864	--		22	828	--	

[†] Based on linear regression of mean weight gain or loss on time
[‡] Significantly different from first three intervals (p < 0.05)
[§] Significantly different from intervals 1996/1997 to 1998/99 and 1998/99 to 2000/2001 (p < 0.05)
Note: All percentages are accurate within +/- 2 percentage points.
Source: 1996/1997 to 2004/2005 National Population Health Survey, longitudinal Health file

Limitations

The data in these analyses were obtained primarily by computer-assisted telephone interviews and were self- or proxy-reported. Self-reported data may be affected by response biases such as social desirability; self-reported weight is generally an underestimate of measured weight.[3] If an individual's reporting bias changed over time, it could affect the results. It is possible that the increased media attention obesity has received in recent years may have changed the magnitude of this bias; however, other analyses (US data) indicate no significant change in the extent of the bias associated with self-reports of weight and height during the 1988-to-1994 and 1999-to-2002 periods.[14]

As in all surveys, non-response may introduce bias into the survey results. While the 1994/1995 longitudinal square weights adjust for non-response at the initial measurement, they do not adjust for subsequent non-response. Differential non-response may have affected the results. However, because regression using the person-period dataset does not require a respondent to answer at each cycle in order to include them in the analysis, this bias is somewhat attenuated. Future analyses should take non-response patterns into account to investigate the possibility that selective attrition is affecting the results.

Because the data can be conceptualized as observations nested within individuals, a growth curve model would be an appropriate approach to analyzing the data.[15] Initial analyses were conducted using a growth curve model in SAS; however, the estimates of SAS PROC MIXED have been reported to be biased when survey weights are used in the estimation[16] and the bootstrapping procedure was not available to estimate variance. Thus, an alternative approach using a person-period data set was adopted. While it is less efficient than a growth curve model, it is unbiased and allowed for variance estimation using the bootstrap procedure.

lose or maintain their weight over all two-year intervals. For example, of the women who lost weight from 1996/1997 to 1998/1999, almost 64% gained weight over the subsequent interval from 1998/1999 to 2000/2001. Conversely, of the women who gained weight in the first interval, approximately 38% lost weight in the following interval, while approximately 39% gained weight in the subsequent interval. The pattern was similar for men with more than two-thirds of those who lost weight in one interval gaining weight in the next.

Cumulative effects

The average weight changes among adults in each two-year interval were gains of 0.5 kg to 1 kg (1.1 to 2.2 lbs), and the overall change during the entire eight years was an average gain of 4.01 kg (8.8 lb) for men and 3.44 kg (7.6 lb) for women. While these amounts may appear relatively small, such changes are cumulative, resulting in a further shift of the distribution of an already predominantly overweight and obese population toward unhealthy weights.[3] Even a small shift in the population distribution toward excess weight can have important consequences for the incidence of weight-related diseases.[17]

Concluding remarks

The results of this analysis describe the pattern of weight change among Canadian adults from 1996/1997 to 2004/2005. There has been a slowdown in the average amount of weight gained and an increase in the number of men losing weight. At the same time, the amount gained by those who gain weight has increased.

Further research is warranted to identify the correlates and causes of these trends. While poor nutrition and lack of physical activity have been identified as primary contributors to weight gain, alternative explanations such as environmental factors are important and should also be considered.[18] Longitudinal analysis in particular is needed to inform public health strategies aimed at addressing the problem of obesity in Canada. Analysis of subsequent cycles of the National Population Health Survey will make it possible to determine if the decrease in the rate of weight gain continues in the future.

Although Canadian adults are still, on average, gaining weight, public health messages promoting healthy eating and physical activity have proliferated, and it is possible that without these interventions, the recent rate of weight gain might have been higher. ●

An electronic version of this article, "Trends in weight change among Canadian adults," was released on November 6, 2006, as part of the Healthy today, healthy tomorrow? Findings from the National Population Health Survey *series (82-618-MWE, free). This publication is available at: http://www.statcan.ca/english/research/82-618-MIE/82-618-MIE2005003.htm.*

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Appendix

Table A
Results of linear regression predicting two-year weight change in kilograms from time, time squared, sex, age group and body mass index category, household population aged 18 to 64, Canada excluding territories, 1996/1997 to 2004/2005

	ß	95% confidence interval
Intercept	0.67*	0.24 to 1.10
Time	0.60*	0.21 to 1.00
Time squared	-0.13*	-0.20 to -0.05
Men[†]	0.40*	0.28 to 0.53
18 to 33[‡]	0.30*	0.15 to 0.46
50 to 64[‡]	-0.33*	-0.47 to -0.18
Underweight[§]	1.56*	0.97 to 2.15
Overweight[§]	-0.82*	-0.99 to -0.66
Obese[§]	-1.88*	-2.13 to -1.63

* $p < 0.05$
[†] *Reference group is females.*
[‡] *Reference group is 34 to 49.*
[§] *Reference group is acceptable weight.*
Source: *1996/1997 to 2004/2005 National Population Health Survey, longitudinal Health file*

Canadians' eating habits

Didier Garriguet

Abstract

Objectives
This report is an overview of Canadians' eating habits: total calories consumed and the number of servings from the various food groups, as well as the percentage of total calories from fat, protein and carbohydrates.

Data sources
The data are from the 2004 Canadian Community Health Survey (CCHS) - Nutrition. Published results from the 1970-1972 Nutrition Canada Survey were used for comparisons over time.

Analytical techniques
An initial 24-hour dietary recall was completed by 35,107 people. A subsample of 10,786 completed a second recall 3 to 10 days later. Data collected in the first interview day were used to estimate, by selected characteristics, average calorie intake and average percentages of calories from fat, protein and carbohydrates. Usual intake of macronutrients was estimated with the Software for Intake Distribution Estimation (SIDE) program, using data from both interview days.

Main results
Although a minimum of five daily servings of vegetables and fruit is recommended, 7 out of 10 children aged 4 to 8 and half of adults did not meet this minimum in 2004. More than a third of 4- to 9-year-olds did not have the recommended two daily servings of milk products. Over a quarter of Canadians aged 31 to 50 obtained more than 35% of their total calories from fat. Snacks account for more calories than breakfast, and about the same number of calories as lunch.

Keywords
diet, dietary habits, eating, energy intake, food intake, nutrition, nutrition surveys

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At home, at work or at school, in a five-star restaurant or in a neighbourhood take-out, Canadians can chooose from an ever-increasing variety of foods. Grocery stores offer an abundance of imported products, along with frozen meals that can be ready in minutes to satisfy the needs of time-crunched households. Fresh fruits and vegetables once considered exotic are now available throughout the year. And today, fast food has become part of a typical diet. In the midst of this array of choices, just what are Canadians eating?

The 2004 Canadian Community Health Survey (CCHS)—Nutrition was the first national survey of Canadians' eating habits since the early 1970s. It was the largest and most comprehensive survey of its kind ever conducted in Canada. Throughout 2004, over 35,000 people were asked to recall what they had eaten during the previous 24 hours. They were also asked when they ate—breakfast, lunch, dinner and snacks—and where the food they ate had been prepared—at home, in a restaurant, or in a fast-food outlet.

<div style="text-align:center">**Methods**</div>

Data source

Most of the data in this analysis are from the 2004 Canadian Community Health Survey (CCHS) - Nutrition, which was designed to collect information about the dietary habits of Canadians (http://www.statcan.ca/english/concepts/hs). The CCHS excludes members of the regular Canadian Forces and people living in the territories, on Indian reserves, in institutions, in some remote regions, and all residents (military and civilian) of Canadian Forces bases. Detailed descriptions of the CCHS design, sample and interview procedures are available in a published report.[1]

An initial 24-hour dietary recall was completed by 35,107 people; a subsample (10,786) completed a second recall 3 to 10 days later. A five-step method was used to maximize recollection of food consumed the previous day:

- a quick list (respondents reported all items in whatever order they wished)
- questions about specific food categories and frequently forgotten foods
- questions about the time and type of meal
- questions seeking more detailed, precise descriptions of foods/beverages and quantities consumed
- a final review

Respondents could report basic food items (for example, an apple) or a recipe (for example, lasagna). To determine the individual food items that constitute recipes, standard recipes were used. However, when respondents reported a recipe, interviewers probed in order to find out if the recipe contained non-standard ingredients.

The response rate for the first interview was 76.5%, and for the second, 72.8%. Composition of the food in terms of macro- and micronutrients came from the Canadian Nutrient file 2001b Supplement[2] of Health Canada.

A total of 112 cases with invalid intake and 20 cases with null intake were excluded from this analysis. Pregnant women (175), women who were breastfeeding (91), and 4-year-old children who were being breastfed (3) were also excluded.

Published results from the 1970-1972 Nutrition Canada Survey were used to compare calorie and fat intake three decades ago with the 2004 results. The response rate for the 1970-1972 survey, which collected data for 10,994 respondents aged 5 or older, was 47%.

Analytical techniques

Data collected on the first interview day were used to estimate, by age and sex, average energy intake (calories) and average percentages of energy from fat, protein and carbohydrates. To determine the calories derived from each of these three macronutrients, amounts in grams were multiplied by 9, 4 and 4, respectively. Averages were defined as the average of the ratios for each individual. Total energy intake includes calories from alcoholic beverages (7 calories per gram), but the percentage of calories from alcohol is not shown separately.

Usual intake of macronutrients was estimated using data from both interview days and the Software for Intake Distribution Estimation (SIDE) program[3,4] (see *One-day versus usual intake*).

The foods (basic food items, recipes, or ingredients) were categorized into four groups as defined in *Canada's Food Guide to Healthy Eating*[5]—vegetables and fruit, milk products, meat and alternatives, and grain products—and "other foods." There was no double-counting; for example, if a recipe was coded as "other foods," the recipe, not the ingredients, was used, and vice versa. As was done for macronutrients, descriptive statistics were used to estimate daily calories from each food group and the number of servings consumed per day. The distribution of usual servings from each food group was estimated with the SIDE program.[3]

Quantities expressed in grams were transformed into servings for vegetables and fruit, milk products, and grain products, using the Canadian Nutrient File[2] provided by Health Canada. Quantities for the meat and alternatives group were expressed in terms of cooked meat, with one serving containing 50 to 100 grams of meat. Servings defined without a range (peanut butter, for example) were multiplied by a factor equal to 50 grams of cooked meat.

The percentage of energy from a particular food group was defined as total calories from that food group in a population, divided by the total calories consumed by that population. The same method was used to calculate the percentage of fat coming from particular food groups.

The foods accounting for the most calories from "other foods" were derived using food item and recipe categories (Table 2). Categories are specific to a food item or a recipe. Some categories are similar for food items and recipes. Therefore, salad dressings and fruit drinks include elements assigned as a food item or as a recipe.

To determine the foods accounting for the most fat consumed in a day, basic food items and recipes were considered (Table 4). The categories "sweet baked goods," "milk and milk-based beverages," "chicken dishes" and "egg dishes" are from food and recipe categories. However, "salads" include dressing only if it is part of the recipe, not if it is reported separately. "Pasta dishes" do not include pasta reported separately, and "cheese dishes" do not include cheese reported separately.

The percentage of calories or fat is defined as total calories or total fat from a category, divided by total calories or total fat for all categories (Tables 2 and 4).

The percentage of the population who had a specific meal (breakfast, lunch, dinner) or ate between meals (snacks) was defined as the number of people who did so the first day of the interview divided by the total population reporting on the first day. This percentage is a snapshot of a given day; it does not show the frequency with which individuals typically have a particular meal or consume snacks. Similarly, the percentage of calories from a specific meal (breakfast, lunch, dinner, snacks) was also defined as the number of calories that the population consumed from that meal, divided by the total number of calories the population consumed in a day.

The same method was used to determine locations where food was prepared (home, fast-food outlet, other).

The bootstrap method, which takes into account the complex survey design,[6-8] was used to estimate standard errors, coefficients of variation and confidence intervals. The significance level was set at $p < 0.05$.

This article is based on the initial results of the 2004 CCHS—Nutrition. It presents an overview of what Canadians are eating: how many calories they consume; whether they eat the daily minimum recommended[5] number of servings of vegetables and fruit, milk products, meat and alternatives, and grain products; and what percentage of their total calories come from fat, protein and carbohydrates. To provide historical context, results from the last national survey of Canadian dietary habits, the 1970-1972 Nutrition Canada Survey,[9] are also presented (see *Methods*, *Definitions* and *Limitations)*.

Calorie intake

Calories are a measure of the amount of energy in food. An individual's energy needs—the calories he or she must consume to remain healthy—vary according to a number of factors, notably, age, sex, weight, height and activity level.[10] For example, a moderately active 30-year-old man who is 1.75 metres tall (5 feet 9 inches) and weighs 75 kilograms (165 pounds) needs 2,750 calories a day; a sedentary 65-year-old woman who is 1.55 metres tall (5 feet 1 inch) and weighs 60 kilograms (132

pounds) needs 1,600 calories a day; and an active 12-year-old boy who is 1.5 metres tall (4 feet 11 inches) and weighs 46 kilograms (101 pounds) needs 2,625 calories a day.

Calorie consumption is highest during adolescence and declines with age (Chart 1). In 2004, males aged 12 to 19 averaged 2,800 calories a day, and females, just over 2,000 (Table 1). Among seniors, average daily intake was 1,950 calories for men and 1,550 calories for women.

