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A Comparison of Household Food Security in Canada and the United States

Mark Nord and Heather Hopwood

Abstract

Food security—consistent access to enough food for an active, healthy life—is essential for health and good nutrition. The extent to which a nation's population achieves food security is an indication of its material and social well-being. Differences in the prevalence of household-level food insecurity between Canada and the United States are described at the national level and for selected economic and demographic subpopulations. Associations of food security with economic and demographic characteristics are examined in multivariate analyses that hold other characteristics constant. Comparable measures of household food security were calculated from the nationally representative Canadian Community Health Survey Cycle 2.2 (2004) and the U.S. Current Population Survey Food Security Supplement (2003-05). Based on the standard U.S. methodology, the percentage of the population living in households classified as food insecure was lower in Canada (7.0 percent) than in the United States (12.6 percent). The difference was greater for the percentage of children living in food-insecure households (8.3 percent vs. 17.9 percent) than for adults (6.6 percent vs. 10.8 percent). These differences primarily reflected different prevalence rates of food insecurity for Canadian and U.S. households with similar demographic and economic characteristics. Differences in population composition on measured economic and demographic characteristics account for only about 15 to 30 percent of the overall Canada-U.S. difference.

About the Authors

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Acknowledgments

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Disclaimer

The analyses in this report are based in part on Statistics Canada's Canadian Community Health Survey, Cycle 2.2 (2004) – Nutrition – General Health Component, Public Use Microdata File, which contains anonymized data. All computations on these microdata were prepared by the Economic Research Service. The Economic Research Service and the authors are entirely responsible for the use of the data and interpretation of the analyses.

Summary

Both the United States (U.S.) and Canada have stated objectives to improve domestic food security, defined as access at all times to adequate food for an active, healthy life. This study examines the extent to which the basic food needs of households in the two countries are met. Using nationally representative surveys from the U.S. and Canada, the study compared rates of food insecurity in economic and demographic subgroups of the two populations. The analysis found that food insecurity was less prevalent in Canada than in the U.S., and that the difference was not well explained by differences in income, employment, education, household composition, or age.

What Is the Issue?

The extent to which the population of a country is food secure is an indication of its material well-being. Both the U.S. and Canadian Governments have policies and programs intended to promote the well-being of families and individuals by ensuring that the basic needs of the population are adequately met. The effects of such efforts are difficult to assess from surveys within a single country. However, comparisons of the food security of various economic and demographic subpopulations in the two countries may reflect the effectiveness of each country's policies. The analyses may also identify areas for future research by detailing the differences in food security between the two countries.

What Did the Study Find?

Canadians were less likely to live in food-insecure households (7.0 percent of the population) than were U.S. residents (12.6 percent). The percentage of the population living in households with very low food security (characterized by self-assessed inadequacy of food intake and disrupted eating patterns) was also lower in Canada (2.4 percent) than in the U.S. (3.6 percent).

To a great extent, the same demographic and economic characteristics were associated with food insecurity in both countries. Younger adults, single parents with children, adults unemployed and looking for work, adults out of the labor force because of disability, and people in households where no adult had completed a 2- or 4-year college degree were more likely to live in food-insecure households. Income level was also strongly associated with food security in both countries.

Canada had smaller proportions of most subpopulations vulnerable to food insecurity than the U.S. However, these differences in population composition and income could account for only about 15 to 20 percent of the overall Canada-U.S. difference in food insecurity among adults and 20 to 30 percent of the difference among children. Education and living arrangements were the only aspects of population composition that contributed substantially to the national-level difference in food insecurity—Canada had a higher proportion of college graduates and a lower proportion of children living with a single parent.

Most of the Canada-U.S. difference in food insecurity was due to lower rates of food insecurity in certain subgroups, including:

- Households with incomes just above the U.S. poverty line.

- Households lacking a high school graduate.

- All age groups 25 years and older.

- Children in virtually all the surveyed subpopulations that could be identified in the surveys.

These differences were partially offset by lower rates of food insecurity in the U.S. for adults in households with incomes near or below the U.S poverty line and for men living alone and women living alone (net of associations with income, employment, age, and education).

The patterns suggest that differences in tax/tax-credit arrangements and the provision of in-kind benefits (such as food and nutrition assistance, health care, housing assistance, and energy assistance) may play important roles. Evidence from this study is only suggestive, however, and further research is needed to explore the reasons behind the differences.

How Was the Study Conducted?

Canadian food security data were provided by the nationally representative Canadian Community Health Survey Cycle 2.2. The 2004 survey included about 35,000 individuals and was conducted as a joint initiative of Statistics Canada and Health Canada. U.S. food security data were provided by the 2003, 2004, and 2005 Current Population Survey Food Security Supplements. The surveys were conducted by the U.S. Census Bureau with support from the U.S. Department of Agriculture and included, altogether, about 141,000 households. The Canadian and U.S. surveys used essentially the same set of questions to assess households' food security, asking about conditions and behaviors known to characterize households having difficulty meeting their food needs. Multivariate logistic regression methods were used to assess the associations of food security with country of residence and selected economic and demographic characteristics, while holding other characteristics constant.

Introduction

Food security, defined as access by all people at all times to enough food for an active, healthy life, is one of several conditions necessary for a nation's population to be healthy and well nourished. The extent to which food security is achieved is an indication of a population's material well-being at the level of basic needs. Both the United States and Canadian Governments have stated objectives to improve domestic food security, as well as international food security, as part of their responses to the 1996 World Food Summit (Agriculture and Agri-Food Canada, 1998; U.S. Department of Health and Human Services, 2000).

Both countries have assessed their domestic food security using household or population surveys. The U.S. Department of Agriculture (USDA) has monitored the food security of U.S. households in annual nationally representative surveys since 1995 (Hamilton et al., 1997b; Nord et al., 2007). Health Canada, in collaboration with Statistics Canada, assessed the income-related food security of Canada's population in a nationally representative health and nutrition survey in 2004, with essentially the same set of questions used in the annual U.S. surveys (Health Canada, 2007).[1] Data from the 2004 survey in Canada and from the annual surveys in the U.S. can be used to compare food security between the two countries at national levels and for selected subpopulations (see box, "About the Data," p. 2).[2]

In this report, prevalence rates of food insecurity in Canada and the U.S. are compared at the national level and for subpopulations disaggregated by age, household living arrangements, income, employment, and education. Demographic and economic characteristics selected for these analyses are known from previous research to be associated with food insecurity in one or both countries (Bartfeld et al., 2006; Health Canada, 2007; Nord and Bickel, 2002; Nord et al., 2007). Then multivariate analyses are described to explore the extent to which U.S. and Canadian differences in food security at the national level may result from differences in age, income, employment, education, and household living arrangements, holding other factors constant.

These analyses are intended primarily to identify areas for future research on the effects of economic, policy, and program factors on food security. Effects of such nationally homogeneous programs and policies are very difficult to observe in surveys within a single country. Similarities and differences between the two countries in the food security of various subpopulations, and in the economic and demographic correlates of food security, may suggest general areas of economic and social policies and programs that could account for the national-level differences in food security.

For example, if differences in food insecurity between the two countries were accounted for by differences in income and income distribution (which turns out not to be the case), then national-level differences in economic policies that affect employment and income might be responsible. If Canada-U.S. differences in food security are greater for elderly than for nonelderly, then policies and programs that uniquely affect their economic situation may be responsible. Canada-U.S. differences in food security of unemployed people might suggest differences in the effectiveness of programs that

[1]Subsequent health surveys have also collected data on the food security of Canadian households using this set of questions, but the most nationally representative Canadian food security data available at this time are from the 2004 survey.

[2]U.S. data used in these analyses were collected in December of each year, while the Canadian data were collected throughout the year from January 2004 to January 2005. Seasonal differences may be reflected in the food security measure in spite of its stated 12-month reference period (Cohen et al., 2002; Nord et al., 2007). The Canadian survey schedule would obviate any seasonal differences. Seasonal differences that may exist in the U.S. are believed to bias December prevalence rates of food insecurity slightly downward relative to an annual average (Nord et al., 2002, p. 4).

About the Data

Canadian food security data are from the 2004 Canadian Community Health Survey Cycle 2.2 (CCHS 2.2). The CCHS 2.2 was a joint initiative of Statistics Canada and Health Canada, which sought to provide reliable information about Canadians' dietary intake and nutritional well-being, and related determinants, and to inform and guide programs, policies, and activities of Federal and provincial governments. The CCHS 2.2 target population included individuals of all ages in private dwellings in the 10 Canadian provinces. The sample size was about 35,000 individuals. The target population did not include individuals who were full-time members of the Canadian Forces or who lived in the territories, on First Nations reserves or Crown Lands, in prison or care facilities, or in some remote areas. Overall the target population represents about 98 percent of the population. The survey was conducted between January 2004 and January 2005. The CCHS 2.2 provides information about the food and nutrient intakes of Canadians and a wide range of related factors, including income-related household food security.

