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## Article

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## Abstract

### Objectives

Based on a representative sample of the Canadian population, this article quantifies the bias resulting from the use of self-reported rather than directly measured height, weight and body mass index (BMI).

### Methods

The analysis is based on 4,567 respondents to the 2005 Canadian Community Health Survey (CCHS) who, during a face-to-face interview, provided self-reported values for height and weight and were then measured by trained interviewers.

### Results

On average, males over-reported their height by 1 cm, and females, by 0.5 cm. Females under-reported their weight by an average of 2.5 kg; males, by 1.8 kg. Reporting bias in weight was strongly associated with measured BMI category. Under-reporting of weight was high among people who were overweight, and particularly high among those who were obese, compared with people of normal weight. When based on measured rather than on self-reported values, the prevalence of obesity was 9 percentage points higher among males and 6 points higher among females.

### Keywords

body mass index, measurement error, misclassification, obesity, self-report, sensitivity and specificity, validity

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Population health surveys often base estimates of the prevalence of obesity on calculations of body mass index (BMI), which is a measure of weight in relation to height. Since the mid-1990s, Statistics Canada's two major health surveys, the Canadian Community Health Survey (CCHS) and the National Population Health Survey (NPHS), have generally relied on respondents to report their weight and height and used these data to estimate BMI.

A recent systematic review of the literature substantiated the existence of a bias associated with self-reported weight and height data.<sup>1</sup> Most studies have found that self-reports underestimate weight and overestimate height. Therefore, estimates of the prevalence of obesity based on self-reports tend to be lower than those based on measured data. As well, some evidence indicates that associations between obesity and morbidity differ depending on whether BMI is calculated with self-reported or measured data.<sup>2,3</sup>

In 2005, the CCHS collected both self-reported and measured height and weight from a subsample of respondents. Using these data, this study documents the magnitude of the bias that exists for the Canadian population when height, weight and BMI are based on self-reports rather than on physical measures. Factors associated with reporting error are examined.

## Methods

### Data source

Data are from the 2005 CCHS. The CCHS covers the population aged 12 years or older living in private households. It excludes residents of Indian reserves, of institutions, and of some remote areas; full-time members of the Canadian Armed Forces; and civilian residents of military bases. Interviews for the 2005 CCHS were conducted between January and December of that year. The response rate was 79%, yielding a sample of 132,947 respondents.

Three sampling frames were used to select the sample of households for the 2005 CCHS: 49% of households came from an area frame; 50% from a list frame of telephone numbers; and the remaining 1%, from a Random Digit Dialing (RDD) sampling frame. Because of cost considerations, measured height and weight were collected for only a subsample (“subsample 2”) of respondents, all of whom were from the area frame. Residents of the territories were not included in this subsample.

In total, 7,376 CCHS respondents were selected for subsample 2. Measured height and weight were obtained for 4,735 of them. The main reason for non-response was refusal. Because measured height and weight were recorded for only 64% of the selected respondents in subsample 2, an adjustment was made to minimize non-response bias. A special sampling weight was created by redistributing the sampling weights of non-respondents to respondents, using response propensity classes. The variables used to create these classes were: region (British Columbia, Prairies, Ontario, Quebec, Atlantic provinces), age, sex, household size, marital status, rural/urban indicator, and quarter of collection.

Of the 4,735 respondents for whom measured height and weight were collected, 125 were excluded from this analysis because self-reported height or weight was missing, and 43 women were excluded because they were pregnant at the time of the survey. This left 4,567 respondents.

A detailed description of the CCHS methodology is available in a published report.<sup>4</sup>

### Analytical techniques

The bias associated with using self-reported data for weight, height and BMI was estimated by calculating the difference between measured and self-reported values (measured minus self-reported). A positive difference indicates under-reporting, and a negative difference, over-reporting. Respondents whose measured minus self-reported value was five or more standard deviations from the mean were considered outliers and dropped from the analysis (28 records were dropped for weight, 30 for height, and 32 for BMI).

Because the validity of self-reported data differs between the sexes,<sup>5-9</sup> separate analyses were conducted for males and females. To identify factors associated with reporting bias, differences between measured and self-reported values were examined in relation to: age, household income, immigrant status, leisure-time physical activity level, and measured weight, height and BMI. Multiple linear regression models were used to determine which factors were independently associated with the bias.

Respondents were classified into BMI categories (see Definitions). The degree of misclassification that resulted from using self-reports to estimate the prevalence of the various BMI categories was assessed by calculating sensitivity and specificity. Sensitivity is the percent of true positives, and specificity, the percent of true negatives. For example, for obesity (BMI 30 kg/m<sup>2</sup> or more), sensitivity is the percentage of respondents classified as obese based on self-reported values among those classified as obese based on measured values; in other words, the percentage of obese respondents who reported themselves as such. Specificity is the percentage of respondents classified as not obese (BMI less than 30 kg/m<sup>2</sup>) based on self-reported values among those who were not obese based on measured values; that is, the percentage of respondents who reported that they were not obese and among those who actually were not obese.

All estimates were weighted to represent the household population aged 12 years or older in 2005 (using the weight created to adjust for non-response to measured height and weight in subsample 2). To

account for the survey design effect of the CCHS, standard errors, coefficients of variation, and 95% confidence intervals were estimated using the bootstrap technique.<sup>10-12</sup> Differences between estimates were tested for statistical significance, which was established at the 0.05 level.

## Definitions

*Self-reported height and weight* were collected with the questions:

- “How tall are you without shoes on?” Categories for height in feet and inches were listed on the questionnaire, with corresponding metric values in brackets. Interviewers were instructed to round up to the closest inch for respondents who reported half-inch measures.
- “How much do you weigh?” If asked, interviewers told respondents to report weight without clothing. After reporting their weight, respondents were asked if they had reported in pounds or kilograms. Most respondents (94%) reported in pounds.

The majority of respondents (73% of males and 67% of females) reported values for their weight that ended in 0 or 5, although it would be expected that by chance only about 20% of respondents would have end-digits of 0 or 5 (10% for each value). This *end-digit preference* is another factor that was examined in relation to reporting bias.

CCHS interviewers were trained to measure the height and weight of respondents. Height was measured to the nearest 0.5 cm, and weight, to the nearest 0.1 kg. Calibrated scales (ProFit UC-321 made by Lifesource) and measuring tapes were used to ensure accuracy and consistency. The interview lasted about 50 minutes—respondents were asked their height and weight near the beginning, and measurements were taken close to the end.

*Body mass index (BMI)* is a measure of weight adjusted for height. In this analysis, BMI was derived from both measured and self-reported values. BMI is calculated by dividing weight in kilograms by the square of height in metres. Based on Canadian guidelines,<sup>13</sup> which are in line with those of the World Health Organization,<sup>14</sup> BMI for adults is classified into six categories:

Category	BMI kg/m <sup>2</sup> range
Underweight	(BMI less than 18.5)
Normal weight	(BMI 18.5 to 24.9)
Overweight	(BMI 25.0 to 29.9)
Obese class I	(BMI 30.0 to 34.9)
Obese class II	(BMI 35.0 to 39.9)
Obese class III	(BMI 40.0 or more)

For adults aged 18 or older, respondents were assigned to *height* and *weight quartiles* based on weighted distributions. Separate quartile cut-points were established for men and women.