The last time comparable information was gathered was the 1970-1972 Nutrition Canada Survey.[9] While the 2004 data cannot be strictly compared with those for 1970-1972 (see *Limitations*), an examination of results of the two surveys suggests that Canadians' average calorie consumption has not increased. On the contrary, initial findings indicate that the trend is down among males aged 12 to 64, and essentially stable among women and older men (Table 1). This is counter to the situation in the United States, where calorie intake rose between 1971-1974 and 1995-2000.[11]

Chart 1
Average daily calorie consumption, by age group and sex, household population aged 4 or older, Canada excluding territories, 2004
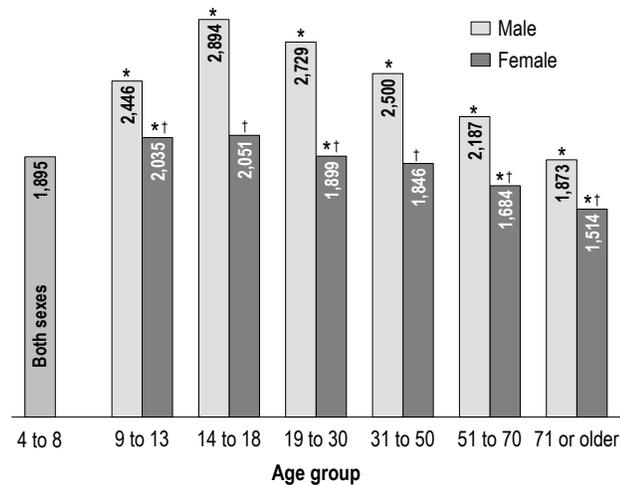
* Significantly different from estimate for preceding age group of same sex (p < 0.05)
† Significantly different from estimate for males in same age group (p < 0.05)
Note: Excludes women who were pregnant or breastfeeding.
Source: 2004 Canadian Community Health Survey - Nutrition

Table 1
Average daily calorie consumption, by age group and sex, household population aged 5 or older, Canada excluding territories, 1972 and 2004

Age group	1972 Average calories	2004 Average calories	2004 95% confidence interval
5 to 11	2,300	2,041	2,005 to 2,076
12 to 19			
Male	3,251	2,806	2,736 to 2,877
Female	2,243	2,047	2,002 to 2,092
20 to 39			
Male	3,374	2,660	2,585 to 2,735
Female	2,001	1,899	1,835 to 1,963
40 to 64			
Male	2,671	2,345	2,280 to 2,410
Female	1,726	1,757	1,720 to 1,794
65 or older			
Male	2,056	1,948	1,889 to 2,007
Female	1,530	1,544	1,507 to 1,581

Notes: *Excludes women who were pregnant or breastfeeding. Estimates of energy intake include calories from alcoholic beverages. Statistical comparisons with 2004 were not possible.*
Sources: *2004 Canadian Community Health Survey - Nutrition; Food Consumption Patterns Report, 1977*

Choices determine a balanced diet

Food choices determine the degree to which an individual's diet is balanced. Since 1942, Health Canada has published a food guide[12] to help Canadians make healthy choices. The version that was in effect when the 2004 CCHS was conducted, *Canada's Food Guide to Healthy Eating for People Four Years Old and Over*,[5] had been released in 1992.

The Guide identified four food groups: vegetables and fruit, milk products, meat and alternatives, and grain products. An "other foods" category covered foods that are mostly fats, oils or sugar; high-fat and/or high-salt snack foods; beverages; and herbs, spices and condiments.

In 2004, grain products were the top energy provider for both children and adults, supplying 31% of daily calories at ages 4 to 18, and 28.5% at age 19 or older (Chart 2). The "other foods" category ranked second, providing, on average, 22% of daily calories for both children and adults.

For each of the four food groups, the Guide recommended a range for the number of servings per day. "Other foods," according to the Guide, should be eaten in moderation. On average,

Canadians consumed the recommended daily number of servings of most food groups (Appendix Table A). However, average consumption hides the fact that substantial shares of the population were not within the suggested ranges.

Not enough vegetables and fruit

The 1992 Food Guide recommended at least five daily servings of vegetables and fruit. One serving would be, for example, a medium-sized apple, two stalks of broccoli, or 125 millilitres (1/2 cup) of juice.

In 2004, 7 out of 10 children aged 4 to 8 had less than five servings of vegetables and fruit a day (Chart 3). At ages 9 to 13, 62% of girls and 68% of boys did not meet the minimum. Consumption was somewhat higher among adults, but around half fell short of the five-serving minimum.

Chart 2
Percentage distribution of sources of calories, by food group and age group, household population aged 4 or older, Canada excluding territories, 2004

Food group
☐ Grain products
☐ Vegetables and fruit
■ Meat and alternatives
☐ Milk products
▨ Other foods

Note: *Excludes women who were pregnant or breastfeeding.*
Source: *2004 Canadian Community Health Survey - Nutrition*

Chart 3
Percentage below recommended minimum number of servings of vegetables and fruit, by age group and sex, household population aged 4 or older, Canada excluding territories, 2004

*   *Significantly different from estimate for preceding age group of same sex (p < 0.05)*
†   *Significantly different from estimate for males in same age group (p < 0.05)*
Notes: *Excludes women who were pregnant or breastfeeding. Based on usual consumption. Canada's Food Guide to Heathy Eating for People Four Years Old and Over recommends a minimum of five servings a day of vegetables and fruit.*
Source: *2004 Canadian Community Health Survey - Nutrition*

One in three children below minimum for milk products

Milk products include not just milk itself, but also foods such as cheese and yogourt. The 1992 Food Guide recommended two to three daily servings for children aged 4 to 9; three to four servings for 10- to 16-year-olds; and two to four servings for people aged 17 or older. One serving would be 250 millilitres (1 cup) of milk, 50 grams of cheese, or 175 grams (3/4 cup) of yogourt.

In 2004, more than one-third of children aged 4 to 9 did not consume the minimum recommended two daily servings of milk products (Chart 4). By ages 10 to 16, 61% of boys and 83% of girls did not meet their recommended minimum of three daily servings. And at age 71 or older, about 80% of both men and women had less than two servings of milk products a day.

Chart 4
Percentage below recommended minimum number of servings of milk products, by age group and sex, household population aged 4 or older, Canada excluding territories, 2004
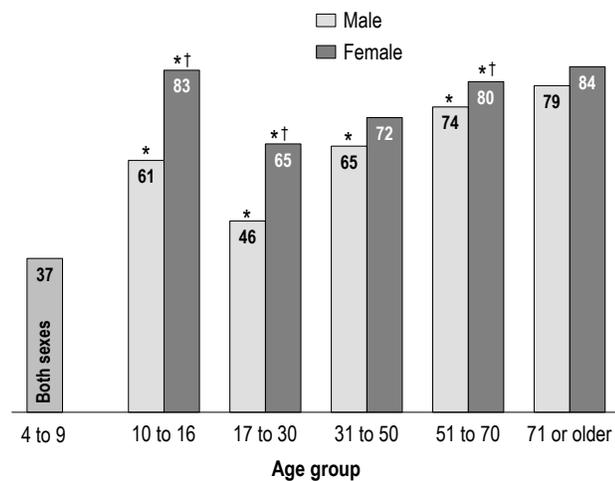
* *Significantly different from estimate for preceding age group of same sex (p < 0.05)*
† *Significantly different from estimate for males in same age group (p < 0.05)*
Notes: *Excludes women who were pregnant or breastfeeding. Based on usual consumption. Age groups are based on Canada's Food Guide to Heathy Eating for People Four Years Old and Over, which recommends a minimum of two servings of milk products a day for children aged 4 to 9 and adults aged 17 or older, and three servings a day for 10- to 16-year-olds.*
Source: *2004 Canadian Community Health Survey - Nutrition*

Meat and alternatives

The meat and alternatives group includes beef, pork, lamb, chicken and fish; legumes such as beans and lentils; soy products such as tofu; and eggs. The 1992 Food Guide suggested two to three daily servings from this group, the equivalent of 100 to 300 grams of cooked meat. One serving would be a chicken leg or a beef patty; 125 to 250 millilitres (1/2 to 1 cup) of beans; 100 grams (1/3 cup) of tofu; or one or two eggs, depending on their size.

Among males aged 14 to 70, average daily consumption of meat and alternatives was at least 200 grams (Appendix Table A), and about one in four had more than 300 grams (data not shown). No female age group averaged more than 200 grams of meat and alternatives a day. As well, 14% to 18% of girls aged 9 to 18 had less than 100 grams, as did 15% of women aged 71 or older (data not shown).

Grain products

The 1992 Food Guide recommended 5 to 12 servings a day of grain products. A serving would amount to one slice of bread, 30 grams of cold cereal, half a bagel, or half a cup of cooked pasta or rice.

In 2004, more than a quarter of children aged 4 to 8 did not eat the recommended daily minimum of five servings of grain products (data not shown). And for each sex, the proportion of people not meeting the minimum rose with age. By age 71 or older, 43% of men and 66% of women had less than five daily servings of grain products.

"Other foods"

"Other foods" covers foods and drinks that are not part of the four major groups. Included here are: fats and oils such as butter and cooking oils; foods that are mostly sugar such as jam, honey, syrup and candies; high-fat and/or high-salt foods such as chips (potato, corn, etc.); beverages such as soft drinks, tea, coffee and alcohol; and herbs and condiments such as pickles, mustard and ketchup.

While the 1992 Food Guide recommended moderate consumption of "other foods," 22% of the total calories consumed by Canadians in 2004 came from this category (Chart 2). For adolescents aged 14 to 18, the figure was 25% (Appendix Table B).

Although a wide range of foods and beverages make up "other foods," a relatively small number of specific items accounted for most consumption. In fact, the 10 most commonly consumed "other foods" represented two-thirds of the calories obtained from this category. Soft drinks ranked first, followed by salad dressing, sugars/syrups/preserves, beer, and oils/fats (Table 2). Given the high sugar and fat content of the top 10 "other foods," this category's sizeable contribution to daily calorie intake is not surprising.

Table 2
Foods and drinks accounting for most calories from "other foods," household population aged 4 or older, Canada excluding territories, 2004

Food/Drink	% of "other foods" calories
Soft drinks	11.3
Salad dressing	9.4
Sugars, syrups, preserves	8.7
Beer	8.2
Fruit drinks	6.1
Vegetable oil, animal fats, shortening	5.8
Margarine	5.3
Chocolate bars	4.8
Potato chips	4.7
Butter	3.9

Note: *Excludes women who were pregnant or breastfeeding.*
Source: *2004 Canadian Community Health Survey - Nutrition*

Macronutrient balance

In a 2002 report, the Institute of Medicine, an independent, non-government organization in the United States, specified "acceptable macronutrient distribution ranges" (AMDR) for the percentage of total calories supplied by fat, protein and carbohydrates, the three "macronutrients."[10] Intake within an AMDR is associated with reduced risk of chronic diseases and provides adequate consumption of essential nutrients. These AMDRs have been adopted by health officials in Canada.

On average, the Canadian diet in 2004 was within the AMDRs (Appendix Table C). Averages, however, conceal the fact that large proportions of the population fell outside the AMDRs.

Many exceed upper limit for fat

Fat is a source of energy and an important part of a healthy diet. The AMDR for fat intake is 25% to 35% of total calories for children and teens, and 20% to 35% of total calories for adults aged 19 or older. If fat accounts for more than 35% of calories, this may pose a potential health problem.

One of the recommendations stemming from the results of the 1970-1972 Nutrition Canada Survey was that Canadians reduce their fat intake, which then averaged about 40% of calories[9] (Table 3). By 2004 an appreciable change was evident, with fat accounting for an average of just over 31% of daily calories (Appendix Table C).

While this average was within the AMDR, substantial shares of the population surpassed the suggested maximum. Excess fat consumption

One-day versus usual intake

Two food consumption concepts must be distinguished: one-day intake and usual intake. *One-day intake* is total nutrient intake over a specific 24-hour period. These data were collected by the 2004 Canadian Community Health Survey - Nutrition during an interview in which respondents were asked to describe everything they ate from midnight to midnight the previous day. *Usual intake* is an overview of food typically consumed in a day, and it cannot be directly estimated based on one-day intake. However, estimates of the proportion of the population below or above a given threshold require a usual intake distribution.

Usual intake varies from one individual to another. One-day intake varies not only from one individual to another, but also from day to day for a given individual. To estimate usual intake, day-to-day variation for individuals was removed using Software for Intake Distribution Estimation (SIDE).[3] With a series of mathematical transformations, this software is able to estimate each component of the variance and to estimate the distribution of usual intake of a nutrient.[4,13] For these calculations, day of the week was used to partially account for the effect of classification.

Table 3
Percentage of total calories from fat, by age group and sex, household population aged 5 or older, Canada excluding territories, 1972 and 2004

	1972	2004	
Age group	**%**	**%**	**95% confidence interval**
5 to 11	**38**	**30.5**	**30.1 to 30.8**
12 to 19			
Male	41	31.3	30.8 to 31.8
Female	40	30.8	30.3 to 31.3
20 to 39			
Male	41	31.0	30.4 to 32.7
Female	40	31.2	30.5 to 31.9
40 to 64			
Male	40	31.7	31.1 to 32.3
Female	39	31.8	31.2 to 32.3
65 or older			
Male	39	31.0	30.3 to 31.6
Female	37	30.5	30.0 to 31.0

Notes: *Excludes women who were pregnant or breastfeeding. Statistical comparisons with 2004 were not possible. Estimates of energy intake include calories from alcoholic beverages.*
Sources: *2004 Canadian Community Health Survey - Nutrition; Food Consumption Patterns Report, 1977*

peaked among people aged 31 to 50, over a quarter of whom obtained more than 35% of their total calories from fat (Chart 5). At older ages, around one person in five got more than 35% of his or her calories from fat.

The meat and alternatives group was the primary source of fat in 2004 (Chart 6). Adults got almost a third of their fat from the meat group, and about a quarter from "other foods." Among children, meat and alternatives, milk products and "other foods" each accounted for nearly the same percentage of fat: 24% or 25%.

The fat that Canadians consumed came from a relatively small number of specific foods. The main contributor, accounting for 15.9% of fat intake, was what can be classified as the "sandwich" category, consisting of items such as pizza, sandwiches, submarines, hamburgers and hot dogs (Table 4). This was followed by sweet baked goods, such as cake, cookies and doughnuts (8.5%).