U.S. food security data are from the 2003, 2004, and 2005 U.S. Current Population Survey Food Security Supplement (CPS-FSS). The Current Population Survey is the primary source of labor force, employment, and earnings data for the U.S. It is a nationally representative survey of about 60,000 households, conducted monthly by the Census Bureau for the Bureau of Labor Statistics. In December, after completing the labor force interview, households are asked to respond to the Food Security Supplement, which includes questions about households' ability to access enough food for their needs. About 15 percent of households that complete the labor force interview are unable or unwilling to complete the supplement. The 3-year sample size was 140,909 households.[*] USDA uses the CPS-FSS data as the basis of its annual reports on the food security of the Nation's households, and for research on food security measurement and factors affecting household food security.

The CPS-FSS data include one record for each person in each sampled household, with demographic information for that person and, if he or she is age 15 or older, information about education, employment, and labor force participation. The individual records, rather than household records, were the units of analysis for this study, in order to be consistent with the sampling methodology and data structure of the Canadian data. Sample weights of individuals in households that completed the supplement were adjusted by the Census Bureau to match State- and national-level population controls so that statistics based on the supplement weights represent the civilian, noninstitutionalized population of the 50 States and the District of Columbia. American Indians and Native Alaskans living outside metropolitan statistical areas (about 0.45 percent of the U.S. population) were omitted from the analysis sample to approximate the omission from the Canadian data of persons living on First Nations reserves.

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*Three years of data were used for the U.S. statistics to minimize the sampling error, even for relatively small subpopulations.

support workers in job transitions. These analyses will not provide definitive answers about national-level factors that influence food security, but they may help focus future research by ruling out some potential explanations and suggesting others.

Preliminary comparison of the 2004 Canadian food security data with U.S. data for 2003-05 found that the prevalence of food insecurity was about

one-third lower in Canada than in the U.S. (Nord et al., 2008). The difference was larger in households with children, for which the prevalence rate of food insecurity in Canada was about half that in the United States. In both countries, food insecurity was more prevalent in households with low annual household income, low educational attainment of adults, and younger adult members, and in those comprised of single parents with children or men or women living alone. In spite of relatively strong associations with food insecurity, however, none of these characteristics could individually account for much of the overall Canada-U.S. difference in food insecurity.

The analyses in Nord et al. (2008) were limited to comparisons of bivariate tabulations of food insecurity prevalence by selected household demographic and economic characteristics. Multivariate analyses could not be conducted because the individual-level public-use file for the Canadian food security data was not yet available. Canadian statistics for that study were taken, with one exception, from the tables in the report published by Health Canada (2007).[3] Although bivariate analyses provided an overview comparison of food insecurity in the two countries, they could not assess the extent to which associations with various risk factors are additive, and could provide only limited information about the reasons for the differences. For example, it was not possible to determine whether the association of higher educational attainment with better food security reflected a direct effect of education or an indirect effect mediated through higher income and more favorable employment.

This report is based on public-use individual-level data from both countries and complements the earlier analysis by Nord et al. The study replicates and extends the bivariate comparisons of food security across various demographic and economic characteristics and adds multivariate analyses of these associations.

[3]The only exception was a comparison of food insecurity prevalence among adults by age, which was based on a special tabulation conducted by Health Canada.

Measures of Food Security and Food Insecurity

The measures of food security described in this report are calculated from responses to a series of questions about conditions and behaviors known to characterize households that have difficulty meeting basic food needs.[4] Each question asks whether the condition or behavior occurred at any time during the previous 12 months and specifies a lack of money or other resources to obtain food as the reason, thereby excluding voluntary fasting or dieting. The series includes 10 questions about food conditions of the household as a whole and of adults in the household, and, if there are children, an additional 8 questions about their food conditions. (See box, "Survey Questions Used To Assess Households' Food Security," p. 5.)

The food security status of each interviewed household is determined by the number of food-insecure conditions and behaviors the household reports. Although Health Canada and USDA base their measures of food security on the same set of questions, they combine responses to the questions somewhat differently to determine each household's food security status and use different language to describe the ranges of severity of food insecurity. (The differences are described in appendix A.) In this report, the U.S. methods were applied to data from both countries, so the statistics are directly comparable.[5] As a result, the Canadian statistics in the report will not match those published by Health Canada (or those in Nord et al., 2008, which were based on the Canadian methodology).[6]

Three measures of food security are used by USDA:

- The *Adult Food Security Scale* is calculated from the 10 adult and general household questions. It is the standard measure in official USDA reports for households without children and can also be used to represent food security among adults in households with children. Households are classified as *food secure* if they report no food-insecure conditions or only one or two food-insecure conditions.[7] They are classified as food insecure if they report three or more food-insecure conditions. Food-insecure households are further classified as having either low food security (3 to 5 food-insecure conditions) or very low food security (6 to 10 food-insecure conditions).[8]

- The *Children's Food Security Scale* is calculated from the eight child-referenced questions (questions 11-18). Households are classified as having food insecurity among children if they report two or more food-insecure conditions of children. Households with food insecurity among children are further classified as having either *low food security among children* (two to four food-insecure conditions of children) or *very low food security among children* (five to eight food-insecure conditions of children).

- The *Household Food Security Scale* is calculated from all 18 questions (household-, adult-, and child-referenced) and is the standard measure used in official USDA reports for households with children. Households without children are classified by the Adult Food Security Scale, as described above. Households with children are classified as *food secure* if they report no food-insecure conditions or if they report only one or two food-insecure

Survey Questions Used To Assess Households' Food Security*

1. "We worried whether our food would run out before we got money to buy more." Was that often, sometimes, or never true for you in the last 12 months?

2. "The food that we bought just didn't last and we didn't have money to get more." Was that often, sometimes, or never true for you in the last 12 months?

3. "We couldn't afford to eat balanced meals." Was that often, sometimes, or never true for you in the last 12 months?

4. In the last 12 months, did you or other adults in the household ever cut the size of your meals or skip meals because there wasn't enough money for food? (Yes/No)

5. (If yes to Question 4) How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?

6. In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money for food? (Yes/No)

7. In the last 12 months, were you ever hungry, but didn't eat, because there wasn't enough money for food? (Yes/No)

8. In the last 12 months, did you lose weight because there wasn't enough money for food? (Yes/No)

9. In the last 12 months did you or other adults in your household ever not eat for a whole day because there wasn't enough money for food? (Yes/No)

10. (If yes to Question 9) How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?

(Questions 11-18 were asked only if the household included children under age 18)

11. "We relied on only a few kinds of low-cost food to feed our children because we were running out of money to buy food." Was that often, sometimes, or never true for you in the last 12 months?

12. "We couldn't feed our children a balanced meal, because we couldn't afford that." Was that often, sometimes, or never true for you in the last 12 months?

13. "The children were not eating enough because we just couldn't afford enough food." Was that often, sometimes, or never true for you in the last 12 months?

14. In the last 12 months, did you ever cut the size of any of the children's meals because there wasn't enough money for food? (Yes/No)

15. In the last 12 months, were the children ever hungry but you just couldn't afford more food? (Yes/No)

16. In the last 12 months, did any of the children ever skip a meal because there wasn't enough money for food? (Yes/No)

17. (If yes to Question 16) How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?

18. In the last 12 months did any of the children ever not eat for a whole day because there wasn't enough money for food? (Yes/No)

_____

*Wording of some questions in the CCHS 2.2 module differs slightly from the U.S. standard presented here. Canadian researchers may prefer to use the CCHS 2.2 module to ensure comparability with the Health Canada statistics.

conditions. They are classified as *food insecure* if they report three or more food-insecure conditions. Food-insecure households are further classified as having either *low food security* (3 to 7 food-insecure conditions) or *very low food security* (8 to 18 food-insecure conditions).

The low food security category is intended to identify households in which dietary quality and variety are reduced, but quantity of food intake is not reduced substantially. Households in this category have reported multiple indications of food access problems, but have typically reported few, if any, indications of reduced food intake (fig. 1). The very low food security category identifies households in which food intake of one or more members (adult members in the case of the adult scale and child members in the case of the child scale) was reduced and eating patterns disrupted because of insufficient money and other resources.

The Adult Food Security Scale and Children's Food Security Scale are used for most analyses in this report. The household measure is used only to compare national-level prevalence rates in Canada and the U.S. The adult scale is preferred for most analyses because it provides the most comparable statistics between households with and without children and among households with children in various age ranges (Nord and Bickel, 2002).