The International Obesity TaskForce (IOTF) has recommended that overweight and obesity among children and adolescents be determined by extrapolating the adult cut-points of 25 kg/m<sup>2</sup> for overweight and 30 kg/m<sup>2</sup> for obese to create sex- and age-specific values.<sup>15</sup> In this analysis, 12- to 17-year-olds were classified as *normal weight*, *overweight* or *obese* based on these IOTF criteria; all obese adolescents were assigned to obese class I.

*Immigrants* were defined as those who were born outside of Canada and were not Canadian citizens by birth. Immigrant respondents were categorized into two groups according to length of residence in Canada: 0 to 10 years, and 11 or more years.

*Leisure-time physical activity level* was based on total energy expenditure (EE) during leisure time. EE was calculated from the reported frequency and duration of all of a respondent's leisure-time physical activities in the three months before the 2005 CCHS interview and the metabolic energy demand (MET value) of each activity, which was independently established.<sup>16</sup>

$EE = \sum(N_i * D_i * MET_i / 365 \text{ days})$  where

$N_i$  = number of occasions of activity  $i$  in a year,

$D_i$  = average duration in hours of activity  $i$ , and

$MET_i$  = a constant value for the metabolic energy cost of activity  $i$ .

An EE of 3 or more kilocalories per kilogram per day (KKD) was defined as *active*; 1.5 to 2.9 KKD, *moderately active*; and less than 1.5 KKD, *inactive*.

*Household income* groups were derived by calculating the ratio between the total household income from all sources in the previous 12 months and Statistics Canada's low-income cutoff (LICO) specific to the number of people in the household, the size of the community, and the survey year. These adjusted income ratios were grouped into deciles (10 groups,

each containing one-tenth of Canadians). Household income was missing for 253 records (8%) on the analysis file. To maximize sample sizes, a category for missing income values was created and included in the regression analysis.

## Results

### Height

On average, self-reported height was 0.7 cm more than measured height (Table 1). Males over-reported their height by an average of 1 cm, compared with 0.5 cm for females.

The tendency to over-report height increased with age, particularly among seniors (Table 2). Men and women aged 65 to 79 years over-reported by 2.3 and 1.6 cm, respectively, and those aged 80 years or older, by 2.6 and 3.3 cm.

The shortest people (those whose measured height placed them in the lowest quartile of the distribution) were the least accurate: males in this group over-reported their height by an average of 2.3 cm, and females, by 1.9 cm. There was no significant difference between measured and self-

reported height for males in the highest quartile (tallest), and for females in the two highest quartiles.

Over-reporting of height varied by measured BMI. For people in the normal weight category, self-reported and measured height did not differ, but those who were overweight or obese tended to over-report. Discrepancies were pronounced among people in obese class III, with males over-reporting their height by an average of 2.1 cm, and females, by 2.8 cm.

Multiple linear regression was used to identify variables associated with differences between self-reported and measured height. Measured height, measured weight and age were independently associated with differences for both sexes (Appendix Table A). In general, height was over-reported. Therefore, positive regression coefficients (for example, height) signal a reduction in this over-reporting bias, and negative coefficients (for example, weight), an increase in the bias. Associations between height discrepancies and household income, immigrant status and physical activity in the univariate analysis did not persist in the multivariate analysis.

**Table 1**  
Mean height, weight and body mass index (BMI), by collection method and sex, household population aged 12 years or older, Canada excluding territories, 2005

	Sample size	Collection method		Difference	
		Measured	Self-reported	Measured minus self-reported	95% confidence interval
<b>Mean height (cm)</b>					
Both sexes	4,537	168.3	169.0*	-0.7	-0.9 to -0.6
Males	2,108	174.8	175.8*	-1.0	-1.2 to -0.8
Females	2,429	161.8	162.3*	-0.5†	-0.7 to -0.3
<b>Mean weight (kg)</b>					
Total	4,539	74.9	72.8*	2.1	2.0 to 2.3
Males	2,112	81.9	80.1*	1.8	1.6 to 2.0
Females	2,427	67.9	65.4*	2.5†	2.2 to 2.7
<b>Mean BMI (kg/m<sup>2</sup>)</b>					
Both sexes	4,535	26.4	25.3*	1.1	1.0 to 1.1
Males	2,113	26.8	25.8*	0.9	0.8 to 1.0
Females	2,422	26.0	24.8*	1.2†	1.1 to 1.3

\* significantly different from estimate for measured ( $p < 0.05$ )

† significantly different from estimate for males ( $p < 0.05$ )

Source: 2005 Canadian Community Health Survey (subsample 2).

**Table 2**  
**Mean height (cm) and mean difference between measured and self-reported height (cm), by selected characteristics, household population aged 12 years or older, Canada excluding territories, 2005**

	Males					Females				
	Sample size	Mean height		Mean difference		Sample size	Mean height		Mean difference	
		Measured	Self-reported	Measured minus self-reported	95% confidence interval		Measured	Self-reported	Measured minus self-reported	95% confidence interval
<b>Total</b>	2,108	174.8	175.8*	-1.0	-1.2 to -0.8	2,429	161.8	162.3*	-0.5	-0.7 to -0.3
<b>Age group</b>										
12 to 24 years	435	174.0	174.4	-0.3 <sup>†</sup>	-0.7 to 0.1	435	162.8	162.6	0.3 <sup>†</sup>	-0.2 to 0.7
25 to 44 years	684	176.0	176.8*	-0.7	-1.1 to -0.4	735	163.3	163.5	-0.2	-0.5 to 0.0
45 to 64 years <sup>†</sup>	589	174.9	176.0*	-1.1	-1.5 to -0.7	673	161.9	162.3*	-0.4	-0.8 to 0.0
65 to 79 years	325	172.6	174.9*	-2.3 <sup>†</sup>	-2.9 to -1.7	426	158.0	159.6*	-1.6 <sup>†</sup>	-2.0 to -1.1
80 years or older	75	171.2	173.9*	-2.6 <sup>†</sup>	-3.7 to -1.5	160	154.7	157.9*	-3.3 <sup>†</sup>	-4.2 to -2.4
<b>Household income decile</b>										
1 to 3 (lowest)	582	173.3	174.5*	-1.2	-1.7 to -0.7	893	159.9	160.8*	-0.9 <sup>†</sup>	-1.3 to -0.5
4 to 7 <sup>†</sup>	795	174.7	175.5*	-0.8	-1.2 to -0.4	815	162.1	162.4	-0.3	-0.6 to 0.1
8 to 10 (highest)	588	175.9	177.1*	-1.1	-1.4 to -0.8	513	163.8	164.1*	-0.3	-0.7 to 0.0
<b>Immigrant status</b>										
Immigrant (0 to 10 years in Canada)	90	173.9	174.8	-0.9	-1.8 to 0.0	103	159.2	159.9*	-0.7	-1.3 to 0.0
Immigrant (11 or more years in Canada)	303	172.7	174.2*	-1.5 <sup>†</sup>	-2.1 to -1.0	332	160.7	161.9*	-1.1 <sup>†</sup>	-1.8 to -0.5
Canadian-born <sup>†</sup>	1,713	175.3	176.2*	-0.9	-1.1 to -0.6	1,994	162.2	162.5*	-0.4	-0.6 to -0.1
<b>Leisure-time physical activity level</b>										
Active	562	174.3	175.2*	-0.9	-1.3 to -0.5	483	163.6	163.7	-0.1 <sup>†</sup>	-0.5 to 0.3
Moderate	548	175.7	176.5*	-0.9	-1.3 to -0.5	615	162.3	162.8*	-0.5	-0.9 to -0.1
Inactive <sup>†</sup>	998	174.6	175.7*	-1.1	-1.4 to -0.7	1,331	160.9	161.5*	-0.6	-0.9 to -0.4
<b>Measured height quartile for age 18 or older (cm)</b>										
1 (lowest)	507	166.0	168.3*	-2.3 <sup>†</sup>	-2.8 to -1.9	660	153.0	154.9*	-1.9 <sup>†</sup>	-2.3 to -1.5
2 <sup>†</sup>	474	172.9	174.2*	-1.3	-1.6 to -0.9	569	159.7	160.1*	-0.5	-0.8 to -0.1
3	466	177.8	178.7*	-0.9	-1.3 to -0.6	560	164.4	164.6	-0.2	-0.5 to 0.1
4 (highest)	438	184.9	184.5	0.4 <sup>†</sup>	-0.1 to 1.0	430	171.6	171.2	0.4 <sup>†</sup>	-0.1 to 0.9
<b>Measured BMI category (range kg/m<sup>2</sup>)</b>										
Underweight (less than 18.5)	19	175.6	173.9	1.7	-1.0 to 4.4	62	162.4	162.9	-0.5	-1.4 to 0.5
Normal weight (18.5 to 24.9) <sup>†</sup>	750	174.9	175.0	-0.1	-0.4 to 0.2	1,133	162.7	162.7	0.0	-0.3 to 0.2
Overweight (25.0 to 29.9)	851	174.9	176.2*	-1.3 <sup>†</sup>	-1.6 to -1.0	696	161.1	161.9*	-0.8 <sup>†</sup>	-1.2 to -0.4
Obese class I (30.0 to 34.9)	382	174.4	176.2*	-1.8 <sup>†</sup>	-2.4 to -1.3	339	160.8	161.7*	-0.8 <sup>†</sup>	-1.3 to -0.4
Obese class II (35.0 to 39.9)	84	175.2	176.9*	-1.7 <sup>†</sup>	-3.0 to -0.4	129	159.7	161.1*	-1.4 <sup>†</sup>	-2.3 to -0.5
Obese class III (40.0 or more)	22	173.3	175.4*	-2.1 <sup>†</sup>	-3.9 to -0.3	70	159.5	162.3*	-2.8 <sup>†</sup>	-4.7 to -0.9