Chart 5
Percentage above upper end of recommended range of total calories from fat, by age group and sex, household population aged 4 or older, Canada excluding territories, 2004
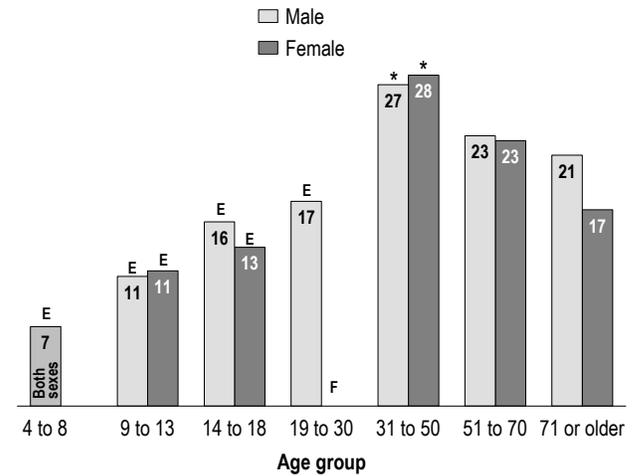
* *Significantly different from estimate for previous age group of same sex (p < 0.05)*
E *use with caution (coefficient of variation 16.6% to 33.3%)*
F *too unreliable to be published (coefficient of variation greater than 33.3%)*
Notes: *Excludes women who were pregnant or breastfeeding. Estimate of energy intake includes calories from alcoholic beverages. Based on usual consumption. The Institute of Medicine recommends 25% to 35% of calories from fat at ages 4 to 18 and 20% to 35% of calories at age 19 or older.*
Source: *2004 Canadian Community Health Survey - Nutrition*

Chart 6
Percentage distribution of sources of fat, by food group and age group, household population aged 4 or older, Canada excluding territories, 2004
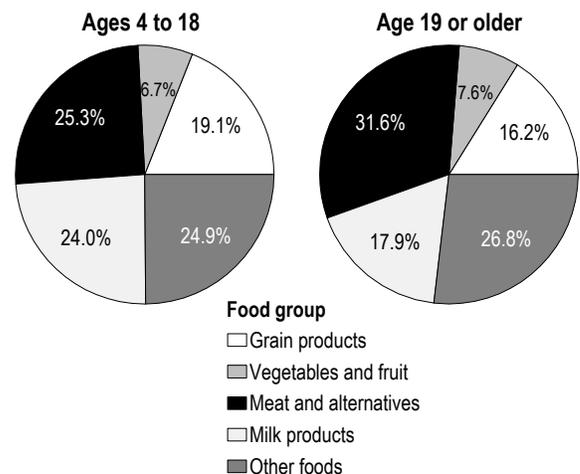
Note: *Excludes women who were pregnant or breastfeeding.*
Source: *2004 Canadian Community Health Survey - Nutrition*

Table 4
Foods and drinks accounting for most fat consumption, household population aged 4 or older, Canada excluding territories, 2004

Food/Drink	% of total fat
Pizza, sandwiches, submarines, hamburgers and hot dogs	15.9
Sweet baked goods (cakes, cookies, muffins, donuts, etc.)	8.5
Liquid milk and milk-based beverages	5.0
Chicken dishes	4.6
Salads (includes salad dressing)	4.6
Cheese	4.2
Pasta dishes	3.7
French fries	3.7
Egg dishes	3.0
Margarine	2.3

Notes: *Excludes women who were pregnant or breastfeeding. Includes basic food items and main recipes.*
Source: *2004 Canadian Community Health Survey - Nutrition*

Proteins in acceptable ranges

Protein is required for growth and is a source of energy. It is needed to maintain the structure, function and regulation of the body's cells, tissues and organs. Important sources of protein include meat, poultry, fish, eggs, dairy products and beans. The AMDR for protein is 10% to 30% of calories for children and adolescents, and 10% to 35% of calories for adults.

In 2004, Canadians' average daily calorie intake from protein was within these ranges. Among children and adolescents aged 4 to 18, protein accounted for an average of 14.5% of total calories; for adults, 16.5% (Appendix Table C). Almost no one fell below or above these ranges.

Carbohydrates primary source of energy

Carbohydrates are the body's most important source of energy. They may be obtained as sugars, starch or fibre. The AMDR for carbohydrates is 45% to 65% of daily calories.

On average, carbohydrates accounted for 55.4% of the calories consumed by children and adolescents in 2004; for adults, the percentage was 50.1% (Appendix Table C).

More calories from snacks than breakfast

Despite the nutritional benefits of eating breakfast,[14,15] close to 10% of Canadians reported that they had not had breakfast the day before they

Respondents to the 2004 Canadian Community Health Survey (CCHS) - Nutrition were asked where the food they ate had been prepared: home, which includes someone else's home; fast food, which includes take-outs and pizzerias; and other locations. Other locations cover: restaurants with waiter/waitress; other restaurants; bars, taverns, lounges; school and non-school cafeterias; work; child care centres; family/adult care centres; vending machines; grocery stores; corner stores; other stores; and other locations. The categories used in this analysis are: home only, at least some fast food (fast food only; fast food and home; fast food and other; fast food, home and other); and other combinations. Some respondents may have provided information about the location where they consumed the food rather than where it had been prepared. If a respondent reported having eaten in a fast-food establishment, he or she was considered to have eaten food prepared in a fast-food restaurant on the interview day.

For each food that they had eaten, respondents specified the *occasion*: breakfast, lunch, dinner and between-meal consumption. Breakfast includes brunch. Between-meal consumption covers anything that was not reported as breakfast, lunch or dinner. It includes snacks, drinks consumed outside of a meal, extended consumption (eating or drinking something throughout the day), and other unspecified occasions.

Age groups were defined according to the dietary reference intake groups used by the Institute of Medicine (IOM): 4 to 8, 9 to 13, 14 to 18, 19 to 30, 31 to 50, 51 to 70, and 71 or older. In Chart 4, data on milk products are presented for the 4 to 9, 10 to 16, and 17 or older age groups, which are used in *Canada's Food Guide to Healthy Eating for People Four Years Old and Over*.[5] In Tables 1 and 3, the age groups presented are those that were used for the analysis of data from the 1970-1972 Nutrition Canada Survey.

Household income was calculated based on the number of people in the household and total income from all sources in the 12 months before the CCHS interview:

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

In the charts, the two lowest income groups were combined.
For ease of reference, the term "calorie" is used in the text, although the term "kilocalorie" is more accurate.

were interviewed for the CCHS (data not shown). Men aged 19 to 30 were the least likely to have eaten breakfast: 19% of them had not done so (data not shown).

On average, Canadians consumed about 18% of their daily calories at breakfast in 2004; lunch made

up another 24%; and dinner, 31% for children and adolescents and 36% for adults (Appendix Table D). Snacks, that is, food or drinks consumed between meals, accounted for more calories than breakfast and about the same percentage as lunch: 27% for children and adolescents and 23% for adults.

The proportion of daily calories eaten as snacks peaked among 14- to 18-year-olds, at 30% for males and 28% for females, and then fell with advancing age to around 16% among seniors aged 71 or older (Chart 7).

The "other foods" category accounted for 41% of the calories that Canadians ate as snacks in 2004 (Chart 8).

One-quarter consuming fast-food items

A quarter of Canadians reported that on the day before their interview they had eaten something that had been prepared in a fast-food outlet (Table 5). Among 14- to 18-year-olds, the figure was one-third, and at 39%, the percentage was highest among men aged 19 to 30 (Chart 9).

Chart 7
Percentage of calories from between-meal consumption, by age group and sex, household population aged 4 or older, Canada excluding territories, 2004
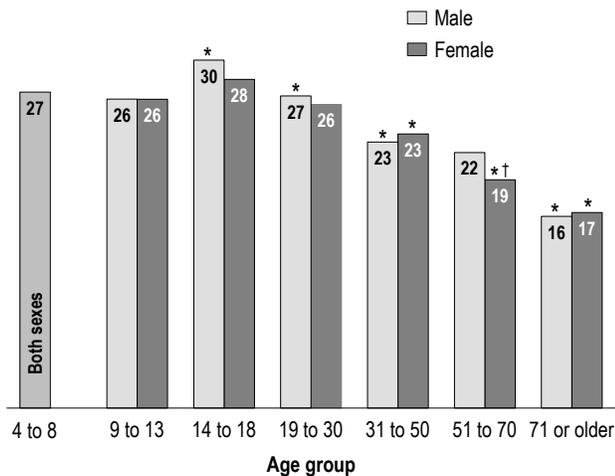
* *Significantly different from estimate for preceding age group of same sex (p < 0.05)*
† *Significantly different from estimate for males in same age group (p < 0.05)*
Note: *Excludes women who were pregnant or breastfeeding.*
Source: *2004 Canadian Community Health Survey - Nutrition*

Chart 8
Percentage distribution of calories from between-meal consumption, by food group, household population aged 4 or older, Canada excluding territories, 2004

Note: *Excludes women who were pregnant or breastfeeding.*
Source: *2004 Canadian Community Health Survey - Nutrition*

Chart 9
Percentage consuming food prepared in fast-food outlets, by age group and sex, household population aged 4 or older, Canada excluding territories, 2004
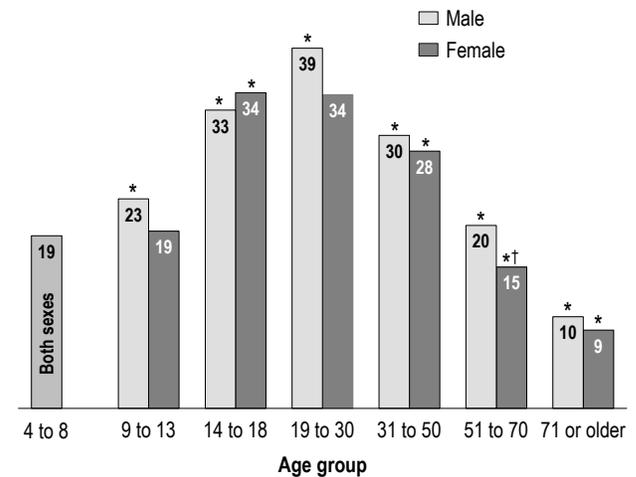
* *Significantly different from estimate for preceding age group of same sex (p < 0.05)*
† *Significantly different from estimate for males in same age group (p < 0.05)*
Note: *Excludes women who were pregnant or breastfeeding.*
Source: *2004 Canadian Community Health Survey - Nutrition*

Table 5
Percentage distribution of locations where food consumed was prepared, by age group and sex, household population aged 4 or older, Canada excluding territories, 2004

	Home only	At least some fast food	Other combination
	%	%	%
Total			
4 to 18	53.9	24.8	21.3
19 or older	51.7	25.4	22.9
Age group and sex			
4 to 8	60.8	18.9	20.4
9 to 13			
Male	54.9*	22.9*	22.3
Female	60.2†	19.4	20.4
14 to 18			
Male	44.6*	32.6*	22.8
Female	44.3*	34.5*	21.2
19 to 30			
Male	37.9*	39.3*	22.7
Female	43.1	34.3	22.6
31 to 50			
Male	44.8*	29.8*	25.4
Female	48.5*	28.1*	23.4
51 to 70			
Male	57.3*	20.0*	22.7
Female	61.2*	15.4*†	23.4
71 or older			
Male	72.1*	10.0*	17.9*
Female	75.7*	8.6*	15.7*

* Significantly different from estimate for preceding age group of same sex (p < 0.05)
† Significantly different from estimate for males in same age group (p < 0.05)
Note: Excludes women who were pregnant or breastfeeding.
Source: 2004 Canadian Community Health Survey - Nutrition

Of course, "something" prepared in a fast-food outlet is not invariably a high-fat, high-calorie item. It might have been as little as a cup of coffee or a salad without dressing. Even so, 40% of patrons of fast-food establishments chose a pizza, sandwich, hamburger or hot dog, and 25% had a regular (as opposed to diet) soft drink (data not shown).

The apparent popularity of fast food notwithstanding, more than half of all Canadians reported that all the food they ate on the day before their interview had been prepared at home. For children aged 4 to 8, the figure was 61% (Table 5). Elderly women were the most likely to have eaten only food prepared at home: 76%. By contrast, among young adult men, the figure was 38%.

Respondents may not recall exactly what they ate or how much. To minimize recall errors, the 2004 Canadian Community Health Survey (CCHS) - Nutrition used the five-step multiple-pass method.[16,17] Under controlled conditions, this method has effectively assessed average energy intake,[18,19] but in different settings, some studies show underreporting,[20-22] and others, overreporting.[23-25]

The data on occasion (breakfast, lunch, dinner or snack) and location (where food was prepared) present a snapshot of a given day. These data should not be interpreted as the typical behaviour of specific individuals.

The fact that occasions were self-defined may affect the results. For instance, respondents' definitions of breakfast may range from as little as a cup of coffee to a full meal, and a snack could be a 400-calorie muffin or a cup of tea without milk or sugar. Such variations influence the percentage of calories consumed at different occasions.

Parents responded on behalf of children younger than 6. However, a parent may not know exactly what a child ate when they were not together (at a daycare, for instance).

No statistical comparisons were made between the 2004 CCHS and the 1970-1972 Nutrition Canada Survey; the estimates for 1970-1972 in this article are based on a published report. As well, some concepts and collection methods differ between the two surveys. In 1970-1972 collection was done manually by dieticians/nutritionists, whereas in 2004 interviewers used an automated system. The 1970-1972 response rate (47%) was much lower than that obtained in 2004 (77%).

For more details on the limitations of the survey, see *The Canadian Community Health Survey 2.2, Nutrition Focus: A Guide to Accessing and Interpreting the Data*, published by Health Canada and available on its Web site (http://www.hc-sc.gc.ca/fn-an/surveill/nutrition/commun/index_e.html).

Diet and income

In some respects, food consumption patterns were associated with household income, especially among adults. For example, the percentage of calories that adults derived from fat tended to rise with income. While 15% of those in the lowest income households exceeded the AMDR for fat (more than 35% of their total calorie intake), this was the case for 25% of adults in the highest income households (Chart 10). Among children and adolescents, the percentage of calories derived from fat generally did not differ by household income.