Figure 1

U.S. households reporting each indicator of food insecurity, by food security status, 2006
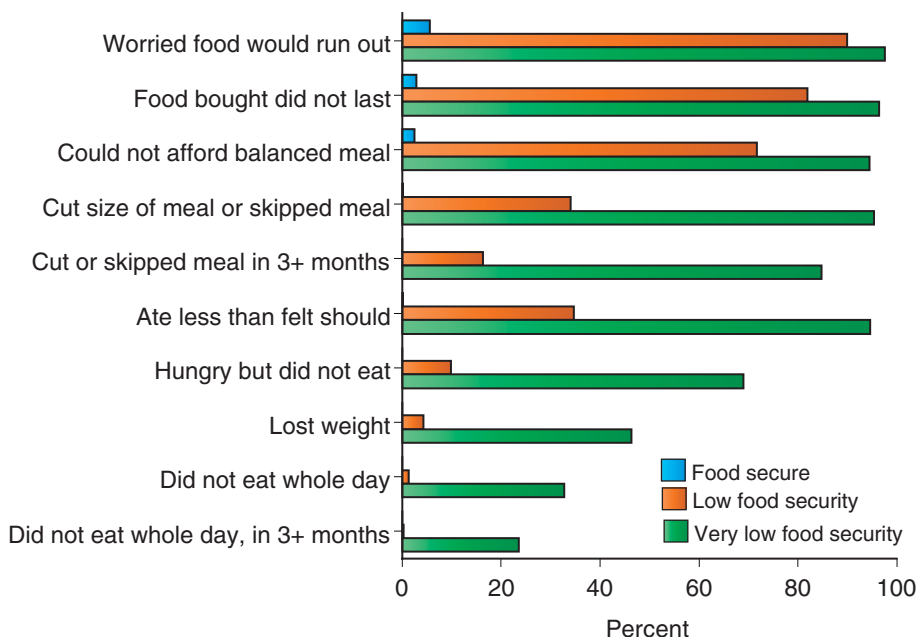
Source: USDA, ERS, *Household Food Security in the United States, 2006*, ERR-49 (Nord et al., 2007).

Comparison of Food Security in Canada and the United States

Methods

Prevalence rates throughout this report are expressed as percentages of populations and subpopulations (i.e., as percentages of individuals). This differs from the usual statistics presented in Economic Research Service (ERS) food security reports, which express prevalence rates as percentages of households. The population-oriented statistics were necessitated by the character of the Canadian survey and data. The Canadian Community Health Survey Cycle 2.2 (CCHS 2.2) sampled and collected data on individuals. In both Canada and the U.S., food security was assessed for the entire household (or for all adults or all children in the household). However, the CCHS 2.2 public-use data provide demographic information (and employment information for adults) only for the sampled person and provide only person-level sampling weights. The U.S. data, from the Current Population Survey Food Security Supplement (CPS-FSS), samples households, but also provides demographic information on all household members, employment information on all adults, and both person-level and household-level sampling weights. The two data sources can, therefore, be compared only at the individual level.

Details on the measurement of demographic and economic characteristics are provided in appendix B, along with percentage breakdowns of adults and children by these characteristics in the Canadian and U.S. analysis samples.

Standard errors of prevalence estimates were calculated using the following design effects:

- 1.6 for all U.S. prevalence estimates, consistent with Cohen et al. (2002). The unweighted number of cases used to calculate standard errors was reduced to the number of unique households represented by the person records in the denominator of each calculated rate;

- Age-specific design effects for Canadian prevalence estimates disaggregated by age, as specified by Statistics Canada (2005);

- 5.67 for Canadian prevalence estimates of individuals and of adults, except when disaggregated by age, as specified in the CCHS 2.2 – Nutrition User Guide (Statistics Canada, 2005); and

- 3.15 for Canadian prevalence estimates for children, except when disaggregated by age. This is a weighted (by population size) average of the age-specific design effects specified by Statistics Canada (2005).

National Level

At the national level, food insecurity and very low food security were less prevalent in Canada than in the U.S., as represented by all three measures (table 1). In Canada, 7.0 percent of the population lived in food-insecure households compared with 12.6 percent of the population in the U.S. The prevalence of very low food security was 2.4 percent in Canada compared

Table 1

Percentage of individuals by household-level food security status in Canada and the U.S.[1]

Household security level	Canada	U.S.
	Percent of individuals	
All individuals		
In food-insecure households (low and very low food security)	7.0	12.6
In households with very low food security	2.4	3.6
In households with food-insecure adults (low and very low food security among adults)	6.2	10.6
In households with very low food security among adults	2.3	3.6
Adults		
In food-insecure households (low and very low food security)	6.6	10.8
In households with very low food security	2.4	3.3
In households with food-insecure adults (low and very low food security)	6.2	9.5
In households with very low food security among adults	2.4	3.4
Children		
In food-insecure households (low or very low food security)	8.3	17.9
In households with very low food security	2.3	4.3
In households with food-insecure adults (low or very low food security among adults)	6.2	14.0
In households with very low food security among adults	2.1	4.3
In households with food-insecure children (low or very low food security among children)	5.3	9.9
In households with very low food security among children	.44E	.72

Note: All Canada-U.S. differences are statistically significant with 95-percent confidence.

E=Interpret with caution, coefficient of variation exceeds 16.6.

[1]Statistics for both countries are based on U.S. food security classification methodology. All measures are at the household level and over a 12-month period. For example, food insecurity among children means that one or more child in the household was food insecure at some time during the year.

Sources: Canadian Community Health Survey Cycle 2.2 (2004); Current Population Survey Food Security Supplements, 2003-05.

with 3.6 percent in the U.S. Prevalence rates of food insecurity based on the Adult Food Security Scale were somewhat lower, but in similar relationship (6.2 percent and 10.6 percent, respectively).

Canada-U.S. differences were larger for children than for adults. In Canada, the percentage of children living in food-insecure households (as measured by the household and adult scales), was about half that in the U.S. The prevalence rates based on the adult scale should be interpreted as the percentage of children living in households with food insecurity among adults in the household. Differences based on the Children's Food Security Scale were somewhat smaller; in Canada, 5.3 percent of children lived in households in which one or more child was food insecure, compared with 9.9 percent of children in the U.S.

Age

In both Canada and the U.S., food security improved steadily across the adult age ranges (fig. 2). In the U.S., the prevalence of food insecurity declined from 12.5 percent for the youngest adults to about 5 percent for those ages 66 and older. In Canada, the decline was even steeper, dropping from 9.2 percent for the youngest adults to less than 2 percent for those ages 66 and older.

In every age range, the prevalence of food insecurity was lower in Canada than in the U.S. Children in Canada were less than half as likely as U.S. children to live in a household with food-insecure adults and about half as likely as U.S. children to live in a household with very low food security among adults. From ages 19 to 65, the prevalence of food insecurity in Canada was about two-thirds that in the U.S. For ages 66 and older, the prevalence of food insecurity in Canada was about one-third that in the U.S. The prevalence of very low food security followed a similar pattern across the adult age range, but the differences were smaller, and for the age-range 19-35, the difference was not statistically significant.

Figure 2

Percentage of individuals living in households with food insecurity among adult members, by age of individual
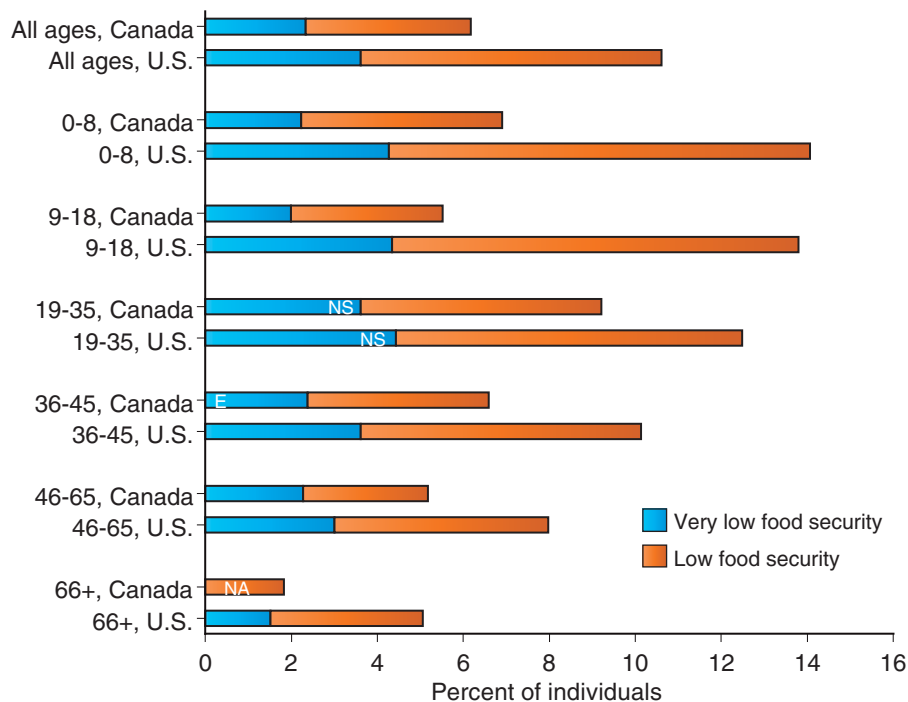
NS=Canada-U.S. difference in prevalence of very low food security not statistically significant (p>0.05).

E=Coefficient of variation for prevalence of very low food security exceeds 16.5 percent; interpret with caution.

NA=Prevalence of very low food security suppressed because the coefficient of variation exceeds 33 percent. Low food security bar includes both low and very low food security for this age category.

Sources: Canadian Community Health Survey Cycle 2.2 (2004); Current Population Survey Food Security Supplements, 2003-05.

In both Canada and the U.S., the percentage of children living in households in which one or more children were food insecure increased with age until the early teenage years (fig. 3). Food security of Canadian children then improved for children ages 14-17, while that of U.S. children remained about the same as that of children ages 9-13. Differences in the food security experienced by individual children probably differed somewhat more across age groups than is suggested by these comparisons. The Children's Food Security Scale is based on whether any child in the household was food insecure. In some households with more than one child, the measure reflects the food insecurity of the oldest child and overstates the severity of food insecurity of younger children.