\* significantly different from estimate for measured ( $p < 0.05$ )

<sup>†</sup> reference category

<sup>‡</sup> significantly different from estimate for reference category ( $p < 0.05$ )

Source: 2005 Canadian Community Health Survey (subsample 2).

## Weight

Self-reported weight was, on average, 2.1 kg less than measured weight. The bias was greater among females, who under-reported by an average of 2.5 kg, compared with 1.8 kg for males.

Females in all four measured weight quartiles under-reported their weight, with the difference rising from an average of 0.6 kg for those in the lowest quartile to 5.1 kg for those in the highest (Table 3). The self-reported and measured weight

of males in the lowest quartile did not differ. Males in the remaining quartiles under-reported, with the difference rising from 1.1 kg for those in the second quartile to 4.1 kg for those in the highest.

End-digit preference (reporting a weight ending in 0 or 5) was associated with under-reporting for females, but not for males. Females with an end-digit preference tended to round their weight down, whereas males were as likely to round up as to round down.

**Table 3**  
**Mean weight (kg) and mean difference between measured and self-reported weight (kg), by selected characteristics, household population aged 12 years or older, Canada excluding territories, 2005**

	Males					Females				
	Sample size	Mean weight		Mean difference		Sample size	Mean weight		Mean difference	
		Measured	Self-reported	Measured minus self-reported	95% confidence interval		Measured	Self-reported	Measured minus self-reported	95% confidence interval
<b>Total</b>	2,112	81.9	80.1*	1.8	1.6 to 2.0	2,427	67.9	65.4*	2.5	2.2 to 2.7
<b>Age group</b>										
12 to 24 years	433	70.6	69.4*	1.2 <sup>†</sup>	0.8 to 1.6	435	60.4	58.6*	1.7 <sup>†</sup>	1.4 to 2.1
25 to 44 years	690	83.5	81.9*	1.5 <sup>†</sup>	1.1 to 1.9	730	67.9	65.6*	2.3 <sup>†</sup>	1.9 to 2.6
45 to 64 years <sup>†</sup>	589	87.2	84.8*	2.4	1.8 to 2.9	673	72.6	69.5*	3.1	2.6 to 3.6
65 to 79 years	325	84.3	81.8*	2.5	2.0 to 3.0	428	68.9	66.2*	2.7	1.8 to 3.6
80 years or older	75	75.0	74.0*	1.0 <sup>†</sup>	0.0 to 1.9	161	62.9	61.0*	1.8 <sup>†</sup>	1.1 to 2.6
<b>Household income decile</b>										
1 to 3 (lowest)	586	79.2	77.5*	1.7	1.2 to 2.2	898	67.5	65.2*	2.3	1.9 to 2.7
4 to 7 <sup>†</sup>	795	81.4	79.7*	1.6	1.3 to 2.0	815	68.5	65.9*	2.6	2.3 to 2.9
8 to 10 (highest)	588	85.8	83.6*	2.2	1.8 to 2.6	507	68.9	66.2*	2.7	2.2 to 3.2
<b>Immigrant status</b>										
Immigrant (0 to 10 years in Canada)	91	76.0	75.6	0.3 <sup>†</sup>	-1.0 to 1.7	102	59.6	58.0*	1.7 <sup>†</sup>	1.0 to 2.4
Immigrant (11 or more years in Canada)	304	81.2	79.2*	1.9	1.3 to 2.5	334	68.3	65.6*	2.7	2.1 to 3.3
Canadian-born <sup>†</sup>	1,715	82.6	80.7*	1.9	1.7 to 2.2	1,991	68.4	65.9*	2.5	2.2 to 2.7
<b>Leisure-time physical activity level</b>										
Active	562	78.3	76.5*	1.8	1.3 to 2.2	480	65.4	62.7*	2.7	2.3 to 3.1
Moderate	549	82.2	80.4*	1.8	1.4 to 2.2	615	65.0	62.8*	2.1	1.8 to 2.5
Inactive <sup>†</sup>	1,001	83.5	81.7*	1.8	1.5 to 2.2	1,332	69.9	67.4*	2.5	2.2 to 2.8
<b>Measured weight quartile for age 18 or older (kg)</b>										
1 (lowest)	497	66.5	66.5	0.0 <sup>†</sup>	-0.5 to 0.5	564	52.5	51.9*	0.6 <sup>†</sup>	0.4 to 0.9
2 <sup>†</sup>	466	77.8	76.7*	1.1	0.6 to 1.6	550	61.6	59.9*	1.7	1.4 to 2.0
3	479	86.8	84.8*	2.0 <sup>†</sup>	1.7 to 2.4	582	71.1	68.4*	2.7 <sup>†</sup>	2.4 to 3.1
4 (highest)	450	103.5	99.4*	4.1 <sup>†</sup>	3.6 to 4.7	522	90.8	85.7*	5.1 <sup>†</sup>	4.4 to 5.8
<b>End-digit preference for weight</b>										
Yes	1,533	82.5	80.7*	1.8	1.6 to 2.1	1,630	69.7	66.9*	2.8 <sup>†</sup>	2.5 to 3.1
No <sup>†</sup>	579	80.2	78.4*	1.8	1.3 to 2.2	797	64.3	62.5*	1.8	1.5 to 2.0
<b>Measured BMI category (range kg/m<sup>2</sup>)</b>										
Underweight (less than 18.5)	18	52.2	59.1*	-6.9 <sup>†</sup>	-12.8 to -1.0	60	46.7	47.5	-0.7 <sup>†</sup>	-2.0 to 0.5
Normal weight (18.5 to 24.9) <sup>†</sup>	751	68.5	68.2	0.3	0.0 to 0.6	1,132	57.8	56.5*	1.3	1.1 to 1.5
Overweight (25.0 to 29.9)	853	83.3	81.4*	1.9 <sup>†</sup>	1.6 to 2.2	701	70.5	67.6*	2.9 <sup>†</sup>	2.5 to 3.3
Obese class I (30.0 to 34.9)	382	97.2	93.5*	3.8 <sup>†</sup>	3.2 to 4.3	339	83.0	79.1*	3.9 <sup>†</sup>	3.2 to 4.6
Obese class II (35.0 to 39.9)	85	112.6	106.5*	6.2 <sup>†</sup>	4.9 to 7.5	131	94.4	88.5*	5.9 <sup>†</sup>	4.1 to 7.7
Obese class III (40.0 or more)	23	118.5	113.5*	5.0 <sup>†</sup>	2.7 to 7.4	64	118.2	109.6*	8.6 <sup>†</sup>	6.0 to 11.1