Adults in the highest income households were less likely than those in the lowest to have fewer than five daily servings of vegetables and fruit:

Chart 10
Percentage above upper end of recommended range of total calories from fat, by age group and household income, household population aged 4 or older, Canada excluding territories, 2004

Age group
☐ 4 to 18
☐ 19 or older
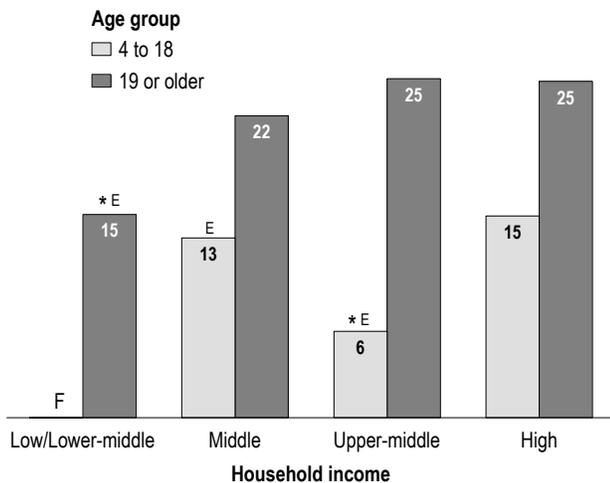
Household income

* Significantly different from estimate for same age group with high household income (p < 0.05)
E use with caution (coefficient of variation 16.6% to 33.3%)
F too unreliable to be published (coefficient of variation greater than 33.3%)
Notes: Excludes women who were pregnant or breastfeeding. Estimates of energy include calories from alcoholic beverages. Based on usual consumption. The Institute of Medicine recommends 25% to 35% of calories from fat at ages 4 to 18 and 20% to 35% of calories at age 19 or older.
Source: 2004 Canadian Community Health Survey - Nutrition

Chart 11
Percentage below recommended minimum number of servings of vegetables and fruit, by age group and household income, household population aged 4 or older, Canada excluding territories, 2004

Age group
☐ 4 to 18
☐ 19 or older
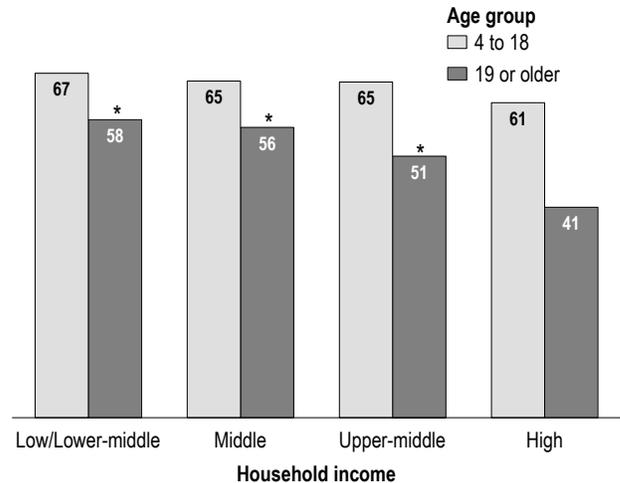
Household income

* Significantly different from estimate for same age group with high household income (p < 0.05)
Notes: Excludes women who were pregnant or breastfeeding. Based on usual consumption. Canada's Food Guide to Healthy Eating for People Four Years Old and Over recommends a minimum of five servings a day of vegetables and fruit.
Source: 2004 Canadian Community Health Survey - Nutrition

41% versus 58% (Chart 11). Again, there were no significant differences by household income in the proportion of children and adolescents eating less than five servings of vegetables and fruit each day.

For people of all ages, the likelihood of having eaten something from a fast-food outlet tended to increase with income. On the day before their interview, 31% of adults and 28% of young people from the highest income households had something that had been prepared in such an establishment, compared with 19% of adults and young people from the lowest income households (data not shown).

Concluding remarks
Results of the 2004 Canadian Community Health Survey—Nutrition show that when averages are considered, Canadians were generally within acceptable ranges for the number of servings from the four major food groups and for the percentage

of calories from fat, protein and carbohydrates. But averages mask the substantial proportions of chidren and adults who did not have a balanced diet.

The majority of Canadians did not eat the recommended daily minimum of five servings of vegetables and fruit. Over a quarter of men and women in their thirties and forties derived more than 35% of their calories from fat. One-third of children aged 4 to 9 did not have the recommended two servings of milk products a day, and among seniors aged 71 or older, the proportion surpassed 70%. Canadians of all ages obtained over a fifth of their calories from "other foods," and on a given day, a quarter of adults and children ate or drank something from a fast-food outlet.

This overview of Canadians' eating habits represents only part of the information collected during the 2004 CCHS. This new national database on nutrition offers an unprecedented opportunity

to examine many other topics, including beverage consumption and vitamin and mineral intake, as well as interrelationships between diet, physical activity and weight. ●

An electronic version of this article, "Overview of Canadians' Eating Habits," was released on July 6, 2006, as part of the Nutrition: Findings from the Canadian Community Health Survey *series (82-620-MIE2006002, free). This publication is available at: http://www.statcan.ca/english/research/82-620-MIE/82-620-MIE2006002.htm.*

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Appendix

Table A
Average daily servings from the four food groups, by age group and sex, household population aged 4 or older, Canada excluding territories, 2004

	Vegetables and fruit		Milk products		Meat and alternatives		Grain products	
	Servings	95% confidence interval	Servings	95% confidence interval	Grams	95% confidence interval	Servings	95% confidence interval
Total								
4 to 18	4.45	4.34 to 4.56	2.29	2.24 to 2.35	153	149 to 157	6.41	6.30 to 6.53
19 or older	5.16	5.05 to 5.26	1.52	1.48 to 1.56	203	198 to 207	5.64	5.53 to 5.75
Age group and sex								
4 to 8	4.18	4.00 to 4.36	2.31	2.22 to 2.41	118	112 to 124	5.76	5.60 to 5.92
9 to 13								
Male	4.53*	4.25 to 4.82	2.55*	2.41 to 2.69	176*	164 to 188	7.09*	6.79 to 7.39
Female	4.40	4.12 to 4.69	2.08*†	1.96 to 2.21	130*†	122 to 137	5.92†	5.68 to 6.15
14 to 18								
Male	4.87	4.58 to 5.17	2.64	2.50 to 2.79	229*	216 to 243	7.98*	7.63 to 8.34
Female	4.45†	4.20 to 4.69	1.82*†	1.72 to 1.93	136†	129 to 144	5.74†	5.50 to 5.97
19 to 30								
Male	5.36	4.97 to 5.74	1.95*	1.80 to 2.09	247	232 to 263	7.32*	6.92 to 7.71
Female	4.67†	4.39 to 4.96	1.64*†	1.50 to 1.77	145†	136 to 154	5.19*†	4.91 to 5.48
31 to 50								
Male	5.26	4.97 to 5.55	1.62*	1.51 to 1.72	254	239 to 268	6.64*	6.32 to 6.96
Female	4.92	4.66 to 5.19	1.52	1.42 to 1.61	169*†	158 to 179	4.87†	4.66 to 5.08
51 to 70								
Male	5.68	5.36 to 6.00	1.37*	1.28 to 1.46	241	228 to 253	5.74*	5.52 to 5.95
Female	5.24†	5.04 to 5.43	1.28*	1.22 to 1.35	174†	165 to 184	4.66†	4.45 to 4.86
71 or older								
Male	5.03*	4.73 to 5.34	1.36	1.16 to 1.56	189*	176 to 202	5.59	5.20 to 5.97
Female	4.76*	4.57 to 4.96	1.24	1.16 to 1.33	140*†	132 to 149	4.47†	4.30 to 4.63

* *Significantly different from estimate for preceding age group of same sex ($p < 0.05$)*
† *Significantly different from estimate for males in same age group ($p < 0.05$)*
Note: *Excludes women who were pregnant or breastfeeding.*
Source: *2004 Canadian Community Health Survey - Nutrition*

Table B
Percentage of calories, fat, protein and carbohydrates from "other foods," by age group and sex, household population aged 4 or older, Canada excluding territories, 2004

	Calories		Fat		Protein		Carbohydrates	
	%	95% confidence interval	%	95% confidence interval	%	95% confidence interval	%	95% confidence interval
Total								
4 to 18	22.3	21.9 to 22.7	24.9	24.4 to 25.5	5.2	5.0 to 5.4	24.8	24.3 to 25.3
19 or older	22.7	22.3 to 23.1	26.8	26.2 to 27.3	5.4	5.2 to 5.6	21.4	20.9 to 21.9
Age group and sex								
4 to 8	18.2	17.5 to 18.9	21.1	20.2 to 22.1	4.1	3.8 to 4.4	20.0	19.2 to 20.8
9 to 13								
Male	22.3*	21.3 to 23.2	24.3*	23.1 to 25.5	5.0*	4.6 to 5.4	25.4*	24.1 to 26.7
Female	22.9*	21.9 to 23.9	26.4*†	25.0 to 27.7	5.6*†	5.2 to 6.1	25.1*	24.0 to 26.3
14 to 18								
Male	25.7*	24.7 to 26.8	27.1*	25.9 to 28.4	5.7*	5.3 to 6.2	29.4*	28.1 to 30.8
Female	25.3*	24.3 to 26.3	28.7*	27.4 to 30.0	6.5*	5.9 to 7.1	27.4*†	26.2 to 28.7
19 to 30								
Male	26.4	25.1 to 27.7	25.6	23.9 to 27.2	6.6	5.8 to 7.5	28.3	26.9 to 29.8
Female	24.2†	22.9 to 25.4	27.7	26.1 to 29.3	6.5	5.9 to 7.2	24.2*†	22.8 to 25.7
31 to 50								
Male	24.3*	23.2 to 25.3	25.9	24.6 to 27.2	5.7*	5.2 to 6.1	24.7*	23.4 to 25.9
Female	22.9	21.8 to 23.9	27.5	26.1 to 29.0	5.7*	5.3 to 6.2	21.4*†	20.1 to 22.6
51 to 70								
Male	22.6*	21.7 to 23.4	26.6	25.4 to 27.8	4.7*	4.3 to 5.1	19.5*	18.5 to 20.4
Female	20.1*†	19.2 to 20.9	27.9	26.7 to 29.1	4.6*	4.3 to 5.0	16.7*†	15.8 to 17.6
71 or older								
Male	18.9*	17.8 to 20.1	25.8	24.2 to 27.4	3.7*	3.3 to 4.2	15.1*	14.0 to 16.2
Female	16.9*†	16.1 to 17.6	26.3	25.1 to 27.4	3.5*	3.2 to 3.8	13.0*†	12.2 to 13.7

*   Significantly different from estimate for preceding age group of same sex (p < 0.05)
†   Significantly different from estimate for males in same age group (p < 0.05)
Note: Excludes women who were pregnant or breastfeeding.
Source: 2004 Canadian Community Health Survey - Nutrition

Table C
Percentage of calories from fat, protein and carbohydrates, by age and sex, household population aged 4 or older, Canada excluding territories, 2004

	Fat		Protein		Carbohydrates	
	%	95% confidence interval	%	95% confidence interval	%	95% confidence interval
Total						
4 to 18	30.7	30.5 to 30.9	14.5	14.4 to 14.6	54.6	54.3 to 54.9
19 or older	31.3	31.1 to 31.6	16.5	16.4 to 16.7	49.1	48.8 to 49.5
Age group and sex						
4 to 8	30.1	29.8 to 30.5	14.3	14.1 to 14.5	55.5	55.1 to 56.0
9 to 13						
Male	30.9*	30.4 to 31.4	14.6	14.3 to 15.0	54.5*	53.9 to 55.1
Female	30.5	29.9 to 31.0	14.0†	13.8 to 14.3	55.5†	54.8 to 56.1
14 to 18						
Male	31.5	31.0 to 32.1	15.2*	14.8 to 15.5	52.7*	52.0 to 53.3
Female	30.8	30.2 to 31.4	14.4†	14.0 to 14.7	54.3*†	53.6 to 55.1
19 to 30						
Male	31.1	30.4 to 31.7	15.6	15.2 to 16.1	49.6*	48.8 to 50.5
Female	30.5	29.7 to 31.3	15.5*	15.1 to 16.0	51.9*†	51.1 to 52.8
31 to 50						
Male	31.6	30.8 to 32.3	16.8*	16.4 to 17.3	47.8*	46.9 to 48.8
Female	32.2*	31.5 to 32.8	16.6*	16.1 to 17.1	48.8*	47.9 to 49.6
51 to 70						
Male	31.5	30.8 to 32.1	17.0	16.6 to 17.4	47.3	46.5 to 48.0
Female	31.2*	30.6 to 31.7	17.1	16.8 to 17.5	49.6†	49.0 to 50.3
71 or older						
Male	30.7	30.0 to 31.4	16.4	15.9 to 16.8	50.1*	49.1 to 51.0
Female	30.3*	29.7 to 30.9	16.6	16.2 to 17.0	51.9*†	51.2 to 52.5

* Significantly different from estimate for preceding age group of same sex (p < 0.05)
† Significantly different from estimate for males in same age group (p < 0.05)
Notes: *Excludes women who were pregnant or breastfeeding. Estimates of energy intake include calories from alcoholic beverages, but calories from alcohol are not shown separately.*
Source: *2004 Canadian Community Health Survey - Nutrition*

Table D
Percentage distribution of calories, by occasion, age and sex, household population aged 4 or older, Canada excluding territories, 2004

	Breakfast/Brunch		Lunch		Dinner		Other	
	%	95% confidence interval	%	95% confidence interval	%	95% confidence interval	%	95% confidence interval
Total								
4 to 18	17.3	16.9 to 17.6	24.2	23.8 to 24.7	31.1	30.6 to 31.5	27.4	26.8 to 28.0
19 or older	17.7	17.4 to 18.1	23.8	23.4 to 24.3	35.9	35.4 to 36.4	22.6	22.1 to 23.1
Age group and sex								
4 to 8	18.0	17.5 to 18.6	25.6	24.9 to 26.4	29.5	28.6 to 30.4	26.8	25.9 to 27.8
9 to 13								
Male	18.0	17.2 to 18.8	24.9	23.6 to 26.1	30.9	29.8 to 31.9	26.3	25.0 to 27.5
Female	17.1	16.4 to 17.9	24.7	23.8 to 25.7	31.9*	30.8 to 33.0	26.2	25.1 to 27.4
14 to 18								
Male	16.4*	15.6 to 17.3	22.5*	21.4 to 23.6	31.5	30.4 to 32.5	29.6*	28.1 to 31.0
Female	16.4	15.3 to 17.5	23.1*	22.1 to 24.2	32.5	31.4 to 33.7	27.9	26.4 to 29.5
19 to 30								
Male	16.4	15.3 to 17.5	22.2	20.9 to 23.5	34.9*	33.3 to 36.5	26.5*	24.8 to 28.2
Female	17.7	16.6 to 18.9	23.4	22.0 to 24.8	33.1	31.7 to 34.4	25.8	24.0 to 27.5
31 to 50								
Male	17.1	16.2 to 18.0	24.9*	23.8 to 26.0	35.4	34.1 to 36.8	22.6*	21.4 to 23.8
Female	17.0	16.2 to 17.9	22.6†	21.5 to 23.8	37.1*	35.7 to 38.4	23.3*	22.0 to 24.6
51 to 70								
Male	17.6	16.8 to 18.4	23.1*	21.9 to 24.2	37.6*	36.4 to 38.8	21.7	20.4 to 23.0
Female	19.1*†	18.2 to 20.0	24.7*†	23.6 to 25.8	36.8	35.7 to 38.0	19.4*†	18.4 to 20.4
71 or older								
Male	21.9*	20.9 to 22.8	25.8*	24.3 to 27.2	36.1	34.6 to 37.5	16.3*	15.0 to 17.6
Female	21.2*	20.3 to 22.1	27.5*	26.3 to 28.6	34.7*	33.5 to 35.9	16.6*	15.6 to 17.6

* Significantly different from estimate for preceding age group of same sex (p < 0.05)
† Significantly different from estimate for males in same age group (p < 0.05)
Note: *Excludes women who were pregnant or breastfeeding.*
Source: *2004 Canadian Community Health Survey - Nutrition*

Marital breakdown and subsequent depression

Michelle Rotermann

Abstract

Objectives
This study examines the relationship between the dissolution of a marital or cohabitating relationship and subsequent depression among Canadians aged 20 to 64.