Parents appear to have protected their children—especially younger children—from the effects of food insecurity to a considerable extent. Adults were more likely to be food insecure than children in the same household, especially compared with children in the youngest age group. In Canada, about 56 percent more children age 3 and younger lived in households with food insecurity among adults than in households with food insecurity among children (7.8 percent vs. 5.0 percent; table 2). In the U.S., the corresponding figure was 64 percent (13.9 percent vs. 8.5 percent). By age 14-17, the corresponding statistics were 7 percent in Canada and 28 percent in the U.S.

Children were protected to an even greater extent from the more severe aspects of food insecurity. Canadian children were about five times as likely, and U.S. children about six times as likely, to live in a household with very low food security among adults as in a household with very low food security among children. For children 3 and younger, the ratio was about 10 to 1

Figure 3

Percentage of children living in households with food insecurity among children in the household, by age
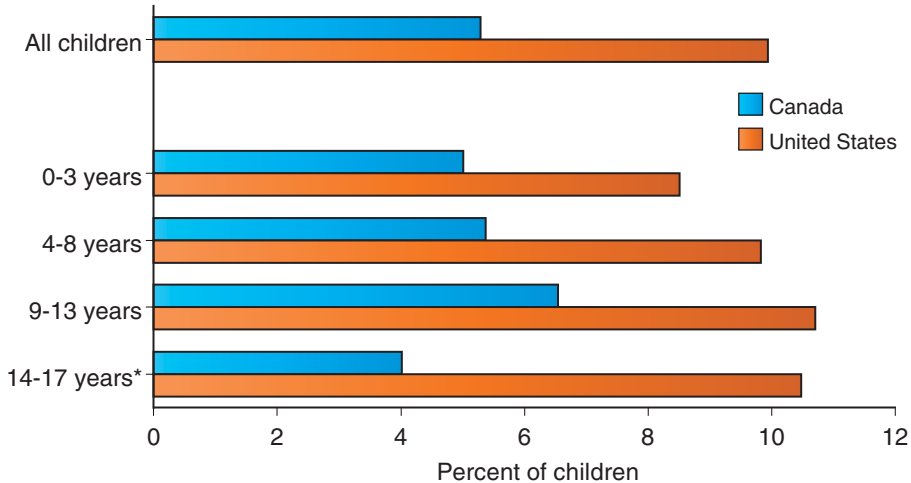
Note: All Canada-U.S. differences are statistically significant with 95-percent confidence.

*The Canada statistic includes a small proportion of 18-year-olds. In both countries, the child-referenced food security questions were administered only to households with at least one child age 17 or younger. However, 18-year-old siblings of younger children are indistinguishable from children ages 14-17 in the CCHS 2.2 public-use data because age is identified only in ranges. In the U.S. CPS-FSS data, where age is reported in single years, including or omitting 18-year-old siblings results in only negligible changes in the estimated prevalence of food insecurity in this age range.

Sources: Canadian Community Health Survey Cycle 2.2 (2004); Current Population Survey Food Security Supplements, 2003-05.

Table 2

Percentage of children living in households with food-insecure children and food-insecure adults

	Canada				United States			
	Food insecurity		Very low food security		Food insecurity		Very low food security	
Age	Among children	Among adults	Among children	Among adults	Among children	Among adults	Among children	Among adults
	Percent							
All ages 0-17*	5.3	6.2	0.44	2.12	9.9	14.0	0.72	4.32
Age 0-3 years	5.0	7.8	NA	2.76	8.5	13.9	.43	4.37
Age 4-8 years	5.4	6.3	NA	1.84	9.8	14.2	.64	4.19
Age 9-13 years	6.5	6.9	NA	3.16	10.7	14.3	.80	4.52
Age 14-17 years*	4.0	4.3	NA	.81	10.5	13.4	.97	4.16

NA = Prevalence of very low food security not reported because fewer than 30 cases had this characteristic.

*The Canada statistic includes a small proportion of 18-year-olds. In both countries, the child-referenced food security questions were administered only to households with at least one child age 17 or younger. However, 18-year-old siblings of younger children are indistinguishable from children ages 14-17 in the CCHS 2.2 public-use data because age is identified only in ranges. In the U.S. CPS-FSS data, where age is reported in single years, including or omitting 18-year-old siblings results in only negligible changes in the estimated prevalence of food insecurity in this age range.

Sources: Canadian Community Health Survey Cycle 2.2 (2004); Current Population Survey Food Security Supplements, 2003-05.

in the U.S. The ratio in the Canadian sample was also about 10 to 1, but the number of children in households with very low food security among children was too small to generalize to the population.

Household Living Arrangements

The prevalence of food insecurity among adults did not differ significantly between Canada and the U.S. for either men living alone or women living alone (fig. 4). In both countries, married couples living alone or cohabiting couples living alone (i.e., without children or other individuals in the household) were less likely to be food insecure than men or women living alone. Couples either with or without children, as well as single parents with children, were less likely to be food insecure in Canada than in the U.S. The prevalence of food insecurity among adults was highest for single parents with children, 16 percent in Canada and 26 percent in the U.S.

The prevalence of food insecurity among children was also considerably higher in single-parent than in two-parent households in both countries (fig. 5). In all three household categories (two-parent, single parent, and other), Canadian children were less likely to be food insecure than U.S. children.

Income

Income is a primary proximate determinant of food security (Nord et al., 2007; Bartfeld et al., 2006). The association of food security with income in Canada and the U.S. was examined using the Statistics Canada "income adequacy" categories because the public-use data for the CCHS 2.2 provides income information only in these categories. Income adequacy is calculated from annual household income by adjusting for household size (table 3; Statistics Canada, 2005). The incomes of U.S. households were classified into the Statistics Canada income adequacy categories after first being converted to Canadian dollars using the purchasing power parity index for 2004 (Organisation for Economic Cooperation and Development, 2008).[9]

[9]U.S. incomes for 2003 and 2005 were first converted to 2004 dollars based on the Consumer Price Index. U.S. incomes for all 3 years were then converted to Canadian dollars using the purchasing power parity index for 2004 published by the Organisation for Economic Cooperation and Development (2008). Purchasing power parities are rates of currency conversion that adjust for differences in price levels. The purchasing power parity was C$1.23=US$1.00 in 2004.

A Comparison of Household Food Security in Canada and the United States / ERR-67
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Figure 4

Percentage of adults living in households with food insecurity among adult members, by household living arrangements
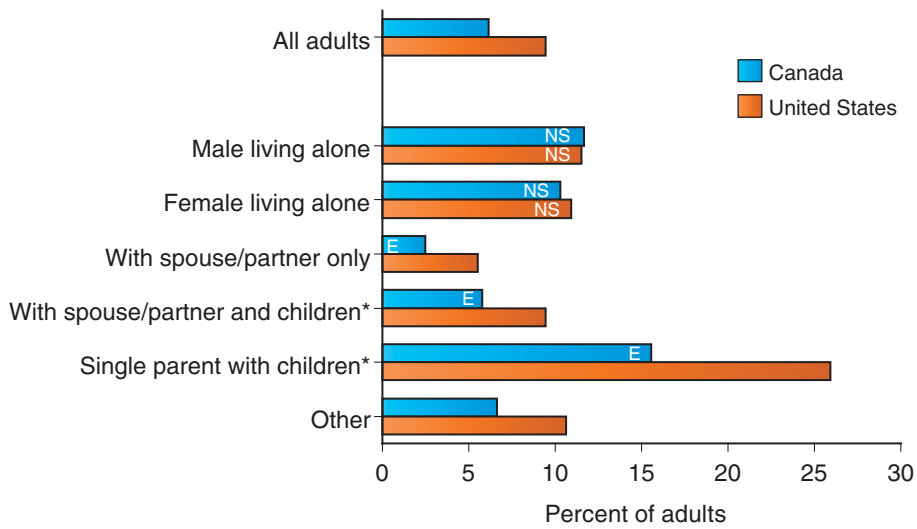
NS=Canada-U.S. difference not statistically significant (p>.05).

E=Coefficient of variation exceeds 16.5 percent; interpret with caution.

 *No other adults are present in the household unless they are adult children of the sampled person.

Sources: Canadian Community Health Survey Cycle 2.2 (2004); Current Population Survey Food Security Supplements, 2003-05.