\* significantly different from estimate for measured ( $p < 0.05$ )

<sup>†</sup> reference category

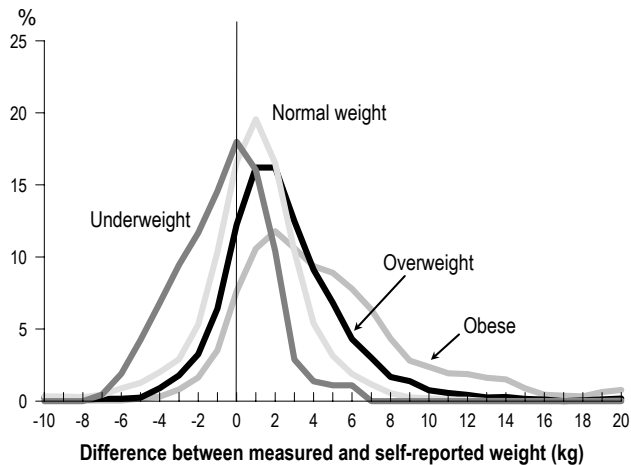
<sup>‡</sup> significantly different from estimate for reference category ( $p < 0.05$ )

Source: 2005 Canadian Community Health Survey (subsample 2).

Differences between self-reported and measured weight were strongly associated with measured BMI. Underweight males over-reported their weight by an average of 6.9 kg. Self-reported and measured weight did not differ significantly for males in the normal weight range, but those who were overweight or obese tended to under-report, with the greatest

difference among the obese. For underweight females, self-reported and measured weight were not significantly different. Females in the normal, overweight and obese categories all under-reported, with discrepancies increasing at successively heavier BMI categories.

**Figure 1**  
**Percentage distribution of difference<sup>†</sup> between measured and self-reported weight (kg), by measured BMI category, household population aged 12 years or older, Canada excluding territories, 2005**



<sup>†</sup> measured minus self-reported

Source: 2005 Canadian Community Health Survey (subsample 2).

When differences between self-reported and measured weight are displayed graphically (Figure 1), the increase in bias associated with BMI category is evident. As BMI moves from underweight to obese, the distribution of average differences shifts to the right of zero, showing that the extent of under-reporting rises with BMI.

In the multivariate analysis, the strongest predictor of a difference between self-reported and measured weight was measured weight (Appendix Table B), as evidenced by the standardized regression coefficients. In this case, the positive value of the regression coefficient for weight indicated an increase in the bias. The negative regression coefficient for measured height for males shows that as measured height increased, under-reporting of weight decreased. For females, an association with leisure-time physical activity level emerged—active females were slightly more likely to under-report their weight. Age and immigrant status were significant in the univariate analysis, but these associations did not persist in the multivariate analysis.

### Body mass index

BMI based on self-reported height and weight was, on average, 1.1 kg/m<sup>2</sup> less than BMI based on measured values. Underestimation occurred for both sexes, but was slightly greater for females (1.2 kg/m<sup>2</sup>) than for males (0.9 kg/m<sup>2</sup>).

The extent of the difference between BMI based on self-reported rather than on measured height and weight was strongly associated with measured BMI (Table 4). For underweight males, BMI based on self-reported values was overestimated, and for underweight females, BMI based on self-reported and measured values did not differ significantly. For all other BMI categories, self-reported BMI underestimated measured BMI, with the degree of underestimation increasing with successively higher BMIs. For obese class III, underestimation was, on average, 4.0 kg/m<sup>2</sup> among males, and 5.0 kg/m<sup>2</sup> among females.

In the multivariate analysis, the strongest predictors of BMI differences were measured weight and height (Appendix Table C). There was also a weak association with age. Among females, an association with leisure-time physical activity level emerged: underestimation of BMI was slightly greater among active and moderately active females, compared with inactive females.

### Misclassification of BMI categories

The degree of misclassification that results when BMI categories are based on self-reported height and weight was assessed by calculating sensitivity and specificity (Table 5).

Sensitivity was high for those who, according to measured height and weight, were in the normal weight category. That is, 95% of males and 93% for females whose measured height and weight put them in the normal weight BMI category were correctly placed in this category based on their self-reported height and weight. For people who were overweight, sensitivity fell to 70% among males and to 63% among females. Sensitivity was low for males and females who were obese: 51% and 54% for those in obese class I, and 45% and 57% for those



**Table 4**  
**Mean body mass index (BMI kg/m<sup>2</sup>) and mean difference between measured and self-reported BMI, by selected characteristics, household population aged 12 years or older, Canada excluding territories, 2005**