Data sources
Data are from the longitudinal component of the National Population Health Survey (1994/1995 through 2004/2005) and include the household population only.

Analytical techniques
Cross-tabulations were used to examine the association of marital dissolution with change in household income, social support, presence and number of children in the household and employment status over a two-year period. Multiple logistic regression was used to examine associations between marital dissolution and depression over a two-year period among those who had not been depressed two years earlier, while controlling for these changes. To maximize sample size, pooling of repeated observations was used.

Main results
For both sexes, dissolution of a marriage or co-habiting relationship was associated with higher odds of a new episode of depression, compared with those who remained with a spouse over the two-year period. When the influences of possible confounders were considered, the association between a break-up and depression was weakened, but persisted. Marital dissolution was more strongly associated with depression among men than among women.

Keywords
divorce, health surveys, income, longitudinal studies, common-law

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In Canada, an estimated 4 marriages in 10 will end before the couple celebrate their 30th wedding anniversary.[1] The most recent data available from the Divorce Registry show that nearly 71,000 married couples divorced in 2003;[1-3] thousands more separated.

Nationally representative cross-sectional and longitudinal studies from the United States and Europe suggest that, compared with people who remain together, those who have experienced marital breakdown are at increased risk of mental health problems.[4-11] Canadian research on the subject is more limited, and most of it is cross-sectional.[12-16]

This article uses longitudinal data from Statistics Canada's National Population Health Survey (NPHS) to examine associations between marital dissolution and subsequent depression among people aged 20 to 64 (see *Methods* and *Limitations*). Specifically, the analysis tests the hypothesis that two-year incident depression is more common among individuals who have recently experienced marital dissolution than among those who remained married. Given the prevalence of common-law unions, people who identified their marital status as "common-law" or "living with a partner" (see *Definitions*) are included as part of the study population.[17-19] Thus, in this analysis the term "marital

Data sources

The analysis of associations between the dissolution of a marriage or common-law relationship and a new episode of depression over a two-year period among those who were free of depression at baseline is based on data from the National Population Health Survey (NPHS). The NPHS, which began in 1994/1995, collects information about the health of Canadians every two years. It covers household and institutional residents in all provinces, except persons living on Indian reserves, on Canadian Forces bases, and in some remote areas.

In 1994/1995, 20,095 respondents were selected for the longitudinal panel. The response rate for this panel was 86% or 17,276 respondents. Attempts were made to re-interview them every two years. The response rates for subsequent cycles, based on these 17,276 individuals, are: 92.8% for cycle 2 (1996/1997); 88.3% for cycle 3 (1998/1999); 84.8% for cycle 4 (2000/2001); 80.5% for cycle 5 (2002/2003); and 77.4% for cycle 6 (2004/2005). This analysis uses the cycle 6 longitudinal "square" file, which contains records for all responding members of the original panel whether or not information about them was obtained in all subsequent cycles.

More detailed descriptions of the NPHS design, sample and interview procedures can be found in previously published reports.[20-22]

Analytical techniques

NPHS respondents who met the following criteria were used for this analysis: aged 20 to 64 at baseline interview; living with a partner or living common-law or married at baseline; living in a private residence (baseline and follow-up); provided complete data on the depression modules (baseline and follow-up); and were not classified as having depression (baseline).

The analysis of the association between marital dissolution and depression was based on data from cycles 1 to 6 (1994/1995 to 2004/2005) of the NPHS. For this analysis, "pooling of repeated observations," combined with logistic regression, was used. Pooling of repeated observations results in increased cell sizes for respondents who have experienced marital or cohabitating union dissolution, and thereby reduces the probability that a lack of statistical power is responsible for non-statistically significant associations.[23] Use of the design-based bootstrapping technique for repeated observations ensured that the variance was not underestimated by eliminating the problem of dependence among observations derived from the same individual.[24,25]

The analysis used five cohorts of pooled observations. Individual respondents for whom the requisite data were available were considered at baseline and follow-up in each two-year interval: 1994/1995 to 1996/1997 (cycle 1 to 2); 1996/1997 to 1998/1999 (cycle 2 to 3); 1998/1999 to 2000/2001 (cycle 3 to 4); 2000/2001 to 2002/2003 (cycle 4 to 5); 2002/2003 to 2004/05 (cycle 5 to 6). The first cycle in each of the two-cycle intervals served as the baseline, and the next cycle, the follow-up. For each baseline year, all respondents who were married or cohabiting and who had not had a major depressive episode in the

previous 12 months were selected. They were considered to have experienced a marital breakdown if, in the follow-up interview two years later, they reported that they were divorced, separated or single.

Sample sizes for respondents who were married/common-law at baseline and divorced/separated/single at follow-up, household component, National Population Health Survey, 1994/1995 to 2004/2005

Cohort	Baseline	Follow-up	Married/ Common-law (baseline)		Divorced, separated, single (follow-up)	
			Men	Women	Men	Women
1	1994/1995	1996/1997	2,439	2,865	109	104
2	1996/1997	1998/1999	2,508	2,749	111	138
3	1998/1999	2000/2001	2,325	2,548	91	118
4	2000/2001	2002/2003	2,130	2,432	85	103
5	2002/2003	2004/2005	2,011	2,298	73	92
Total			11,413	12,892	469	555

Marital status, depression and most control variables were assessed at both cycles. At the end of each two-year interval, marital status was assigned one of two values: remained married or became divorced/separated/single. Depression was dichotomously categorized as not depressed or depressed at follow-up (see *Definitions*). Each eligible respondent could contribute as many as five records. For this analysis, 7,614 respondents contributed 25,329 records; 1,037 records were excluded because of depression at baseline.

The variables entered into the multivariate model, which were selected based on the literature and availability in the NPHS, were change in household income, change in social support, change in number and/or presence of children in the household, change in employment status, history of depression, education, and age.

Preliminary analysis revealed that some characteristics of respondents who were excluded because of depression before the baseline interview differed from those of respondents who were retained in the analysis (Appendix A, Table A). For example, respondents who were excluded were slightly younger, more likely to be female, less educated, and generally less likely to be employed at baseline and follow-up. These exclusions likely weakened the observed association between marital dissolution and depression.

Weighted cross-tabulations were used to examine the association of marital dissolution with the selected control variables: change in household income, social support, presence and number of children, and employment status. Decisions to collapse certain categories of control variables were guided by the distribution of responses and by sample sizes.

The relationship between marital dissolution and two-year incident depression was examined using unadjusted and adjusted logistic regression. Unadjusted odds ratios were estimated for marital dissolution in relation to depression. Because previous research has suggested that the consequences of marital dissolution may differ between men and women,[6,9,11,14,26-28] preliminary logistic regression models were run

for depression to test for interaction effects between marital status and sex. Most of the previous studies compared results from separate sex-specific models but failed to use interaction analysis to assess the observed differences between the sexes.[23] Following interaction testing, unadjusted and adjusted odds ratios were calculated for each sex (Table 1). Before exclusions, the data were weighted to represent the target population in 1994/1995. Coefficients of variation on estimates and confidence intervals on odds ratios were calculated using the bootstrap technique, which accounts for survey design effects and dependence between observations from the same respondent.[24,32,33] Results at the $p < 0.05$ level were considered significant.

dissolution" includes the termination of these cohabiting relationships.

The end of a marriage (legal or common-law) brings other disruptive life changes, which in themselves might be detrimental to mental health. Therefore, in this analysis, several potentially confounding factors were taken into account in multivariate analyses including: changes over a two-year period in household income, social support, presence and number of children in the household, and employment status. Because depression tends to recur, history of depression, in addition to educational attainment and age, were also controlled.[5,9-11,15,16,29,30] Unadjusted odds ratios were calculated to examine the strength of the association between marital dissolution and incident depression before potential confounders were considered.

Marital dissolution and depression

Averaged over each two-year interval from 1994/1995 to 2004/2005, 4.2% of people aged 20 to 64 who had been married or living with a common-law partner at the time of their baseline NPHS interview were no longer in a relationship when they were re-interviewed two years later (see *Methods*) (data not shown).

Among married people who did not report having had symptoms of depression in the year before their baseline interview, a new depressive episode was nearly four times as common (12%) if they were separated, divorced or single at the follow-up interview, compared with those who remained in a relationship (3%) (data not shown).

Earlier studies have found sex differences in the association between marital dissolution and mental health.[27-29,31] Analysis of NPHS data indicated that men whose marriages ended were at higher risk of depression than were women. In relation to depression, the interaction term (marital dissolution*male) was statistically significant, suggesting that marital dissolution was more detrimental to the mental health of men than of women (data not shown). Because of this difference, sex-specific analyses were conducted.

Marital dissolution often sets in motion a series of stressful disruptions that create further personal and financial difficulties,[31,34] which themselves may contribute to depression. Thus, it is possible that marital dissolution is a surrogate for the other life changes that come in its wake, and that may be more directly related to incident depression. In this analysis, emphasis is placed on determining if marital dissolution is associated with depression, independent of other life changes and factors.

Women's economic well-being suffers

Financial difficulties often follow marital dissolution, as the original family income is divided between two households and economies of scale are less pertinent. Consistent with other research,[29,30,34,35] analysis of NPHS data shows that a substantially higher proportion of women than men experienced a drop in income after a break-up (even when adjusted for household size). Women who experienced marital dissolution were nearly three times as likely as their male counterparts to have a drop of at least one quintile in the ranking of their household income (Chart 1). As a result, after a break-up, women tended to live in households with an income ranking far below that of their male counterparts: men's average household income decile was 6.3, compared with 4.1 for women (decile

Chart 1
Percentage distribution of change in household income over two-year period, by sex and marital status at follow-up, household population aged 20 to 64 and married at baseline, 1994/1995 to 2004/2005, Canada excluding territories

Change in household income over 2-year period

Men ▽ **Women**

□ Separated/Divorced/Single   ■ Remained married
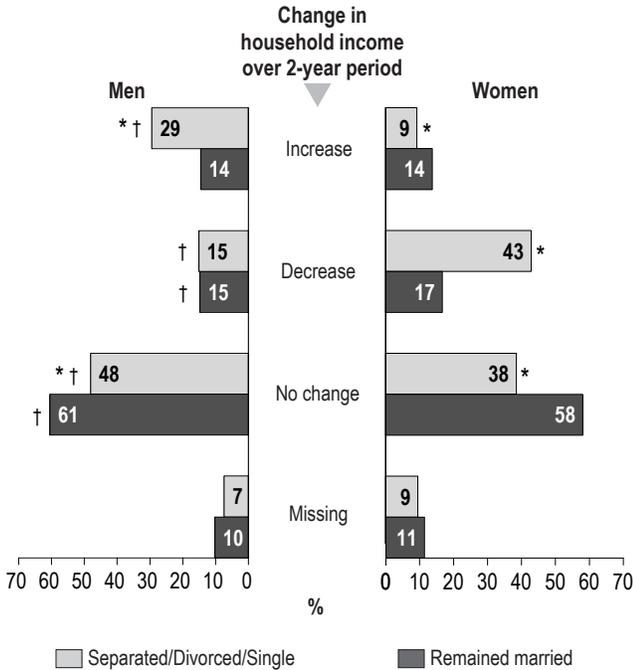
* *Significantly different from estimate for those who remained married (p < 0.05)*
† *Significantly different from corresponding category for women (p < 0.05)*
Note: *Increase/Decrease denotes at least a 20% (one-quintile) change in relative ranking of household's income over a 2-year period.*
Source: *1994/1995 to 2004/2005 National Population Health Survey, longitudinal file (square)*

1 is the bottom 10% of the household income distribution; decile 10, the highest 10%) (data not shown). Moreover, nearly 30% of recently divorced or separated men actually experienced an improvement in the ranking of their adjusted household income; the comparable figure for women was less than 10%.

Social support disrupted

Marital dissolution can change the amount of social support available to an individual. A break-up means not only the loss of a partner, but can also reduce the size of a social network by dividing extended family and mutual friends. The loss of social support may be particularly difficult for men. Many men rely solely on their partner for support, while women tend to have larger social networks.[19]

People who experienced a break-up were more likely than those who remained married to report a decline in social support between their baseline and follow-up interviews (Chart 2). Whereas 19% of men who were no longer with their spouse reported a drop in social support, the figure was 6% for those who remained in a relationship. Among women, the corresponding proportions were 11% and 5%.