Figure 5

Percentage of children living in households with food insecurity among children in the household, by household living arrangements
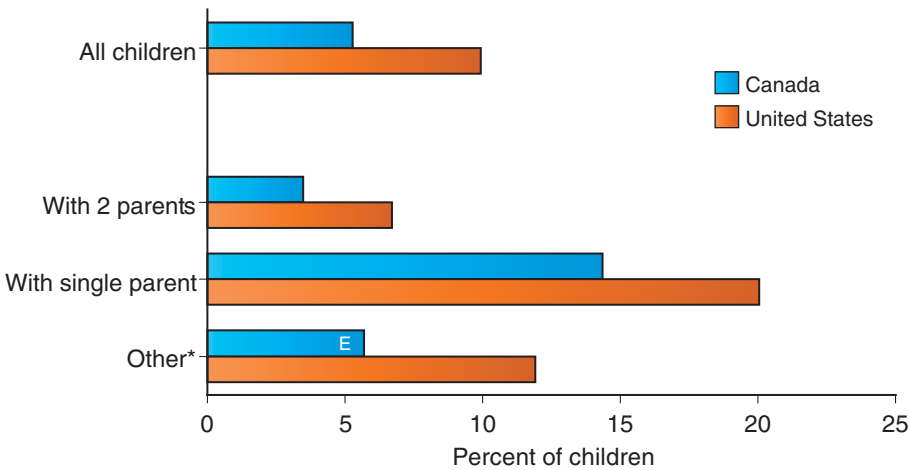
Note: All Canada-U.S. differences are statistically significant with 95-percent confidence.

* Includes children living in households with neither parent and children living in a household that includes one or both parents along with other adults who are not siblings of the child.

E=Coefficient of variation exceeds 16.5 percent; interpret with caution.

Sources: Canadian Community Health Survey Cycle 2.2 (2004); Current Population Survey Food Security Supplements, 2003-05.

Table 3
Statistics Canada income adequacy categories

Income adequacy category	Household income	Household size
	($CND)	*Number*
Lowest	< 10,000	1 - 4 persons
	< 15,000	5+ persons
Lower-middle	10,000 - 14,999	1 - 2 persons
	10,000 - 19,999	3 - 4 persons
	15,000 - 29,000	5+ persons
Middle	15,000 - 29,999	1 - 2 persons
	20,000 - 39,999	3 - 4 persons
	30,000 - 59,999	5+ persons
Upper-middle	30,000 - 59,999	1 - 2 persons
	40,000 - 79,999	3 - 4 persons
	60,000 - 79,999	5+ persons
Highest	≥ 60,000	1 - 2 persons
	≥ 80,000	3+ persons

Source: Statistics Canada, 2005. Canadian Community Health Survey (CCHS), Cycle 2.2 (Nutrition) 2004: Derived Variables Specifications.

Income concepts in the two surveys were similar; both of them included all pretax cash income received by the household, but omitted in-kind assistance.

Income adequacy categories are not directly comparable with U.S. income-to-poverty categories or with Statistics Canada's low-income cutoffs (LICOs, a commonly used measure of income poverty in Canada). The U.S. poverty line and Canadian LICOs adjust more completely for household size and age composition than do the income adequacy categories. Most households in the lowest income adequacy category have incomes less than 50 percent of the U.S. poverty line, those in the lower-middle-income adequacy category have incomes near the U.S. poverty line, and those in the middle-income adequacy category have incomes around 1.5 times the U.S. poverty line (see box, "Income Adequacy and Poverty," p. 14). Similarly, household incomes in the lowest and lower-middle income adequacy categories, and some of those in the middle-income adequacy group, fall below Statistics Canada's LICOs.

As expected, food insecurity was strongly associated with income adequacy in both countries. About one-third of people in the lowest income adequacy category lived in households with food-insecure adults, compared with 1 to 2 percent in the highest income adequacy category (fig. 6). In the lowest income adequacy category, the prevalence of adult food insecurity was similar in the two countries (somewhat higher in Canada than in the U.S. in the sample, but the difference was not statistically significant). In all other income adequacy categories, the prevalence of adult food insecurity was lower in Canada than in the U.S. Food insecurity among children was less prevalent in Canada than in the U.S. in all income adequacy categories in the sample, but the differences were not statistically significant in the two lowest income adequacy categories (fig. 7).

Income distribution differed between the Canadian and U.S. surveys. The U.S. had larger population shares than Canada in the lowest and lower-middle income adequacy categories, in which food insecurity was more prevalent in

Income Adequacy and Poverty

Statistics Canada provides household income data in some public-use files in "income adequacy categories" that represent annual income adjusted for household size. The categories primarily differentiate income across a relatively low income range; median income for all households in the country is in the upper-middle income adequacy category. The only income data available in the Canadian Community Health Survey 2.2 is for income adequacy.

Income adequacy categories are not directly comparable with U.S. income-to-poverty categories (or with Statistics Canada's low income cutoff, which is a commonly used measure of income poverty in Canada). The poverty line and low income cutoff adjust more completely for household size and age composition than do the income adequacy categories.

To relate income adequacy to U.S. poverty line-based income categories that are more familiar to most readers in the U.S., the 25th percentile, median, and 75th percentile of the income-to-poverty ratio for U.S. households in the analysis file for this study were calculated within each income adequacy category. The poverty line for each household was calculated based on the U.S. Census Bureau's table of poverty thresholds for the survey year. The annual income reported by each household (evaluated at the midpoint of the range in which it was reported) was divided by the poverty line for that household to calculate the income-to-poverty ratio. The income adequacy category was assigned according to Statistics Canada criteria, after first converting the U.S. dollar income to Canadian dollars based on the purchasing power parity index (OECD, 2008).

Median income of households in the lowest income adequacy category was less than half the poverty line; for those in the lower-middle income adequacy category, the median was about at the poverty line; and for those in the middle-income adequacy category, at about 1.6 times the poverty line.

Income-to-poverty ratios of U.S. households by Statistics Canada income-adequacy category

Income-to-poverty ratio

Income adequacy category (Statistics Canada)
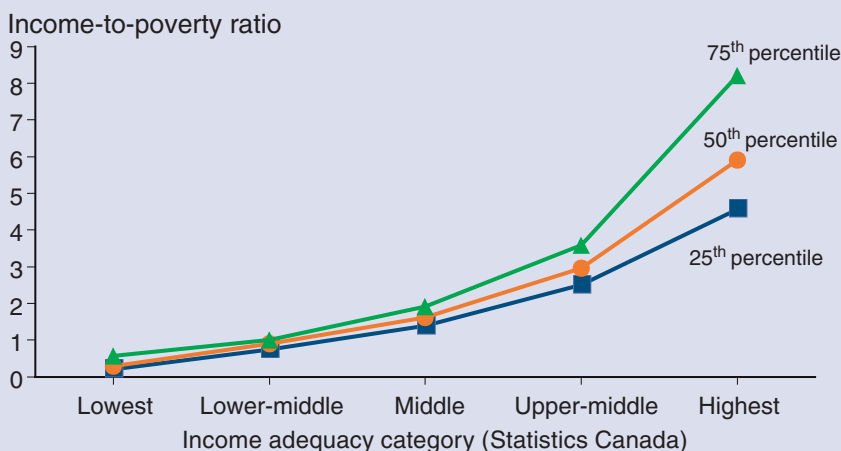
Note: U.S. households were classified by Statistics Canada income adequacy criteria after adjusting household Income to Canadian dollars by the purchasing power index.

Source: Current Population Survey Food Security Supplements, 2003-05.

Figure 6

Percentage of persons living in households with food insecurity among adult members, by income adequacy*
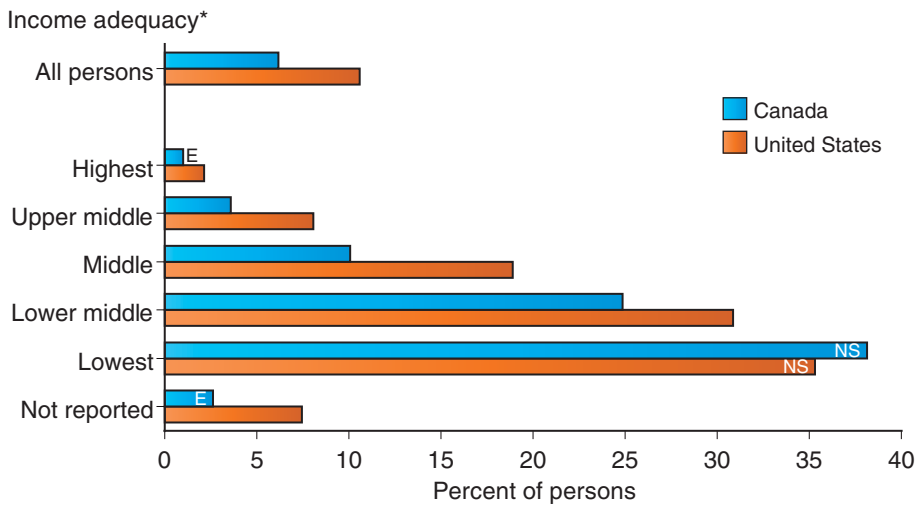
Income adequacy*

NS=Canada-U.S. difference not statistically significant (p>0.05).

E=Coefficient of variation exceeds 16.5 percent; interpret with caution.

*Income adequacy is a Statistics Canada classification of households by annual income adjusted for household size. Low and lower-middle income adequacy correspond approximately to incomes below the U.S. poverty line; middle-income adequacy corresponds approximately to the range of from 1 to 2 times the U.S. poverty line; and upper-middle-income adequacy corresponds approximately to the range of from 2 to 3.5 times the U.S. poverty line.

Sources: Canadian Community Health Survey Cycle 2.2 (2004); Current Population Survey Food Security Supplements, 2003-05.