	Males					Females				
	Sample size	Mean BMI		Mean difference		Sample size	Mean BMI		Mean difference	
		Measured	Self-reported	Measured minus self-reported	95% confidence interval		Measured	Self-reported	Measured minus self-reported	95% confidence interval
<b>Total</b>	2,113	26.8	25.8*	0.9	0.8 to 1.0	2,422	26.0	24.8*	1.2	1.1 to 1.3
<b>Age group</b>										
12 to 24 years	436	23.2	22.6*	0.6 <sup>†</sup>	0.4 to 0.8	437	22.8	22.0*	0.8 <sup>†</sup>	0.5 to 1.1
25 to 44 years	688	26.9	26.2*	0.8 <sup>†</sup>	0.6 to 0.9	730	25.5	24.6*	0.9 <sup>†</sup>	0.8 to 1.1
45 to 64 years <sup>†</sup>	589	28.5	27.3*	1.1	0.9 to 1.4	668	27.8	26.4*	1.4	1.1 to 1.7
65 to 79 years	325	28.3	26.7*	1.6 <sup>†</sup>	1.3 to 1.9	426	27.6	26.0*	1.6	1.3 to 2.0
80 years or older	75	25.5	24.4*	1.1	0.7 to 1.4	161	26.3	24.5*	1.9	1.4 to 2.4
<b>Household income decile</b>										
1 to 3 (lowest)	587	26.4	25.4*	1.0	0.8 to 1.3	893	26.5	25.2*	1.3	1.0 to 1.5
4 to 7 <sup>†</sup>	795	26.6	25.7*	0.8	0.7 to 1.0	815	26.1	25.0*	1.1	0.9 to 1.3
8 to 10 (highest)	588	27.6	26.6*	1.1	0.9 to 1.2	508	25.7	24.5*	1.2	0.9 to 1.4
<b>Immigrant status</b>										
Immigrant: (0 to 10 years in Canada)	91	25.2	24.7	0.5	-0.1 to 1.0	102	23.5	22.6*	0.9	0.6 to 1.1
Immigrant (11 or more years in Canada)	304	27.2	26.1*	1.1	0.9 to 1.3	333	26.5	25.0*	1.5	1.1 to 1.8
Canadian-born <sup>†</sup>	1,716	26.8	25.9*	1.0	0.8 to 1.1	1,987	26.1	25.0*	1.1	1.0 to 1.3
<b>Leisure-time physical activity level</b>										
Active	562	25.6	24.8*	0.9	0.7 to 1.1	478	24.5	23.4*	1.1	0.9 to 1.3
Moderate	550	26.6	25.7*	0.9	0.7 to 1.1	614	24.7	23.7*	1.0 <sup>†</sup>	0.9 to 1.2
Inactive <sup>†</sup>	1,001	27.4	26.4*	1.0	0.8 to 1.2	1,330	27.0	25.8*	1.3	1.1 to 1.5
<b>End-digit preference for weight</b>										
Yes	1,533	26.9	25.9*	1.0	0.9 to 1.1	1,628	26.6	25.3*	1.3 <sup>†</sup>	1.1 to 1.5
No <sup>†</sup>	580	26.5	25.6*	0.9	0.6 to 1.1	794	24.7	23.8*	0.9	0.8 to 1.0
<b>Measured BMI category (range kg/m<sup>2</sup>)</b>										
Underweight (less than 18.5)	18	16.9	19.5*	-2.6 <sup>†</sup>	-4.9 to -0.4	60	17.6	17.8	-0.2 <sup>†</sup>	-0.6 to 0.2
Normal weight (18.5 to 24.9) <sup>†</sup>	751	22.3	22.1*	0.1	0.0 to 0.3	1,132	21.8	21.3*	0.5	0.4 to 0.6
Overweight (25.0 to 29.9)	853	27.2	26.2*	1.0 <sup>†</sup>	0.9 to 1.2	701	27.1	25.7*	1.4 <sup>†</sup>	1.2 to 1.6
Obese class I (30.0 to 34.9)	383	31.9	30.0*	1.9 <sup>†</sup>	1.6 to 2.2	341	32.1	30.1*	2.1 <sup>†</sup>	1.7 to 2.5
Obese class II (35.0 to 39.9)	85	36.7	34.0*	2.7 <sup>†</sup>	2.2 to 3.3	131	37.1	34.1*	3.0 <sup>†</sup>	2.1 to 3.8
Obese class III (40.0 or more)	23	41.6	37.6*	4.0 <sup>†</sup>	2.7 to 5.3	57	47.3	42.4*	5.0 <sup>†</sup>	3.0 to 6.9

\* significantly different from estimate for measured ( $p < 0.05$ )

<sup>†</sup> reference category

<sup>‡</sup> significantly different from estimate for reference category ( $p < 0.05$ )

Source: 2005 Canadian Community Health Survey (subsample 2).

in obese class II/III. Among people who were underweight, sensitivity was particularly low for males at 40%, but higher for females at 78%.

For the obese category overall (BMI 30 kg/m<sup>2</sup> or more), sensitivity was 63%, and was somewhat higher for females than for males (Table 6). Sensitivity was particularly low for seniors.

Specificity was very high (more than 95%) for the obese categories, indicating that very few respondents reported height and weight that put them in the obese category unless they really were obese.

**Table 5**  
**Self-reported body mass index (BMI) category, by measured BMI category and sex, household population aged 12 years or older, Canada excluding territories, 2005**

	Measured BMI category (range kg/m <sup>2</sup> )									
	Underweight (less than 18.5)		Normal weight (18.5 to 24.9)		Overweight (25.0 to 29.9)		Obese class I (30.0 to 34.9)		Obese class II/III (35 or more)	
	'000	%	'000	%	'000	%	'000	%	'000	%
<b>Self-reported BMI category (range kg/m<sup>2</sup>)</b>										
<b>Both sexes</b>	<b>402</b>	<b>100</b>	<b>10,859</b>	<b>100</b>	<b>8,746</b>	<b>100</b>	<b>4,288</b>	<b>100</b>	<b>1,562</b>	<b>100</b>
Underweight (less than 18.5)	271	67	308	3	1	0	6	0	0	0
Normal weight (18.5 to 24.9)	131	33	10,163	94	2,651	30	120	3	4	0
Overweight (25.0 to 29.9)	0	0	388	4	5,851	67	1,894	44	134	9
Obese class I (30.0 to 34.9)	0	0	0	0	244	3	2,247	52	603	39
Obese class II/III (35.0 or more)	0	0	0	0	0	0	22	1	822	53
<b>Sensitivity</b>										
% true positives (95% confidence interval)	67 (53 to 82)		94 (92 to 95)		67 (63 to 71)		52 (46 to 58)		53 (44 to 62)	
<b>Specificity</b>										
% true negatives (95% confidence interval)	99 (98 to 99)		81 (78 to 83)		86 (84 to 88)		96 (95 to 97)		100 (100 to 100)	
<b>Males</b>	<b>110</b>	<b>100</b>	<b>4,620</b>	<b>100</b>	<b>5,130</b>	<b>100</b>	<b>2,595</b>	<b>100</b>	<b>556</b>	<b>100</b>
Underweight (less than 18.5)	44	40	43	1	0	0	6	0	0	0
Normal weight (18.5 to 24.9)	66	60	4,374	95	1,387	27	37	1	0	0
Overweight (25.0 to 29.9)	0	0	203	4	3,584	70	1,208	47	56	10
Obese class I (30.0 to 34.9)	0	0	0	0	159	3	1,325	51	248	45
Obese class II/III (35.0 or more)	0	0	0	0	0	0	20	1	252	45
<b>Sensitivity</b>										
% true positives (95% confidence interval)	40 (8 to 71)		95 (93 to 97)		70 (65 to 75)		51 (43 to 59)		45 (32 to 59)	
<b>Specificity</b>										
% true negatives (95% confidence interval)	100 (99 to 100)		82 (79 to 85)		81 (78 to 84)		96 (95 to 98)		100 (100 to 100)	
<b>Females</b>	<b>293</b>	<b>100</b>	<b>6,238</b>	<b>100</b>	<b>3,617</b>	<b>100</b>	<b>1,693</b>	<b>100</b>	<b>1,006</b>	<b>100</b>
Underweight (less than 18.5)	227	78	265	4	1	0	0	0	0	0
Normal weight (18.5 to 24.9)	65	22	5,789	93	1,265	35	83	5	4	0
Overweight (25.0 to 29.9)	0	0	185	3	2,267	63	686	41	78	8
Obese class I (30.0 to 34.9)	0	0	0	0	85	2	922	54	355	35
Obese class II/III (35 or more)	0	0	0	0	0	0	2	0	570	57
<b>Sensitivity</b>										
% true positives (95% confidence interval)	78 (63 to 92)		93 (90 to 95)		63 (57 to 68)		54 (46 to 63)		57 (45 to 68)	
<b>Specificity</b>										
% true negatives (95% confidence interval)	98 (97 to 99)		79 (75 to 82)		90 (88 to 92)		96 (95 to 97)		100 (100 to 100)	

Source: 2005 Canadian Community Health Survey (subsample 2).