Chart 2
Percentage distribution of change in social support over a two-year period, by sex and marital status at follow-up, household population aged 20 to 64 and married at baseline, 1994/1995 to 2004/2005, Canada excluding territories

Change in social support over 2-year period

Men ▽ **Women**

□ Separated/Divorced/Single   ■ Remained married
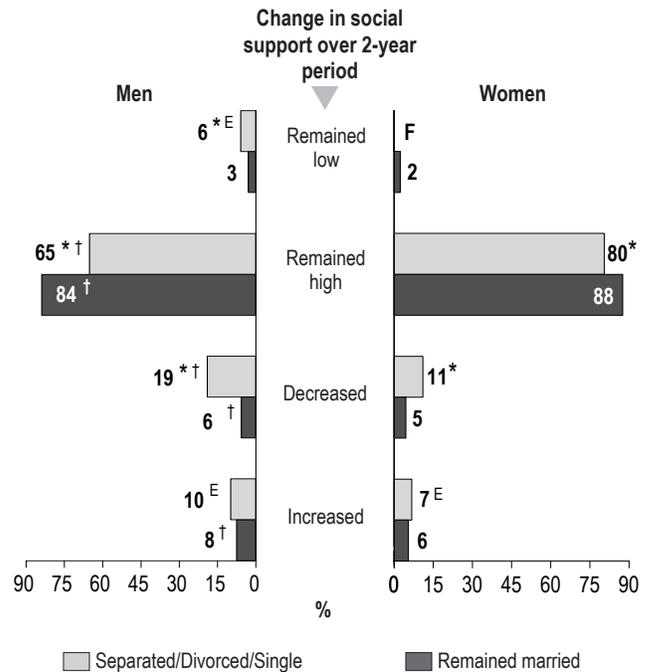
* *Significantly different from estimate for those who remained married (p < 0.05)*
† *Significantly different from corresponding category for women (p < 0.05)*
E *use with caution (coefficient of variation 16.6% to 33.3%)*
F *too unreliable to be published (coefficient of variation greater than 33.3%)*
Source: *1994/1995 to 2004/2005 National Population Health Survey, longitudinal file (square)*

Men no longer live with children

Research has suggested that loss of custody or a change in parental responsibilities is one of the most stressful aspects of post-divorce life for men.[36] According to the analysis of NPHS data, 34% of men and 3% of women whose relationship ended were residing with at least one fewer child(ren) between their baseline and follow-up interviews (Chart 3).

Employment patterns not likely to change

The breakdown of a marital relationship may mean a change in employment status, which could have some effect on mental health. However, analysis of the longitudinal NPHS data showed no statistically significant differences in employment status over the two years between married and divorced/separated men (Chart 4). Among women, differences in employment status were significant only among those who remained consistently unemployed or who were employed at both times.

Chart 3
Percentage distribution of change in number of children in household over a two-year period, by sex and marital status at follow-up, household population aged 20 to 64 and married at baseline, 1994/1995 to 2004/2005, Canada excluding territories

Chart 4
Percentage distribution of change in work status over a two-year period, by sex and marital status, household population aged 20 to 64 and married at baseline, 1994/1995 to 2004/2005, Canada excluding territories
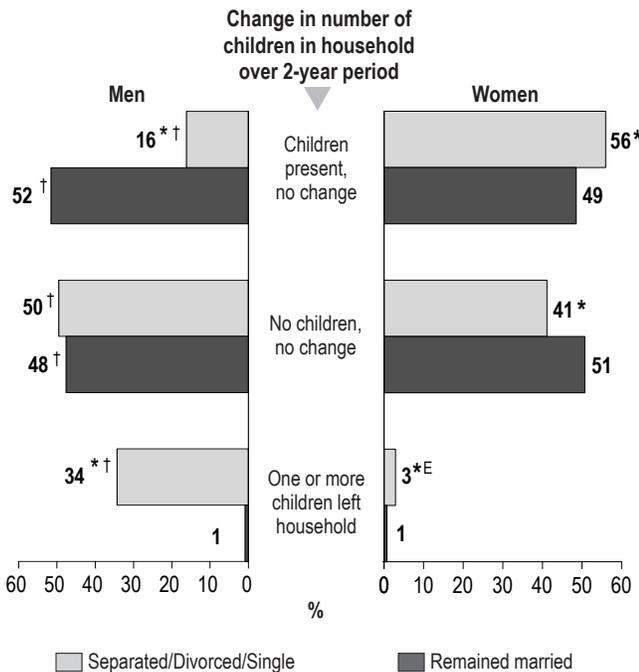
*   *Significantly different from estimate for those who remained married (p < 0.05)*
†   *Significantly different from corresponding category for women (p < 0.05)*
E   *use with caution (coefficient of variation 16.6% to 33.3%)*
Note: *A small proportion of respondents (7.2%) who had no children at baseline reported living with children at follow-up.*
Source: *1994/1995 to 2004/2005 National Population Health Survey, longitudinal file (square)*
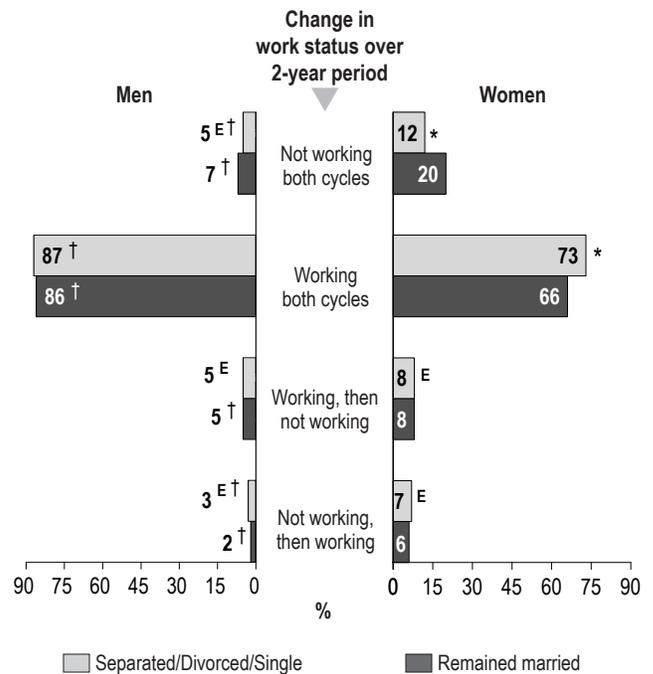
*   *Significantly different from estimate for those who remained married (p < 0.05)*
†   *Significantly different from corresponding category for women (p < 0.05)*
E   *use with caution (coefficient of variation 16.6% to 33.3%)*
Source: *1994/1995 to 2004/2005 National Population Health Survey, longitudinal file (square)*

Definitions

Depression is characterized by a depressed mood and/or lack of interest in most things, along with other symptoms, all lasting at least two weeks. These symptoms include appetite or sleep disturbance, decreased energy, difficulty concentrating, feelings of worthlessness, and/or suicidal thoughts.   The National Population Health Survey (NPHS) measures depression with a subset of questions, administered by lay interviewers, from the Composite International Diagnostic Interview.[37,38] These questions cover a cluster of symptoms for a depressive disorder, which are listed in the Diagnostic and Statistical Manual of Mental Disorders (DSM-III-R).[39]   For this article, the presence of depression refers to the 12 months before the date of the survey interview. The NPHS questionnaire is available at www.statcan.ca/cgi-bin/imdb/p2SV.pl?Function=getSurvey&SDDS=3225&lang=en&db=IMDB&dbg=f&adm=8&dis=2. Overall scores were totaled, and the results were transformed into a probability estimate of a diagnosis of depression. For this article, if the estimate was 0.9 or more (that is, a 90% likelihood of a positive diagnosis of depression, corresponding to a value of 5 or more), the respondent was considered to have experienced depression in the previous 12 months. For the algorithm and questions used to measure depression, see Appendix B.

At cycle 6 only, respondents were asked if they had ever been diagnosed with depression by a health professional, and their age at diagnosis. This information was combined and cross-referenced against the respondent's age at each baseline cycle. Respondents who had been diagnosed with depression before their age at baseline were considered to have a history of depression. Data on history of depression were missing for 14.4% of records. A missing category was included to retain as many observations as possible for the multivariate analyses. Additional analyses were done using the probability estimate of a diagnosis of depression from earlier cycles of the NPHS (data not shown). Because the association between marital dissolution and depression was virtually unchanged, this information was not included in the models.

Marital status was categorized as: remained married or experienced marital dissolution. Respondents were considered to have remained married if they reported their marital status as "married," "common-law" or "living with a partner" at baseline and again two years later. Respondents were considered to have experienced marital dissolution if they reported their marital status as "married," "common-law" or "living with a partner" at baseline, and two years later reported their marital status as "separated," "divorced" or "single." Marital status definitions were not provided to respondents.

Total *household income* from all sources in the previous 12 months was adjusted for the number of people in the household and for the low-income cutoff (LICO) specific to the household and community size. Adjusted household incomes were then grouped into deciles (10 groupings each containing one-tenth of Canadians). A two-decile (one-quintile) change in the ranking between two consecutive NPHS cycles was defined as a change in adjusted household income. Because of missing values, the change in adjusted household income could not be calculated for 10.2% of records. A missing category was included to retain as many observations as possible for the multivariate analyses.

Number of children in household was based on the number of children aged 15 or younger in the household at baseline and the number aged 17 or younger in the household at follow-up two years later. Because many older adolescents leave home for postsecondary education, the ages of youth included in this calculation were restricted. Only households in which children were reported to reside at baseline were considered to have them. Households were defined as those from which children had departed if the number of children decreased between consecutive NPHS cycles. An additional variable for no children in household at baseline was included to retain individuals without children in the analyses.

Four questions measured *social support* across all six NPHS cycles, using an abridged version of measures in the Medical Outcomes Study (MOS).[40] Respondents were asked if they had someone to confide in, to give them advice, to count on in a crisis, and to make them feel loved and cared for or to show them love and affection. In 1994/1995 and 1996/1997, the possible responses to these questions were "yes" or "no." In the remaining cycles, responses were structured on a five-point scale: "all of the time," "most of the time," "some of the time," "a little of the time," and "none of the time." Respondents who answered "no" (in 1994/1995 and 1996/1997) and "none of the time" or "a little of the time" (in subsequent cycles) to at least one of the four questions were considered to have low emotional support in that cycle. Respondents were grouped into four categories depending on their level of support and any change between cycles: support increased, support remained high, support decreased, and support remained low.

Work status was assigned one of four possible values: working at baseline and follow-up; working at baseline, but not at follow-up; not working at baseline, but working at follow-up; and not working at baseline or follow-up. Respondents who reported having a job last week and those who reported currently working were classified as working; those who did not have a job or who were permanently unable to work were considered not to have been working.

Respondents were grouped into three *education* categories based on the highest level attained at baseline: secondary graduation or less, some postsecondary and postsecondary graduation.

Age at baseline was used as a continuous variable and ranged in value from 20 to 64.

Marital breakdown independently associated with depression

Compared with men who remained married, those who underwent a break-up over a two-year period had six times the odds of reporting symptoms of depression. Among women, the unadjusted odds of two-year incident depression were three and a half times greater if their relationship ended (Table 1, unadjusted odds). When the effects of changes in income, social support, presence of children and employment status, as well as a history of depression, education and age, were taken into account, the relationship between marital dissolution and two-year incident depression remained statistically significant for both sexes, although the strength of the association was reduced (Table 1, adjusted odds). The adjusted odds of depression for men whose relationship ended were about three times those of men who remained with their spouse; for women, the adjusted odds of depression after a break-up were about two and a half times greater. The weakening of the association between marital dissolution and depression suggests that other factors that may accompany a break-up, notably

Table 1
Unadjusted and adjusted odds ratios relating marital dissolution and selected characteristics to a new episode of depression over a two-year period, by sex, household population aged 20 to 64 and married at baseline, Canada excluding territories

	Men				Women			
	Unadjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval	Unadjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval
Marital dissolution†	6.0*	4.0 to 8.8	3.3*	1.7 to 6.5	3.5*	2.4 to 4.9	2.4*	1.6 to 3.5
Household income								
Decreased			1.0	0.7 to 1.5			1.5*	1.1 to 2.1
Increased or unchanged‡			1.0	…			1.0	…
Number of children in household								
Children present, no change‡			1.0	…			1.0	…
No children, no change			0.8	0.6 to 1.2			1.3	1.0 to 1.8
One or more children left household			1.9	0.9 to 4.2			1.1	0.5 to 2.6
Social support								
Increased			0.9	0.5 to 1.6			1.7*	1.1 to 2.5
Remained high‡			1.0	…			1.0	…
Decreased			2.3*	1.3 to 3.9			2.4*	1.6 to 3.5
Remained low			2.9*	1.4 to 6.0			1.7	0.9 to 3.0
Work status								
Working at baseline and follow-up‡			1.0	…			1.0	…
Working at baseline, not at follow-up			1.7	1.0 to 3.1			1.4	1.0 to 2.0
Not working at baseline, working at follow-up			0.5	0.2 to 1.4			1.3	0.8 to 2.0
Not working at baseline or follow-up			1.1	0.7 to 1.9			1.4	1.0 to 1.9
History of depression†			5.8*	3.6 to 9.2			3.2*	2.3 to 4.3
Education								
Secondary graduation or less‡			1.0	…			1.0	…
Some postsecondary			0.7	0.4 to 1.1			0.9	0.6 to 1.3
Postsecondary graduation			0.6*	0.4 to 0.9			1.0	0.7 to 1.5
Age§			1.0*	1.0 to 1.0			1.0*	1.0 to 1.0

† Reference category is absence of characteristic. For example, reference category for "marital dissolution" is "remained married."
‡ Reference category
§ Used as a continuous variable
* Significantly different from reference category ($p < 0.05$).
... not applicable
Notes: *The adjusted model for men is based on 11,443 records (439 missing) of respondents aged 20 to 64 at baseline who did not report depression two years earlier. The adjusted model for women is based on 13,202 records (245 missing) of respondents aged 20 to 64 at baseline who did not report depression two years earlier. Missing values for change in adjusted household income and history of depression were included in models to maximize sample size; the odds ratios are not shown. A small proportion of respondents who had no children at baseline and reported living with children at follow-up (7.2%) were included in the "No children, no change" category. Because of rounding, some odds ratio with lower or upper confidence limits of 1.0 were statistically significant.*
Source: *1994/1995 to 2004/2005 National Population Health Survey, longitudinal file (square)*

Limitations

The potential for bias due to respondent attrition is problematic in longitudinal research. From one National Population Health Survey (NPHS) cycle to the next, respondents were lost for reasons such as refusal to participate, item non-response, death, institutionalization, or relocation out of country. Selective loss to follow-up, notably failure to collect information from respondents who had poorer mental health, may have weakened the observed association between marital dissolution and depression. Out of the pooled total of 27,662 respondents assessed in the baseline cycles, 2,333 (8.4%) did not respond in the follow-up cycle.