Figure 7

Percentage of childern living in households with food insecurity among childern in the household, by income adequacy*

Income adequacy*
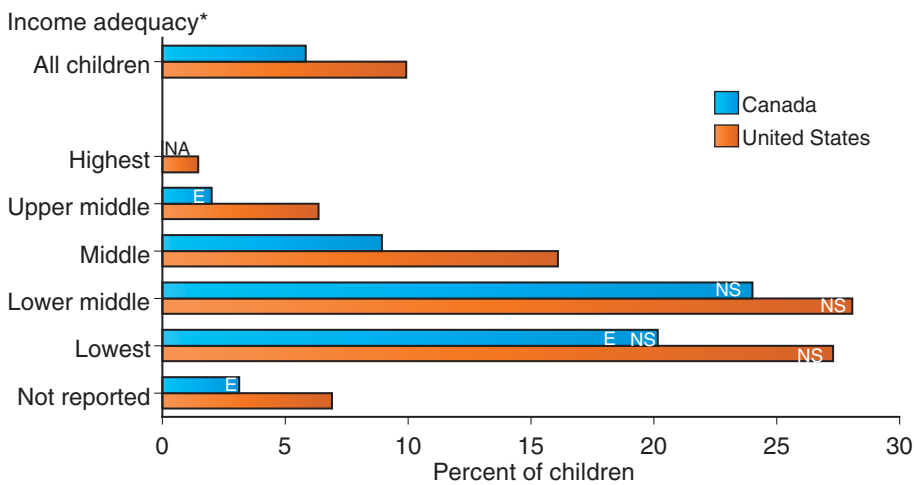
NA=Prevalence of very low food security not reported because coefficient of variation exceeds 33 percent.

E=Coefficient of variation exceeds 16.5 percent; interpret with caution.

NS=Canada-U.S. difference not statistically significant (p>0.05).

* Income adequacy is a Statistics Canada classification of households by annual income adjusted for household size. Low and lower-middle income adequacy correspond approximately to incomes below the U.S. poverty line; middle income adequacy corresponds approximately to the range of from 1 to 2 times the U.S. poverty line; and upper-middle income adequacy corresponds approximately to the range of from 2 to 3.5 times the U.S. poverty line.

Sources: Canadian Community Health Survey Cycle 2.2 (2004); Current Population Survey Food Security Supplements, 2003-05.

both countries, but also in the highest income adequacy category, in which food insecurity was least prevalent in both countries (fig. 8).[10] It is not apparent whether the combined effect of the two differences contributed to the overall Canada-U.S. difference in the prevalence of food insecurity, since the effects would be partially or completely offsetting. This question will be explored in the multivariate analysis later in the report.

Employment and Labor Force Status

In both Canada and the U.S., adults who were employed or retired were less likely to live in households with food insecurity among adults than those who were unemployed, disabled, or not in the labor force for other reasons (fig. 9).[11] Canadian adults who were employed, retired, or unemployed were less likely to live in households with food insecurity among adults than their U.S. counterparts. The largest difference was for those who were unemployed. Canada-U.S. differences were not statistically significant for adults who were out of the labor force because of disability or for reasons other than disability or retirement.

Education

Educational attainment of the most highly educated adult in the household was associated with adult food insecurity in both countries, but the association was stronger in the U.S. than in Canada (fig.10). In Canada, the percentage of people living in households with adult food insecurity was about the same (10 percent) across the three lowest education categories and

[10]The differences in income distribution between Canada and the U.S. observed in these surveys are consistent with those for family income in 1995 reported by Wolfson and Murphy (1998).

[11]Employment status generally referred to "usual" status, but unemployed (in this report, referring to those actively seeking work) referred to the current status (i.e., a week prior to the interview). See appendix B for details of the classification protocol.

Figure 8

Distribution of population by income adequacy* in the Canadian Community Health Survey Cycle 2.2 and the U.S. Current Population Survey Food Security Supplement

Percentage of population
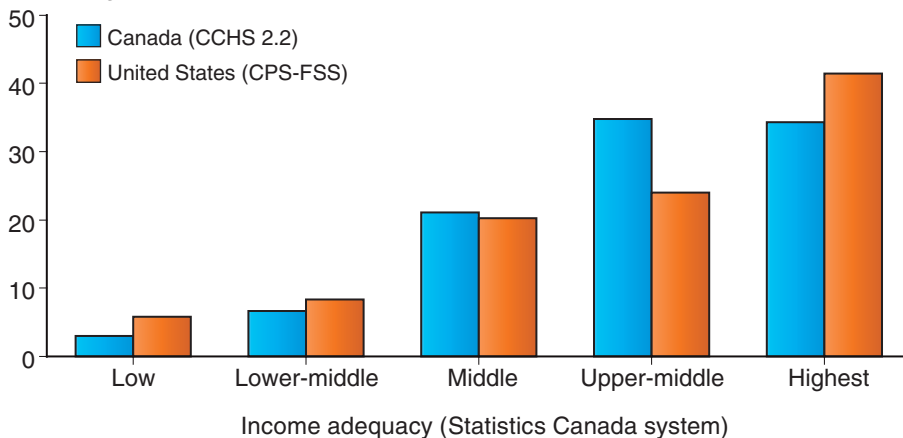
Income adequacy (Statistics Canada system)

* Income adequacy is a Statistics Canada classification of households by annual income adjusted for household size. Low- and lower-middle income adequacy correspond approximately to incomes below the U.S. poverty line; middle-income adequacy corresponds approximately to the range of from 1 to 2 times the U.S. poverty line; and upper-middle income adequacy corresponds approximately to the range of from 2 to 3.5 times the U.S. poverty line. United States incomes were adjusted to Canadian dollars by purchasing power parity index.

Sources: Canadian Community Health Survey Cycle 2.2 (2004); Current Population Survey Food Security Supplements, 2003-05.

Figure 9

Percentage of adults living in households with food insecurity among adult members, by labor force status
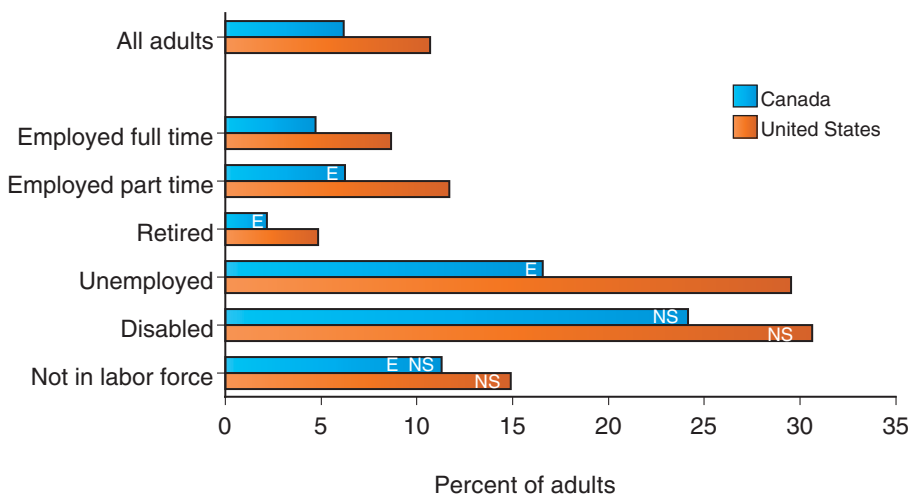
E=Coefficient of variation exceeds 16.5 percent; interpret with caution.

NS=Canada-U.S. difference not statistically significant (p>0.05).

Sources: Canadian Community Health Survey Cycle 2.2 (2004); Current Population Survey Food Security Supplements, 2003-05.

Figure 10

Percentage of persons living in households with food insecurity among adult members, by education of the most highly educated adult in the household
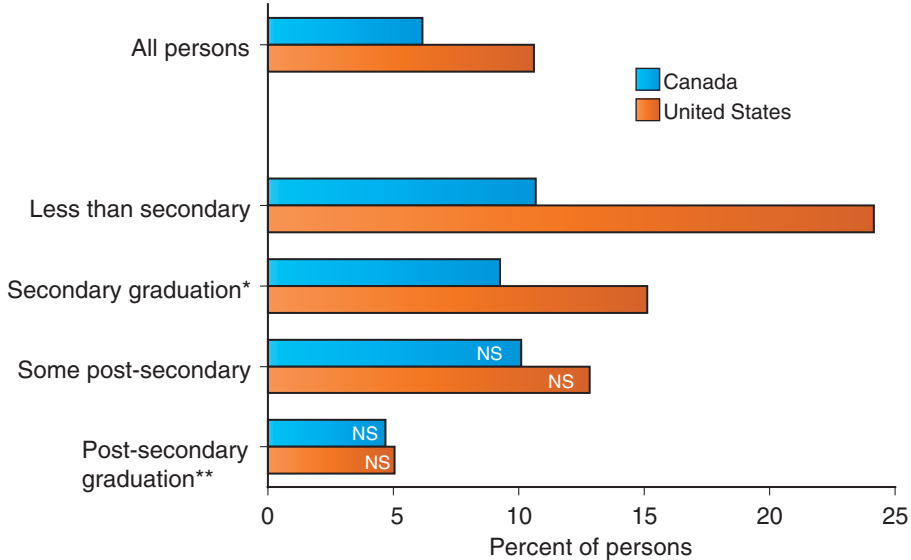
*Secondary graduation includes high school graduation (or GED in the U.S.), with no further education.