**Table 6**  
**Accuracy of classification of obesity (BMI 30 kg/m<sup>2</sup> or more) based on self-reported weight and height, by sex and age group, household population aged 12 years or older, Canada excluding territories, 2005**

	Sensitivity (% true positives)			Specificity (% true negatives)		
	Both sexes	Males	Females	Both sexes	Males	Females
	<b>Total</b>	<b>63.1</b>	<b>58.5</b>	<b>68.5</b>	<b>98.8</b>	<b>98.4</b>
<b>Age group</b>						
12 to 24 years	56.6	47.1	66.6	99.0	99.8	98.2
25 to 44 years <sup>†</sup>	70.0	67.8	73.0	98.7	98.0	99.4
45 to 64 years	63.8	56.7	72.4	98.3	97.1	99.4
65 years or older	52.5*	49.9*	55.0*	99.7	99.7	99.8

<sup>†</sup> reference category

\* significantly different from estimate for reference category ( $p < 0.05$ )

Source: 2005 Canadian Community Health Survey (subsample 2).

### Prevalence of obesity

Prevalence estimates of BMI categories differed substantially when calculated with measured rather than self-reported height and weight (Table 7). The prevalence of obesity based on measured data was 7 percentage points higher than the estimate based on self-reported data (22.6% versus 15.2%). Among males, the prevalence was 9 percentage points higher, and among females, 6 percentage points higher.

Differences were particularly pronounced among people aged 65 years or older (Figure 2). For elderly men, the estimate of obesity based on measured values was 15 percentage points higher than the estimate based on self-reported values, and for elderly women, 13 percentage points higher.

**Table 7**  
Body mass index (BMI) prevalence distribution, by collection method and sex, household population aged 12 years or older, Canada excluding territories, 2005

BMI category (range kg/m <sup>2</sup> )	Collection method		Percentage point difference	
	Measured	Self-reported	Measured minus self-reported	95% confidence interval
	%			
<b>Both sexes</b>				
Obese (30.0 or more)	22.6	15.2*	7.4	6.0 to 8.8
Overweight/Obese (25.0 or more)	56.5	47.2*	9.3	7.8 to 10.7
Underweight (less than 18.5)	1.6	2.3*	-0.7	-1.2 to -0.2
Normal weight (18.5 to 24.9)	42.0	50.5*	-8.5	-10.0 to -7.1
Overweight (25.0 to 29.9)	33.8	32.0	1.9	-0.1 to 3.8
Obese class I (30.0 to 34.9)	16.6	12.0*	4.6	3.2 to 6.1
Obese class II/III (35.0 or more)	6.0	3.3*	2.8	2.1 to 3.4
<b>Males</b>				
Obese (30.0 or more)	24.2	15.4*	8.8	6.7 to 11.0
Overweight/Obese (25.0 or more)	63.6	54.2*	9.4	7.5 to 11.4
Underweight (less than 18.5)	0.8 <sup>E</sup>	0.7 <sup>E</sup>	0.1	-0.4 to 0.6
Normal weight (18.5 to 24.9)	35.5	45.1*	-9.6	-11.6 to -7.5
Overweight (25.0 to 29.9)	39.4	38.8	0.6	-2.4 to 3.6
Obese class I (30.0 to 34.9)	19.9	13.3*	6.6	4.3 to 8.9
Obese class II/III (35.0 or more)	4.3	2.1 <sup>E*</sup>	2.2	1.4 to 3.0
<b>Females</b>				
Obese (30.0 or more)	21.0	15.0*	6.0	4.4 to 7.5
Overweight/Obese (25.0 or more)	49.2	40.1*	9.1	6.9 to 11.3
Underweight (less than 18.5)	2.3 <sup>E</sup>	3.8*	-1.6	-2.4 to -0.7
Normal weight (18.5 to 24.9)	48.6	56.1*	-7.5	-9.9 to -5.2
Overweight (25.0 to 29.9)	28.2	25.0*	3.1	0.7 to 5.6
Obese class I (30.0 to 34.9)	13.2	10.6*	2.6	0.9 to 4.3
Obese class II/III (35.0 or more)	7.8	4.4*	3.4	2.4 to 4.4

\* significantly different from estimate for measured (p < 0.05)

<sup>E</sup> use with caution (coefficient of variation 16.6% to 33.3%)

Source: 2005 Canadian Community Health Survey (subsample 2).

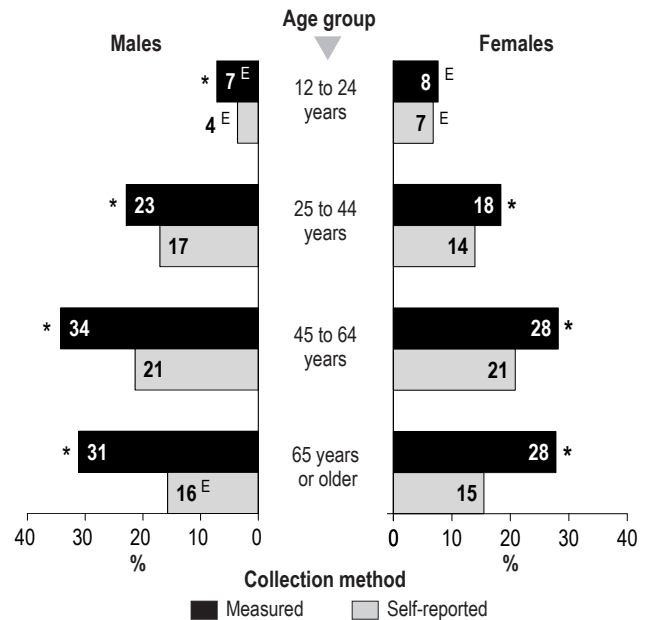
## Discussion

This is the first nationally representative study to compare self-reported and measured height, weight and BMI for the Canadian population. Consistent with other research,<sup>1</sup> systematic errors emerged, with height over-reported, and weight under-reported.

As in other studies,<sup>5,7,8,17,18</sup> over-reporting of height rose with age for both sexes and was substantial at age 65 years or older. Loss of stature commonly occurs among seniors as a result of aging-related processes such as osteoporosis and loss of muscle tone,<sup>19</sup> and they may report their height as it was in earlier years.

The degree of under-reporting of weight in the 2005 CCHS was greater than in studies based on

**Figure 2**  
Percentage obese (BMI 30 kg/m<sup>2</sup> or more), by collection method, sex and age group, household population aged 12 years or older, Canada excluding territories, 2005



\* significantly higher than estimate for same sex based on self-reported values (p < 0.05)

<sup>E</sup> use with caution (coefficient of variation 16.6% to 33.3%)

Source: 2005 Canadian Community Health Survey (subsample 2).

population health surveys conducted in the past in other countries, including the United States,<sup>5,20,21</sup> England,<sup>22,23</sup> Scotland,<sup>24</sup> Wales,<sup>7</sup> Spain,<sup>17</sup> New Zealand,<sup>18</sup> Mexico,<sup>25</sup> Finland,<sup>26</sup> and Brazil.<sup>27</sup> Most of the data for these studies were collected at least 10 years ago.

As well, for Canada, two decades ago, self-reported weight from the 1985 Health Promotion Survey was compared with measured weight from the 1981 Canada Fitness Survey.<sup>28</sup> For those aged 20 to 69 years, males' average weight did not differ between the two surveys, and for females, average weight based on measured values was actually 0.6 kg lower than that based on self-reports. These results are similar to findings from a contemporaneous American study,<sup>29</sup> and indicate that the reporting bias for weight has increased in the intervening years.