Respondents and non-respondents (unweighted sample), household population aged 20 to 64 at baseline, by two-cycle interval, National Population Health Survey, 1994/1995 to 2004/2005

	Number of respondents at baseline	Number of respondents at follow-up	Number (percentage) of respondents at baseline who became non-respondents next cycle	
1994/95 to 1996/97 (Cycle 1 to 2)	5,927	5,517	410	(6.9%)
1996/97 to 1998/99 (Cycle 2 to 3)	5,906	5,506	400	(6.8%)
1998/99 to 2000/01 (Cycle 3 to 4)	5,563	5,082	481	(8.6%)
2000/01 to 2002/03 (Cycle 4 to 5)	5,281	4,750	531	(10.1%)
2002/03 to 2004/05 (Cycle 5 to 6)	4,985	4,474	511	(10.3%)
Total	**27,662**	**25,329**	**2,333**	**(8.4%)**

The survey weights were those applied to the cycle 1 (1994/1995) data. The weights were not adjusted to account for subsequent non-response, which could have biased the estimates if continuers in the longitudinal panel differed from non-respondents according to characteristics considered in this analysis. To assess the potential effects of non-response on the results, the weighted proportions or averages of selected variables between non-respondents and respondents were compared. Statistically significant differences by respondent status emerged: non-respondents were more likely than respondents to be male and to have been in a common-law relationship (rather than legally married) at baseline (data not shown). Because of these differences, it is possible that the strength and/or magnitude of the observed associations between marital dissolution and depression in the study population were different from what they might have been if non-respondents had participated.

Information about whether respondents had ever been professionally diagnosed with depression was collected at cycle 6 only, and appended to the earlier records for the same respondent. Owing to loss to follow-up, the likelihood that this information could be appended to respondents varied by cycle: it was missing from less than 1% of records for cycle 6 (2004/2005), but 23% of records for cycle 1 (1994/1995) (data not shown).

Because NPHS interviews are conducted every two years and respondents are asked about depressive symptoms that occurred during the 12 months before the interview, those who experienced depression only in the year following their baseline interview are categorized as not having suffered from depression. Misclassifying respondents because of the one-year period would dilute the strength of the true association between marital dissolution and depression.

The NPHS does not ask respondents when marital dissolution occurred. It could be argued that knowing the precise date would not contribute substantively to the analysis, since marital breakdown is an extended process that does not occur at a single point in time. On the other hand, the point in the process at which the interview took place could influence the findings. It is also unclear if depression preceded the breakdown of the relationship or if depression followed the marital dissolution.

The definition of "remained married" required only that respondents report that they were married both at baseline and follow-up two years later, even though they might have divorced and married someone else. Such a scenario was probably rare, given the frequency of data collection (every two years).

Sample size restrictions prevented analysis of associations between the dissolution of specific types of marriages (legal versus common-law) and subsequent depression.

Household income is based on total household income, household and community size and the associated low-income cutoff (LICO). While child support and alimony are included in the calculation of total household income, such payments are not deducted from the household incomes of those who pay them. As a result, the adjusted household income of those paying support might be overestimated.

The NPHS data show an association between marital dissolution and depression; causality cannot be inferred. As well, the associations observed may result from factors not considered in this analysis such as beliefs about marriage, spousal infidelity, re-marriage, age at marriage, marriage duration, or which partner initiated the break-up.

The analyses are based on self-reported data, and the extent to which the data are biased because of reporting error is unknown.

changes in income and social support, contributed to the risk of experiencing incident depression among men and women.

For many, depression short term

For the majority of individuals who experienced depression in the post-relationship period, the passage of time was beneficial. More than three-quarters of those who had had a depressive episode in the two-year period associated with the break-up did not report another episode when they were re-interviewed after another two years had passed (that is, four years later) (data not shown).

Concluding remarks

These longitudinal results from the National Population Health Survey support the hypothesis that marital dissolution is linked to subsequent depression. This association persisted even when other events that often accompany a break-up—change in adjusted household income, change in

social support, change in number of children in household, change in work status—were taken into account, along with having a history of depression, educational attainment and age. While some of these factors were associated with an increased risk of depression, they did not completely account for it. The results are consistent with the findings of other longitudinal studies.[5,8,11,31,41]

Also, as reported in previous research,[27-29,31] the NPHS data show sex differences in the association between marital dissolution and mental health. Men who experienced a break-up were more at risk of experiencing depression than were women.

The longer-term follow-up suggests that, for the majority, depression was isolated to the period immediately surrounding the break-up. Nonetheless, depression continued to be a problem for a sizable minority four years later. Given the frequency of divorce and separation and its association with mental health problems, these findings are relevant to population health. ●

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Appendix A

Table A
Averages and proportions for selected characteristics in sample included and in sample excluded because of depression at baseline

	Included	Excluded because of depression at baseline
Experienced marital dissolution over two-year period (%)	4.0	9.5*
Age (average years)	43.2	41.1*
Male (%)	49.6	30.8*
Adjusted ratio of household income (average 0-1)†	0.18	0.17
Children present, no change (%)	49.6	50.3
No children, no change (%)	49.0	46.8
One or more children left household (%)	1.4	2.9*
Working at baseline and follow-up (%)	75.8	63.7*
Working at baseline, not at follow-up (%)	6.5	7.6
Not working at baseline, working at follow-up (%)	4.0	7.2*
Not working at baseline and follow-up (%)	13.7	21.4*
Secondary graduation or less (%)	33.1	35.2
Some postsecondary (%)	25.7	29.0
Postsecondary graduation (%)	41.1	35.8*

* *Significantly different from estimate for respondents included in study (p < 0.05)*
† *Lower ratios suggest household is in difficult financial situation because spending on necessities likely accounts for substantial proportion of income.*
Source: *1994/1995 to 2004/2005 National Population Health Survey, longitudinal file (square)*

Appendix B

Using the methodology of Kessler et al,[37] the National Population Health Survey (NPHS) measures a major depressive episode with a subset of questions from the Composite International Diagnostic Interview. These questions cover a cluster of symptoms for a *depressive disorder*, which are listed in the *Diagnostic and Statistical Manual of Mental Disorders (DSM-III-R)*.[39] The question numbers refer to those used in the mental health section of the NPHS questionnaire. There are three possible paths through these questions: "yes" to 2, then 3 to 13; "no" to 2, "yes" to 16, then 17 to 26; and "no" to 2 and "no" to 16.

2   During the past 12 months, was there ever a time when you felt sad, blue, or depressed for two weeks or more in a row?
(Yes - go to 3; No - go to 16)

16   During the past 12 months, was there ever a time lasting two weeks or more when you lost interest in most things like hobbies, work, or activities that usually give you pleasure?
(Yes - go to 17; No - end)

3/17   For the next few questions, please think of the two-week period during the past 12 months when: 3. these feelings were worst. 17. you had the most complete loss of interest in things. During that time how long did these feelings usually last?
(All day long; Most of the day; About half of the day; Less than half the day)

4/18   How often did you feel this way during those two weeks?
(Every day; Almost every day; Less often)

5   During those two weeks did you lose interest in most things?
(Yes; No)

6/19   Did you feel tired out or low on energy all of the time?
(Yes; No)

7/20   Did you gain weight, lose weight, or stay about the same?
(Gained weight; Lost weight; Stayed about the same; Was on a diet)

8/21   About how much did you gain/lose?

9/22   Did you have more trouble falling asleep than you usually do?
(Yes; No)

10/23   How often did that happen?
(Every night; Nearly every night; Less often)

11/24   Did you have a lot more trouble concentrating than usual?
(Yes; No)

12/25   At these times, people sometimes feel down on themselves, no good, or worthless. Did you feel this way?
(Yes; No)

13/26   Did you think a lot about death—either your own, someone else's, or death in general?
(Yes; No)

A value of 1 was assigned to any "yes" answer to the "yes/no" questions. For questions 8 and 21, a score of 1 was assigned if the change in weight was at least 10 pounds (4.5 kilograms). For questions 10 and 23, a score of 1 was given to respondents who reported having trouble falling asleep every night or nearly every night. Those who replied "yes" to question 2, and whose symptoms lasted all day or most of the day, and had occurred every day or almost every day, had a maximum possible score of 8. For those who responded "yes" to question 16, and whose symptoms lasted all day or most of the day, and had occurred every day or almost every day, the maximum possible was 7. Respondents who replied "no" to questions 2 and 16 scored 0.

Health matters

Short, descriptive reports,
presenting recent information
from surveys and
administrative databases

Sodium consumption at all ages *by Didier Garriguet*

Keywords: diet, dietary sodium chloride, food habits, nutrition surveys

Canadians consume a large amount of sodium. Although some sodium is needed to control blood volume and to help cells function properly,[1] most Canadians consume far more than is necessary, or recommended. Results from the 2004 Canadian Community Health Survey (CCHS)–Nutrition (see *Data source*) indicate that, among people aged 19 to 70, over 85% of men and 60% of women had sodium intakes exceeding the recommended upper

limit beyond which health risks increase (Table 1).

Most sodium is consumed as sodium chloride, usually called "table salt." In fact, a US study has estimated that 90% of sodium intake comes from sodium chloride.[2] Processed foods are the main source, accounting for 77% of average daily sodium intake. Another 12% occurs naturally in foods, and salt added during cooking (6%) or at the table (5%) makes up the remainder.[2]

Recommended sodium intake

The Institute of Medicine (IOM)[1] recommends the following "adequate intakes," or AIs, per day:
- 1,000 milligrams (mg) for children aged 1 to 3
- 1,200 mg for children aged 4 to 8
- 1,500 mg for people aged 9 to 50
- 1,300 mg for adults aged 51 to 70
- 1,200 mg for seniors over 70 years of age.

The IOM has also established a "tolerable upper intake level," or UL (see *Definitions* and *Limitations*),

Table 1

Percentage of people with usual sodium intake above the tolerable upper intake level (UL), by age group and sex, household population aged 1 or older, Canada excluding territories, 2004

Age group	% above UL	95% confidence interval	UL
1 to 3	77.1	71.6 to 82.5	1,500
4 to 8	92.7*	88.8 to 96.5	1,900
9 to 13			
Male	96.9	94.7 to 99.1	2,200
Female	83.0†	77.8 to 88.1	2,200
14 to 18			
Male	97.1	95.4 to 98.8	2,300
Female	82.0†	76.8 to 87.2	2,300
19 to 30			
Male	98.8	96.9 to 100	2,300
Female	76.3†	66.5 to 86.2	2,300
31 to 50			
Male	91.7	87.3 to 96.1	2,300
Female	72.1†	66.3 to 78.0	2,300
51 to 70			
Male	85.7	81.5 to 89.9	2,300
Female	62.3†	56.2 to 68.4	2,300
71 or older			
Male	76.9	70.0 to 83.7	2,300
Female	45.1*,†	37.6 to 52.6	2,300

* *Significantly different from estimate for preceding age group of same sex (p < 0.05)*
† *Significantly different from estimate for males in same age group (p < 0.05)*
Note: *Excludes salt added at the table or while cooking.*
Source: *2004 Canadian Community Health Survey - Nutrition*

Definitions

Adequate intake (AI) is the recommended average daily intake of a nutrient, based on observation, testing or approximate estimates of the nutritional intake of one or more groups of apparently healthy people who appear to maintain an adequate level of nutrition.

Tolerable upper intake level (UL) represents the highest continuous daily intake of a nutrient that does not appear to carry risks of adverse health effects in most members of a given group, defined by stage of life and sex. The risk of adverse effects increases as intake exceeds the UL.

These reference values were established by Canadian and American scientists, and are part of a comprehensive set of nutrient reference values.[3]

which ranges from 1,500 mg to 2,200 mg of sodium per day for children and adolescents aged 1 to 13, up to 2,300 mg per day for people aged 14 or older. Consumption exceeding these limits increases the risks of adverse health effects, especially those linked to hypertension.[1]

Dietary recall

Information on Canadians' sodium consumption was gathered as part of the 2004 CCHS–Nutrition 24-hour "dietary recall." Respondents were asked to list everything they ate or drank the day before they were interviewed for the survey (see *The questions*). Information for children younger than 6

was collected from their parents, and interviews for children aged 6 to 11 were conducted with parental help. When parents were unable to provide the details (for example, foods/beverages eaten at daycare or at school), they were asked to get as much information as possible from those who had been in charge of their child(ren). The sodium content of food was taken from Health Canada's Canadian Nutrient File 2001b, Supplement.[9]

Data source

The 2004 Canadian Community Health Survey (CCHS)–Nutrition was designed to collect information about the household population's food and nutrient intake at the national and provincial levels. It excludes members of the regular Canadian Forces, residents of the three territories, people living on Indian reserves, in institutions, or in some remote areas, as well as all residents (military and civilian) of Canadian Forces bases. Detailed descriptions of the CCHS design, sample and interview procedures are available in a published report.[4]

A total of 35,107 people completed an initial 24-hour dietary recall. A sub-sample of 10,786 people completed a second recall 3 to 10 days later. Response rates were 76.5% and 72.8%, respectively. A number of invalid and "null" recalls were excluded from the responses, as were records for breastfeeding children and children younger than 1 year of age.