**Post-secondary graduation includes 2-year-degree holders.

NS= Canada-U.S. difference not statistically significant (p>0.05).

Sources: Canadian Community Health Survey Cycle 2.2 (2004); Current Population Survey Food Security Supplements, 2003-05.

about half as high for those in households with a post-secondary graduate. In the U.S., food insecurity among adults was about twice as prevalent in households in which the most educated adult had less than a secondary-school education—i.e., less than a high school diploma or General Education Development certificate (GED)—as in households with an adult with some post-secondary education, and almost five times as high compared with households with a post-secondary graduate.

The prevalence of food insecurity for individuals living in households in which a member had completed post-secondary schooling was similar in the two countries (about 5 percent), and was considerably lower than in other households.[12] The share of the population that lived in households with a post-secondary graduate was larger in Canada than in the U.S. (72 percent vs. 48 percent in these surveys). The extent to which this is associated with the overall difference in food insecurity between the two countries will be explored in the multivariate analysis later in the report.

[12]The post-secondary graduation category included those with a 2-year college degree.

Multivariate Analysis: To What Extent Might Differences in Income, Employment, Education, Age, and Household Structure Account for the Lower Prevalence of Food Insecurity in Canada?

Analytic Approaches

The national-level difference in food security between Canada and the U.S. could result from a variety of social, economic, and policy differences in the two countries. Effects of such differences cannot be examined directly in the data used in this study, but analysis of associations of food insecurity with more proximate causal factors may provide indirect information about the effects of those policies. Two analytic approaches were used to explore two general questions about possible effects of proximate causal factors. Both approaches used multivariate logistic regression analyses, which assess the associations of food insecurity (measured at the household level) with multiple, potentially causal factors, while statistically holding constant the other potentially causal factors in the analysis.

Did Composition of the Canadian and U.S. Populations Account for Differences in Food Insecurity?

The first approach examined whether differences in the makeup of the Canadian and U.S. population across factors that were measured in both surveys could account for the national-level differences in food insecurity. The bivariate associations described above demonstrate that adults in both countries were more likely to live in food-insecure households if they were younger, less educated, unemployed, disabled, living alone or as a single parent, or in a household with lower income. If there were smaller proportions of these vulnerable populations in Canada than in the U.S., then those differences in population composition could account for some or all of the difference in food security between the two countries.

To assess the extent to which the data are consistent with this potential explanatory scenario, a series of logistic regression models were estimated using pooled data for adults from the two countries. Food insecurity among adults in the household was the dependent variable in these models, and the independent variable of primary interest was a binary variable indicating whether the observation was from the Canada CCHS 2.2 data (*Canadian residence*=1) or the U.S. CPS-FSS data (*Canadian residence*=0).

In the baseline model, the *Canadian residence* variable was the only independent variable. The logistic regression coefficient on the variable reflects the overall difference in food insecurity between the two countries.

The full model was estimated next, including sets of dummy variables for age, household living arrangements, income adequacy, employment and labor force status, and education. The extent to which the coefficient on the *Canadian residence* variable approaches zero (or the associated odds ratio approaches 1) in this model, compared with the baseline model, is a measure

of the extent to which differences in composition of the Canadian and U.S. populations across these observed characteristics might account for the overall difference in food insecurity between the two countries. If the size of the coefficient on the *Canadian residence* variable were to become zero or very small (i.e., if the odds ratio approached 1.0), it would suggest that differences in population composition could account for much or all of the Canada-U.S. difference. If the coefficient remains unchanged or near that of the baseline model, it would suggest that differences in population composition are, at most, a minor factor in the overall difference.[13]

Several partial models were then estimated to identify which characteristics accounted for the change observed between the baseline and full model (while holding other factors constant). Again, the indicator of interest was the coefficient on the *Canadian residence* variable.

Which Characteristics Were Differently Associated With Food Insecurity in the U.S. and Canada?

The second approach examined the assumption, implicit in the pooled-data analyses, that each independent variable was similarly associated with food insecurity in the two countries. Separate models for adults in Canada and the U.S. were estimated, and the size of each coefficient was compared between the two countries. The models comprised the same covariates as the full model described above, except that the *Canadian residence* variable was omitted.

The purpose of the separate regression models was to identify characteristics that were associated differently with food insecurity in the two countries, while holding other factors constant. These characteristics may suggest economic or policy factors that could be influencing food security. These analyses cannot definitively identify specific factors responsible for the differences, but by identifying subpopulations that are affected differentially, they may suggest policy factors that could be responsible and may thus suggest fruitful directions for research.

All of the logistic regression analyses were repeated with children ages 0-17 as the unit of analysis and food insecurity among children as the dependent variable. Employment could not be included in the analysis of children's food security because household-level employment information is not available in the CCHS 2.2 data.

In all regression analyses, sample weights were adjusted to approximate the number of independent observations. Sample weights in the Canadian data were multiplied by a constant selected to equate the sum of weights to the number of unweighted cases. Sample weights in the U.S. data were multiplied by a constant selected to equate the sum of weights to the sum of unweighted households represented by the adult cases in the sample (or child cases in the child analyses). In the U.S. data, each member of a household contributes a case to the analysis file, but all members of the same household have the same food security status since food security was measured at the household level. (In the Canadian survey, only one person was interviewed in each household.) The logistic regression analyses and calculation of variances of the logistic coefficients were based on these adjusted weights. The weight adjustments did not account for any further clustering due to the

[13]Caution should be exercised in inferring causality from these results. Cross-sectional association does not prove causality. However, a lack of change in the *Canadian residence* coefficient with controls for characteristics that are known to be strongly associated with food insecurity is quite strong evidence that differences in population distribution on those characteristics does not account for the Canada-U.S. difference in food insecurity.

sampling designs. However, such clustering is not likely to substantially affect variance estimates for complex associations involving the number of covariates in these models, and marginally significant associations are interpreted with caution.[14]

Details on measurement of covariates are provided in appendix B, along with percentage breakdowns of adults and children by these characteristics in the Canadian and U.S. analysis samples.

Several subsidiary analyses were conducted to assess the robustness of the findings to various analytic decisions. Descriptions of those analyses and results are reported after the main findings.

Findings of the Multivariate Analyses

Population Composition and Adult Food Insecurity

Canada-U.S. differences in population composition on characteristics measured in both surveys accounted for only a modest proportion of the lower prevalence of food insecurity in Canada. The baseline difference in adult food insecurity corresponded to a Canada-to-U.S. odds ratio of 0.636 (table 4). In other words, for adults age 19 or older, the odds of living in a household with food insecurity among adults were 36.4 percent lower in Canada than in the U.S. Controlling for age, household living arrangements, income adequacy, employment, and education only reduced that down to 30.7 percent (odds ratio=0.693 in the full model). Thus, the proportion of the overall Canada-U.S. difference in the prevalence of adult food insecurity that was associated with differences in population composition (on the observed variables) amounted to about 16 percent if calculated on odds ratios. If calculated based on the logistic regression coefficients (not shown), the proportion was 19 percent.[15]

Thus, the Canada-U.S. difference in food insecurity does not appear to have resulted, to any great extent, from differences in population composition that were measured in both of these surveys. The lack of a substantial reduction in the size of the Canadian residence coefficient does not reflect a poorly fitting or inadequately specified model. In fact, the model fit the data quite well. Each set of variables representing a characteristic or construct was highly significant, and coefficients for almost all individual variables were statistically significant (i.e., they differed from the reference category by a statistically significant amount). Somers' D for the full model was .629, also indicating a reasonably good fit.[16]

The small proportion of the Canada-U.S. difference accounted for by the model could result from there being only small differences in population composition on the characteristics represented in the model, or from the effects of some differences in composition offsetting the effects of others. To explore the latter possibility, additional models were estimated with selected sets of variables included.

[14]Neither survey provides the information on sample design that would be needed to calculate corrected variance estimates using Taylor series approximations. The average design effect for national-level prevalence estimates in the CPS-FSS has been calculated at about 1.6 (Cohen et al., 2002). Design effects for age-specific prevalence estimates in the CCHS 2.2 range from 3.11 to 4.03 (Statistics Canada, 2005). Effects of survey design on the complex associations in the multivariate models are expected to be much smaller.

[15]A Blinder-Oaxaca decomposition (Blinder 1973; Oaxaca, 1973) using a linear probability model and average coefficients, assigned 22 percent of the Canada-U.S. difference to differences in population composition.

[16]Somers' D is a measure of how well a logistic regression model fits the observed data. In a model with food insecurity as the dependent variable, for example, it assesses the extent to which predicted probabilities of food insecurity are higher for food-insecure households than for food-secure households. A value of 1.0 would indicate that predicted probabilities are higher for all food-insecure households than for any food-secure households.