In recent years, the percentage of Canadians with excess weight has risen considerably,<sup>30,31</sup> mirroring

a worldwide trend.<sup>32</sup> Because the extent to which weight is under-reported increases with BMI, the greater overall bias may reflect the higher percentages of Canadians in the overweight and obese categories in 2005. Another possibility is the stigma associated with obesity. The increasing prevalence of obesity does not seem to have made excess weight more acceptable, and some evidence suggests that the stigma is intensifying.<sup>33</sup> This may also explain the greater tendency to under-report weight among females, who may feel more pressure to conform to “desirable” standards.<sup>34</sup>

### Limitations

For various reasons, measured height and weight were obtained for only 64% of the respondents who were selected for the physical measures component (subsample 2) of the CCHS. A special sampling weight was created to minimize the non-response bias associated with factors such as age, sex and region of the country (see Data source). Nonetheless, estimates of obesity based on measured values could still be biased if the height and weight of non-respondents differed systematically from the height and weight of those for whom measured data were obtained. However, because self-reported height and weight were collected for both respondents and non-respondents to the physical measures, it was possible to partially evaluate the extent of this bias by comparing obesity estimates based on these self-reported data. Among all respondents selected for the physical measures, the prevalence of obesity based on self-reported values was 15.9% (Appendix Table D). The prevalence was substantially higher among non-respondents than among those whose height and weight were measured (19.1% versus 14.0%), indicating that heavier people were less likely to agree to be measured. But when the special sampling weight was applied to respondents to the physical measures, the prevalence of obesity based on self-reported data was 15.2%, fairly close to the estimate for all respondents selected for physical measures.

Some of the bias associated with under-reporting weight may be due to clothing. Respondents were weighed fully clothed, but people may weigh

themselves at home with minimal or no clothing, and if asked, interviewers told respondents to report their weight without clothing.

Some of the bias associated with over-reporting height may be due to rounding. Interviewers were instructed to round up to the nearest inch for respondents who reported half-inch values, while for the measurement component, height was measured to the nearest 0.5 cm.

A number of other studies have been designed to ensure participants were unaware that measurements would be taken,<sup>2,18</sup> because it is believed that if respondents know they are going to be measured, they may report more accurate values. Although CCHS interviewers were not instructed to ensure that respondents in subsample 2 did not know that they would be measured, this did not seem to have affected the self-reported values—there were no differences between the average self-reported height and weight of respondents from the area frame who were selected to be measured and those who were not.

Although measured height and weight were considered “true” values, some factors may have limited their accuracy. Trained Statistics Canada interviewers measured the height and weight of respondents; measures taken by health technicians, as have been used in other studies, may be more accurate.<sup>5,29</sup> The Statistics Canada interviewers used identically calibrated scales and measuring tapes, but validity and reliability studies to assess inter- and intra-interviewer accuracy and reproducibility were not performed. Stadiometers might have provided more accurate measures of height than measuring tapes.

Finally, this study compares measured height and weight with self-reported values obtained in face-to-face interviews. Self-reports from face-to-face interviews may yield higher prevalence estimates of obesity than do data collected by telephone.<sup>35</sup> Even so, the estimate of obesity based on self-reports for the sample from the telephone frame was only one percentage point lower than the estimate for subsample 2, which was based on self-reported data from interviews conducted in person.

### Why is this study important?

- For fiscal and logistical reasons, self-reported height and weight data are collected in the large-scale health surveys conducted by Statistics Canada.
- It is important to document the extent to which the use of self-reported data biases estimates of overweight and obesity, and to identify factors associated with reporting error.

### What else is known on this topic?

- The majority of studies have found that self-reports underestimate weight and overestimate height, resulting in lower estimates of the prevalence of obesity, compared with estimates based on measured data.

### What does this study add?

- In 2005, the estimate of the prevalence of obesity based on measured data was 7 percentage points higher than the estimate based on self-reported data: 22.6% versus 15.2%.
- The degree of underestimation of weight in the 2005 CCHS was greater than that reported by other studies based on population health surveys conducted in the past in various countries.
- Over-reporting of height and under-reporting of weight increased with rising levels of BMI.

### Conclusion

For fiscal and logistical reasons, the collection of self-reported height and weight data will continue in large-scale health surveys conducted by Statistics Canada. As this study reveals, this practice yields biased values for height and weight, which result in substantial misclassification of the population by BMI category. The prevalence of obesity based on

measured data was 7 percentage points higher than the estimate based on self-reported data (22.6% versus 15.2%).

The implications of this study are relevant to policy-makers, researchers and data users. Until now, trends in the prevalence of obesity in Canada have generally been based on self-reports, but the use of such data means that the accuracy of estimates and true changes in prevalence over time are unknown.

As well, the results raise the question of whether associations between BMI and obesity-related health conditions are distorted when BMI is derived from self-reported data. It is often suggested that underestimating the prevalence of obesity may *diminish* associations between obesity and health outcomes. However, a second study, also based on 2005 CCHS data,<sup>36</sup> found that associations between obesity-related conditions and overweight and obesity were *exaggerated* when BMI was based on self-reported rather than measured data. To correct the bias, researchers may wish to consider adjusting self-reported values or lowering BMI cut-points for the overweight and obese categories.

Finally, it will be important to measure the magnitude of the bias periodically to see if it changes over time. In 2007, Statistics Canada launched the Canadian Health Measures Survey (CHMS), the most comprehensive national survey using physical measurements ever conducted in Canada. The CHMS data will provide the opportunity for further analysis of the bias resulting from using self-reported measures in estimating the prevalence of obesity. As well, the data set will be used to study measured BMI in comparison with other anthropometric measures such as waist and hip circumference and skinfold measurements. ●

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## Appendix

**Table A**  
Regression coefficients relating selected characteristics to difference<sup>†</sup> between measured and self-reported height (cm), household population aged 12 years or older, Canada excluding territories, 2005

	Males			Females		
	Regression coefficient (B)	95% confidence interval	Standardized regression coefficient (beta)	Regression coefficient (B)	95% confidence interval	Standardized regression coefficient (beta)
<b>Age group</b>						
12 to 24 years	0.17	-0.48 to 0.82	0.02	0.15	-0.43 to 0.74	0.02
25 to 44 years	0.02	-0.54 to 0.58	0.00	-0.14	-0.62 to 0.33	-0.02
45 to 64 years <sup>‡</sup>	...	...	...	...	...	...
65 to 79 years	-0.99*	-1.68 to -0.29	-0.09	-0.75*	-1.29 to -0.22	-0.07
80 years or older	-1.55*	-2.71 to -0.39	-0.06	-2.08*	-2.98 to -1.18	-0.13
<b>Household income decile</b>						
1 to 3 (lowest)	-0.14	-0.64 to 0.36	-0.02	-0.16	-0.62 to 0.30	-0.02
4 to 7 <sup>‡</sup>	...	...	...	...	...	...
8 to 10 (highest)	-0.34	-0.85 to 0.18	-0.04	-0.34	-0.80 to 0.11	-0.04
<b>Immigrant status</b>						
Immigrant (0 to 10 years in Canada)	-0.22	-1.10 to 0.66	-0.02	-0.35	-1.01 to 0.31	-0.03
Immigrant (11 or more years in Canada)	-0.18	-0.73 to 0.38	-0.02	-0.43	-1.01 to 0.15	-0.05
Canadian-born <sup>‡</sup>	...	...	...	...	...	...
<b>Leisure-time physical activity level</b>						
Active	-0.10	-0.61 to 0.41	-0.01	-0.10	-0.56 to 0.36	-0.01
Moderate	-0.05	-0.51 to 0.42	-0.01	-0.31	-0.76 to 0.13	-0.04
Inactive <sup>‡</sup>	...	...	...	...	...	...
<b>Measured height (cm)</b>	0.16*	0.12 to 0.19	0.38	0.14*	0.10 to 0.18	0.32
<b>Measured weight (kg)</b>	-0.05*	-0.06 to -0.03	-0.22	-0.03*	-0.05 to -0.02	-0.15
<b>Intercept</b>	-24.24			-20.86		
<b>Model information</b>						
R <sup>2</sup>	0.14			0.15		
Sample size	2,106			2,429		

<sup>†</sup> measured minus self-reported

<sup>‡</sup> reference category

\* significantly different from estimate for reference category or from 0 for continuous variables ( $p < 0.05$ )

... not applicable

Source: 2005 Canadian Community Health Survey (subsample 2).