The proportion of the population exceeding the tolerable upper intake level (UL) for sodium was estimated from the data collected during the two interviews using the Software for Intake Distribution program (SIDE).[5,6]

The bootstrap method, which takes into account the complex survey design, was used to estimate standard errors, coefficients of variation and confidence intervals.[7,8] The significance level was set at $p < 0.05$.

The questions

This article is based on data from the 24-hour dietary recall component of the 2004 Canadian Community Health Survey–Nutrition. Respondents were asked to list all foods and beverages consumed during the 24 hours before the day of their interview; specifically, from midnight to midnight. Interviewers used the Automated Multi-pass Method,[10,11] with a five-step approach to help respondents remember what they had had to eat/drink:

- a quick list (respondents reported all items in whatever order they wished)
- questions about specific food categories and frequently forgotten foods
- questions about the time and type of meal
- questions seeking more detailed, precise descriptions of foods/beverages and quantities consumed
- a final review

A sub-sample of the population responded to a second 24-hour recall a few days later to help assess the day-to-day variation in an individual's food/beverage intake.

People who replied "None" when asked "What type of salt do you usually add to your food at the table?" were classified as never *adding salt at the table*. Otherwise, respondents were asked how often they added salt to their food: rarely, occasionally, or very often.

Respondents were asked about certain long-term health conditions that were expected to last or had already lasted six months or more and that had been diagnosed by a health professional. Those who answered "yes" to "Do you have high blood pressure?" were defined as having *hypertension*.

All ages exceed recommended levels

In 2004, regardless of their age, Canadians' average daily intake of sodium was far beyond the recommended UL (Chart 1). Males consumed more sodium than females, with intakes above 4,000 mg/day for those aged 14 to 30. Among people aged 9 to 70, over 85% of males and between 60% to 80% of females had usual sodium intakes that surpassed the recommended UL (Table 1).

Even young children consume too much sodium. Children aged 1 to 3 averaged close to 2,000 mg a day in 2004. In this age group, 77% of children exceeded the recommended daily UL. Among 4-to 8-year-olds, daily intake averaged 2,700 mg, and 93% had consumed more than the UL. For most of these children, adding salt at the table was not contributing to the high sodium intake levels. According to the CCHS, 69% of 1- to 3-year-olds and 52% of 4- to 8-year-olds "never" added salt to their food.

By age 9, children were beginning to adopt the adult habit of adding salt to their food. From this age onwards, the percentage of people saying they "never" salted their food at the table dropped to around 30% (Table 2).

Chart 1

Average daily sodium intake (milligrams), by age group and sex, household population aged 1 or older, Canada excluding territories, 2004
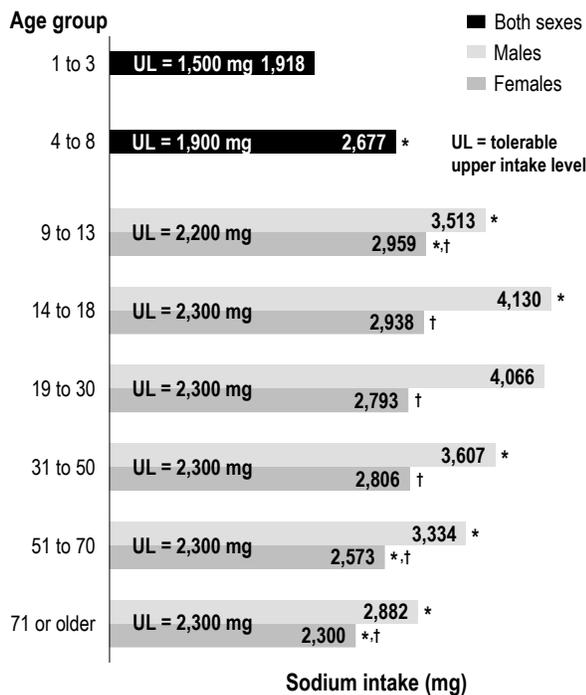
* *Significantly different from estimate for preceding age group of same sex (p < 0.05)*
† *Significantly different from estimate for males in same age group (p < 0.05)*
Note: *Excludes salt added at table or while cooking.*
Source: *2005 Canadian Community Health Survey - Nutrition*

Table 2

Percentage of people who never add salt to food at the table, by age group and sex, household population aged 1 or older, Canada excluding territories, 2004

Age group	Never add salt to food at table %	95% confidence interval
1 to 3	69	66 to 72
4 to 8	52*	49 to 55
9 to 13		
Male	37*	33 to 40
Female	35*	32 to 38
14 to 18		
Male	27*	24 to 30
Female	29*	26 to 32
19 to 30		
Male	29	26 to 33
Female	28	25 to 31
31 to 50		
Male	31	27 to 34
Female	31	28 to 34
51 to 70		
Male	31	28 to 34
Female	29	27 to 32
71 or older		
Male	31	27 to 34
Female	34*	31 to 38

* *Significantly different from estimate for preceding age group of same sex (p < 0.05)*
Source: *2004 Canadian Community Health Survey - Nutrition*

Salt and more salt

The amount of salt people added to their food was not measured by the CCHS, and it was not included in daily sodium intake. Yet it was the people who were already consuming the highest amounts of

sodium in the foods they ate who reported most frequently ("very often") adding salt (Chart 2). Respondents who said they "never" added extra salt were consuming much less sodium in a day. Even so, the percentage in this group with levels beyond the recommended UL was almost the same as that for the population as a whole (data not shown).

Chart 2
Average daily sodium intake (milligrams), by frequency of salt added at the table, household population aged 1 or older, Canada excluding territories, 2004
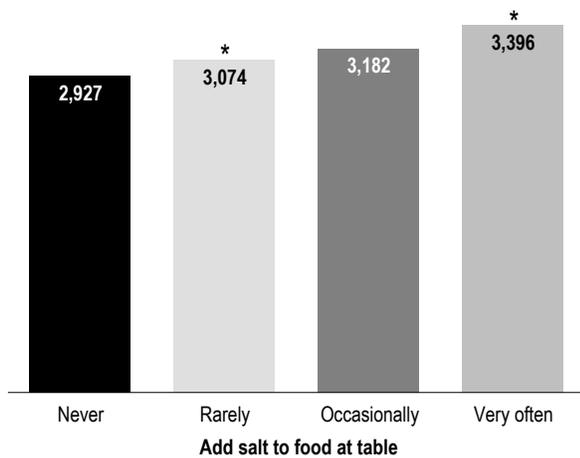
* Significantly different from estimate for preceding category (p < 0.05)
Note: *Excludes salt added at table or while cooking.*
Source: *2004 Canadian Community Health Survey - Nutrition*

Risk of hypertension

A number of studies have shown a link between sodium intake and hypertension.[1] When sodium intake rises in susceptible individuals, blood pressure tends to increase. Hypertension is usually diagnosed sometime after age 31; in the 2004 CCHS–Nutrition, 6% of 31- to 50-year-olds reported having been diagnosed with high blood pressure. For the 51-to-70 and 70-or-older age groups, the estimates rose to 27% and 47%, respectively.

The results from the CCHS question about adding salt to food at the table suggest that people aged 31 or older who had been diagnosed with hypertension seem to be aware that they should reduce their salt consumption. They were significantly less likely to report salting their food either "occasionally" or "very often" (Chart 3).

Although it may be more visible, salt added at the table actually accounts for only a small amount (5%) of daily sodium intake.[2] When the source of sodium was less obvious because it was already in the food, the intake of adults with hypertension was similar to that of people without the condition (data not shown). Excluding added salt, the usual sodium intake of adults with hypertension was well above the recommended UL.

Increased sodium intake has been linked with high blood pressure, but increased potassium intake can help reduce blood pressure.[1] However, the CCHS results indicate that Canadians' potassium intake, regardless of age and sex, is lower than recommended (data not shown).

Chart 3
Percentage of people who reported adding salt to food at the table, by frequency and high blood pressure status, household population aged 31 or older, Canada excluding territories, 2004
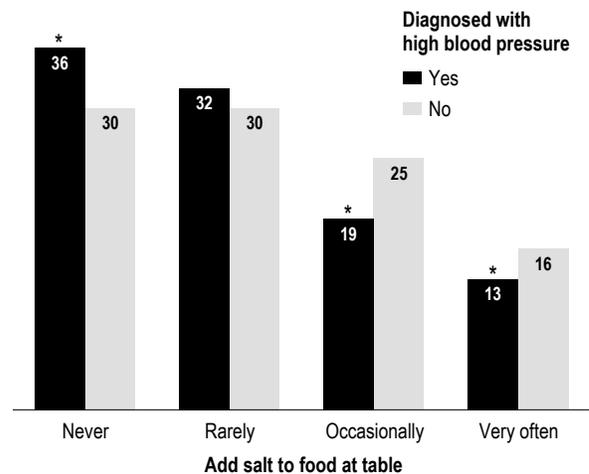
* Significantly different from estimate for no diagnosed high blood pressure (p < 0.05)
Source: *2004 Canadian Community Health Survey - Nutrition*

Provincial differences

Sodium consumption exceeds the recommended levels throughout the country, but two provinces stand out. In Quebec and British Columbia, the 2004 average daily intake for residents aged 1 or older was more than 3,300 mg versus 3,092 mg for Canadians overall. In Ontario, the only province where average daily sodium consumption was significantly below the Canadian figure, average intake was 2,871 mg (Chart 4)—still above the recommended daily UL. Provincial differences did not change when the sexes were considered separately (data not shown). (The CCHS–Nutrition did not cover the three territories.)

Limitations

The recommended daily intakes for sodium are based on moderately active people and do not apply to everyone.[1] For example, individuals who participate in intense physical activity need more sodium because of losses through sweat. However, the 2004 Canadian Community Health Survey–Nutrition did not ask respondents about their activity level, so differences in sodium consumption by level of physical activity could not be examined.

The amount of salt added at the table or during cooking is likely less than that reported by a US study, which found that all participants added salt at the table and when cooking.[2] In addition, the study was conducted in the United States and may differ from the Canadian reality.

The estimated prevalence of hypertension for 2004 was based on self-reports of a diagnosed condition. Some people may have had hypertension but were not yet aware of it, so they would not have changed their salt consumption in response to a diagnosis of hypertension.

Although the salt content of recipes could not be adjusted based on how often salt was added to cooking, there was no difference by hypertension status in the frequency with which salt was added. Moreover, the proportion of sodium intake from salt added during cooking is relatively low,[2] and only 15% of respondents reported never adding salt when cooking.

Chart 4
Average daily sodium intake (milligrams), by province, household population aged 1 or older, Canada excluding territories, 2004

Province	Sodium intake (mg)
Que.	3,350 *
B.C.	3,300 *
N.B.	3,183
Sask.	3,181
N.S.	3,115
Man.	3,089
Alta.	3,041
P.E.I.	3,023
N.L.	2,994
Ont.	2,871 *

Canada (3,092 mg)

Sodium intake (mg)
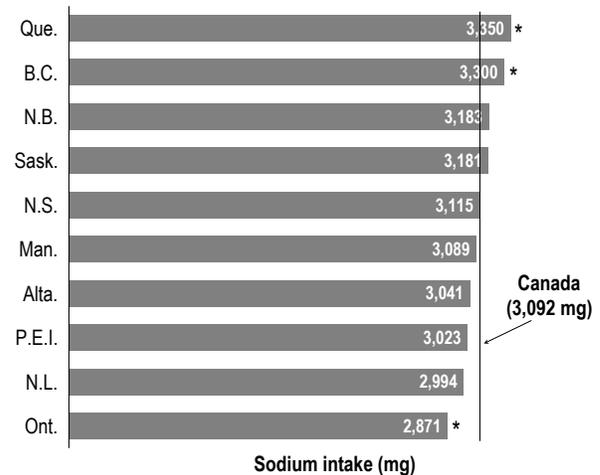
* *Significantly different from estimate for Canada (p < 0.05)*
Note: *Excludes salt added at the table or while cooking.*
Source: *2004 Canadian Community Health Survey - Nutrition*

The Canadian diet–10 main sources of sodium

Results from the 2004 CCHS–Nutrition indicate that the following 10 groupings of foods/beverages accounted for over half (55%) of all sodium that Canadians consumed:

	% of total sodium intake
Pizza, sandwiches, submarines, hamburgers and hotdogs	19.1
Soups	7.4
Pasta	5.7
Liquid milk and milk-based beverages	4.0
Poultry and poultry dishes	3.8
Potatoes	3.4
Cheese	3.2
Cereals	3.0
Beef	3.0
Sauces	2.9

Slightly below US intake

A comparison of estimates based on the 2004 CCHS and results based on the 2001-2002 National Health and Nutrition Examination Survey (NHANES) in the United States[12] indicates that Canadians consume slightly less sodium than do Americans. Canadian levels were lower for children aged 1 to 8, men aged 31 to 70, and women aged 19 to 30. No Canada–US differences were observed for the other groups (Table 3).

These differences may have been slightly greater if the Canadian and US surveys had made the same adjustments when processing their data. The US approach adjusted the salt content of recipes downward, based on the frequency with which salt is added to foods during cooking, but the CCHS did not do so.

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Table 3

Average daily sodium intake (milligrams), by age group and sex, Canada excluding territories, 2004 and United States, 2001-2002

Age group	Canada (mg)	United States (mg)
1 to 3	1,918*	2,140
4 to 8	2,677*	2,831
9 to 13		
Male	3,513	3,549
Female	2,959	2,806
14 to 18		
Male	4,130	4,086
Female	2,938	2,799
19 to 30		
Male	4,066	4,141
Female	2,793*	3,098
31 to 50		
Male	3,607*	4,252
Female	2,806	3,011
51 to 70		
Male	3,334*	3,645
Female	2,573	2,652
71 or older		
Male	2,882	3,051
Female	2,300	2,404

* *Significantly different from estimate for United States (p < 0.05)*
Note: *Excludes salt added at the table or while cooking.*
Sources: *2004 Canadian Community Health Survey - Nutrition; 2001-2002 NHANES - What We Eat in America*

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