Table B

Regression coefficients relating selected characteristics to difference<sup>†</sup> between measured and self-reported weight (kg), household population aged 12 years or older, Canada excluding territories, 2005

	Males			Females		
	Regression coefficient (B)	95% confidence interval	Standardized regression coefficient (beta)	Regression coefficient (B)	95% confidence interval	Standardized regression coefficient (beta)
<b>Age group</b>						
12 to 24 years	0.81	-0.03 to 1.66	0.08	-0.04	-0.64 to 0.56	0.00
25 to 44 years	-0.21	-0.87 to 0.45	-0.03	-0.33	-0.89 to 0.22	-0.04
45 to 64 years <sup>‡</sup>	...	...	...	...	...	...
65 to 79 years	0.25	-0.43 to 0.93	0.02	0.07	-0.92 to 1.06	0.01
80 years or older	-0.26	-1.28 to 0.77	-0.01	-0.15	-0.95 to 0.64	-0.01
<b>Household income decile</b>						
1 to 3 (lowest)	0.31	-0.26 to 0.87	0.03	-0.24	-0.69 to 0.21	-0.03
4 to 7 <sup>‡</sup>	...	...	...	...	...	...
8 to 10 (highest)	0.12	-0.40 to 0.64	0.01	0.08	-0.51 to 0.66	0.01
<b>Immigrant status</b>						
Immigrant (0 to 10 years in Canada)	-0.88	-2.05 to 0.29	-0.06	0.45	-0.27 to 1.17	0.03
Immigrant (11 or more years in Canada)	0.05	-0.61 to 0.72	0.01	0.22	-0.36 to 0.79	0.02
Canadian-born <sup>‡</sup>	...	...	...	...	...	...
<b>Leisure-time physical activity level</b>						
Active	0.31	-0.20 to 0.83	0.04	0.79*	0.32 to 1.25	0.08
Moderate	0.09	-0.41 to 0.59	0.01	0.25	-0.13 to 0.63	0.03
Inactive <sup>‡</sup>	...	...	...	...	...	...
<b>End-digit preference for weight</b>						
Yes	-0.18	-0.63 to 0.28	-0.02	0.47*	0.15 to 0.78	0.06
No <sup>‡</sup>	...	...	...	...	...	...
<b>Measured weight (kg)</b>	0.13*	0.10 to 0.15	0.52	0.11*	0.09 to 0.14	0.50
<b>Measured height (cm)</b>	-0.09*	-0.13 to -0.05	-0.20	-0.03	-0.05 to 0.00	-0.06
<b>Intercept</b>	6.91			-1.48		
<b>Model information</b>						
R <sup>2</sup>	0.20			0.25		
Sample size	2,110			2,427		

<sup>†</sup> measured minus self-reported

<sup>‡</sup> reference category

\* significantly different from estimate for reference category or from 0 for continuous variables (p < 0.05)

... not applicable

Source: 2005 Canadian Community Health Survey (subsample 2).



Table C

Regression coefficients relating selected characteristics to difference<sup>†</sup> between measured and self-reported body mass index (BMI kg/m<sup>2</sup>), household population aged 12 years or older, Canada excluding territories, 2005

	Males			Females		
	Regression coefficient (B)	95% confidence interval	Standardized regression coefficient (beta)	Regression coefficient (B)	95% confidence interval	Standardized regression coefficient (beta)
<b>Age group</b>						
12 to 24 years	0.38*	0.01 to 0.74	0.09	0.19	-0.22 to 0.61	0.04
25 to 44 years	-0.01	-0.29 to 0.28	0.00	-0.07	-0.34 to 0.20	-0.02
45 to 64 years <sup>‡</sup>	...	...	...	...	...	...
65 to 79 years	0.41*	0.06 to 0.75	0.07	0.21	-0.21 to 0.63	0.03
80 years or older	0.29	-0.14 to 0.73	0.02	0.57*	0.07 to 1.07	0.06
<b>Household income decile</b>						
1 to 3 (lowest)	0.17	-0.06 to 0.40	0.04	-0.01	-0.26 to 0.25	0.00
4 to 7 <sup>‡</sup>	...	...	...	...	...	...
8 to 10 (highest)	0.11	-0.12 to 0.33	0.03	0.17	-0.15 to 0.49	0.04
<b>Immigrant status</b>						
Immigrant (0 to 10 years in Canada)	-0.20	-0.63 to 0.22	-0.03	0.22	-0.10 to 0.54	0.03
Immigrant (11 or more years in Canada)	0.00	-0.26 to 0.27	0.00	0.21	-0.05 to 0.47	0.04
Canadian-born <sup>‡</sup>	...	...	...	...	...	...
<b>Leisure-time physical activity level</b>						
Active	0.10	-0.12 to 0.32	0.03	0.31*	0.06 to 0.56	0.06
Moderate	0.09	-0.14 to 0.32	0.02	0.19*	0.01 to 0.38	0.04
Inactive <sup>‡</sup>	...	...	...	...	...	...
<b>End-digit preference for weight</b>						
Yes	0.09	-0.12 to 0.29	0.02	0.11	-0.04 to 0.27	0.03
No <sup>‡</sup>	...	...	...	...	...	...
<b>Measured weight (kg)</b>	0.06*	0.05 to 0.07	0.57	0.06*	0.05 to 0.08	0.52
<b>Measured height (cm)</b>	-0.10*	-0.12 to -0.09	-0.48	-0.08*	-0.10 to -0.06	-0.31
<b>Intercept</b>	+13.33			9.64		
<b>Model information</b>						
R <sup>2</sup>	0.29			0.28		
Sample size	2,111			2,422		

<sup>†</sup> measured minus self-reported

<sup>‡</sup> reference category

\* significantly different from estimate for reference category or from 0 for continuous variables (p < 0.05)

... not applicable

Source: 2005 Canadian Community Health Survey (subsample 2).

Table D

Self-reported body mass index (BMI) percentage distribution, by response to measured BMI, household population aged 12 years or older, Canada excluding territories, 2005

Self-reported BMI category (range kg/m <sup>2</sup> )	Total sub-sample 2	Measured (with weight adjustment for non-response)		
		Measured	Not measured	Measured (with weight adjustment for non-response)
		%		
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>
Underweight (less than 18.5)	2.5	2.7	2.1	2.3
Normal weight (18.5 to 24.9)	49.3	52.0	44.8	50.5
Overweight (25.0 to 29.9)	32.4	31.4	34.1	32.0
Obese (30.0 or more)	15.9	14.0	19.1	15.2

Source: 2005 Canadian Community Health Survey (sub-sample 2).