Table 4

Logistic regression of food insecurity of adults[1] on individual and household characteristics and residence in Canada vs. the United States

Characteristic	Baseline model		Full model	
	Odds ratio	p	Odds ratio	p
Canadian residence	0.636	<.001	0.693	<.001
Age 19-24 (reference)			1.000	--.--
Age 25-35			1.074	.023
Age 36-45			.998	.958
Age 46-55			.884	<.001
Age 56-65			.684	<.001
Age 66 or older			.432	<.001
Male living alone[2]			1.197	<.001
Female living alone[2]			1.278	<.001
Male or female with spouse or partner only[3] (reference)			1.000	--.--
Couple (married or cohabiting) with one or more child[4]			1.139	<.001
Single male with one or more child[4]			1.793	<.001
Single female with one or more child[4]			1.761	<.001
Other male			1.281	<.001
Other female			1.301	<.001
Lowest income adequacy			1.954	<.001
Lower-middle income adequacy			1.758	<.001
Middle income adequacy (reference)			1.000	--.--
Upper-middle income adequacy			.443	<.001
Highest income adequacy			.128	<.001
Income not reported			.396	<.001
Employed full time (reference)			1.000	--.--
Employed part time			1.121	<.001
Unemployed (looking for work)			2.282	<.001
Disabled, not in labor force			2.376	<.001
Retired, not in labor force			.695	<.001
Not in labor force for other reasons			1.099	.002
Education less than secondary graduation[5]			1.278	<.001
Education secondary graduation[5] (reference)			1.000	--.--
Education some post-secondary[5]			.982	.486
Education post-secondary graduation[5]			.615	<.001
Somers' D	.016		.629	

[1] Adults age 19 and older were the units of analysis, and food insecurity (low or very low food security) among adults was the dependent variable. There were 276,928 observations, but the U.S. observations were down-weighted to the number of households, resulting in an effective N for the combined Canada-U.S. sample (used to calculate variances) of 160,517.

[2] No other person lived in these households.

[3] These are two-person households.

[4] No other adults lived in these households unless they were an adult child of the individual in the sample.

[5] Education variables refer to education of the most highly educated adult in the household. Secondary graduation includes high school graduation (or GED in the U.S.), with no further education. Post-secondary graduation includes 2-year-degree holders.

Sources: Canadian Community Health Survey Cycle 2.2 (2004); Current Population Survey Food Security Supplements, 2003-05.

The general picture that emerges from these analyses is that:

- Differences in age and household living arrangements in the two countries account for little or none of the difference in adult food insecurity;

- Differences in education could account for nearly half of the difference in adult food insecurity; and

- The effects of education were partially offset by differences in income and employment.

Omitting either the age variables (table 5, model 3) or the household living arrangement variables (model 4) from the full model left the coefficient on *Canadian residence* essentially unchanged from that in the full model (model 2). Furthermore, including only those two sets of variables in the model resulted in a coefficient on *Canadian residence* almost identical to that in the baseline model (model 5). Adding the education variables, but still omitting income and employment variables (model 6), reduced the logistic coefficient on *Canadian residence* by nearly half from the baseline (model 1). The full model, including income and employment variables (model 2), reduced the size of the logistic coefficient on *Canadian residence* by only 19 percent from the baseline (model 2), so the effect of adding income and employment variables was to partially offset the effect of education differences. Comparison of the coefficients on *Canadian residence* in models 7 and 8 suggests that difference in income composition rather than employment composition was the major offsetting factor. Model 9 confirmed that if composition on all factors except education were the same in the two countries, the difference in food insecurity would be *larger* than the difference actually observed (provided associations between food insecurity and the modeled household characteristics remained unchanged).

Population Composition and Children's Food Insecurity

The Canada-U.S. difference in children's food insecurity, like that in adults' food insecurity, was primarily associated with subpopulation-specific differences in food insecurity rates rather than with differences in population composition. The baseline (i.e., national-level) difference in the proportion of children living in households in which one or more child was food insecure corresponded to a Canada-to-U.S. odds ratio of 0.506 (table 6). In other words, for children ages 0-17, the odds of living in a household with food insecurity among children were 49.4 percent lower in Canada than in the U.S. Controlling for age, household living arrangements, income adequacy, and adults' education reduced that only to 40.0 percent (odds ratio=0.600 in the full model). Thus, the proportion of the overall Canada-U.S. difference in the prevalence of children's food insecurity that was associated with differences in population composition (on the observed variables) amounted to about 19 percent if calculated on odds ratios. If calculated based on the logistic regression coefficients (not shown), the proportion was 25 percent.[17]

[17]A Blinder-Oaxaca decomposition (Blinder 1973; Oaxaca, 1973) using a linear probability model and average coefficients assigned 30 percent of the Canada-U.S. difference to differences in population composition.

The model fit the child data reasonably well, as was true for the adult data. Each set of variables representing a characteristic or construct was highly significant, and coefficients for almost all individual variables were statistically significant. Somers' D for the full model was 0.605, also indicating a reasonably good fit.

Table 5

Coefficient on residence in Canada from logistic regressions of food insecurity of adults[1] on selected sets of individual and household characteristics [2]

| Model | Description of model ("X" indicates that variables representing the characteristic or construct are in the model) | | | | | Coefficient on *Canadian residence* | | |
	Age	Household living arrangements	Income	Employment	Education	Odds ratio	Logistic coefficient	Std. Error of logistic coefficient
Model 1 (Baseline)						0.636	-0.453	0.031
Model 2 (Full model)	X	X	X	X	X	.693	-.367	.033
Model 3		X	X	X	X	.693	-.366	.033
Model 4	X		X	X	X	.699	-.358	.033
Model 5	X	X				.632	-.459	.031
Model 6	X	X			X	.775	-.255	.032
Model 7	X	X		X	X	.768	-.265	.032
Model 8	X	X	X		X	.707	-.347	.033
Model 9	X	X	X	X		.606	-.500	.032

[1] Adults age 19 and older were the units of analysis and food insecurity (low or very low food security) among adults was the dependent variable. There were 276,928 observations, but the U.S. observations were down-weighted to the number of households, resulting in an effective N for the combined Canada-U.S. sample (used to calculate variances) of 160,517.

[2] See table 4 for specific variables representing each characteristic or construct.

Source: Canadian Community Health Survey Cycle 2.2 (2004); Current Population Survey Food Security Supplements, 2003-05.

In the child model, as in the adult model, differences in educational attainment accounted for most of the relatively small proportion of overall difference associated with population composition. Differences between the two countries in children's ages and household living arrangements also contributed, and together, age, household living arrangements, and education differences could account for nearly half of the baseline difference (table 7, model 6 compared with model 1). Differences in income partially offset the differences in composition on the other characteristics.

Characteristics Differently Associated With Food Insecurity of Adults in Canada and the U.S.

Since the greater part of the Canada-U.S. difference in adult food insecurity cannot be accounted for by differences in population composition, it must reflect differences in food insecurity between Canadian and U.S. households that are economically and demographically similar (as measured by the variables available for this study). Comparison of coefficients from models estimated separately for the two countries identifies characteristics that are differently associated with food insecurity, holding effects of other characteristics in the model constant (table 8).

The log-odds of food insecurity presented in table 8 are those predicted for the specified subpopulation, with other characteristics held constant at the reference characteristics. The reference population was specified as a man or woman age 19-24 living with a spouse or partner only, with income in the

Table 6

Logistic regression of children's food insecurity[1] on the child's age, household characteristics, and residence in Canada vs. the United States

Characteristic	Baseline model		Full model	
	Odds ratio	p	Odds ratio	p
Canadian residence	0.506	<.001	0.600	<.001
Age 0-3			.730	<.001
Age 4-8			.871	.001
Age 9-13			1.028	.503
Age 14-17 (reference)			1.000	--.--
With two parents (reference)[2]			1.000	--.--
With single parent[2]			1.663	<.001
In other living arrangements[3]			1.336	<.001
Lowest income adequacy			1.633	<.001
Lower-middle income adequacy			1.930	<.001
Middle income adequacy (reference)			1.000	--.--
Upper-middle income adequacy			.362	<.001
Highest income adequacy			.099	<.001
Income not reported			.400	<.001
Education less than secondary graduation[4]			1.317	<.001
Education secondary graduation[4] (reference)			1.000	--.--
Education some post-secondary[4]			1.003	.939
Education post-secondary graduation[4]			.702	<.001
Somers' D	.059		.605	

[1] Children ages 0 to 17 were the units of analysis, and food insecurity (low or very low food security) among children was the dependent variable. There were 105,721 observations, but the U.S. observations were down-weighted to the number of households, resulting in an effective N for the combined Canada-U.S. sample (used to calculate variances) of 62,873. The Canadian sample includes a small proportion of 18-year-olds. In both countries, the child-referenced food security questions were administered only to households with at least one child age 17 or younger. However, 18-year-old siblings of younger children are indistinguishable from children ages 14-17 in the CCHS 2.2 public-use data because age is identified only in ranges. In the U.S. CPS-FSS data, where age is reported in single years, including or omitting 18-year-old siblings results in only negligible changes in the estimated prevalence of food insecurity in this age range.

[2] Some of these households included an adult sibling of the child in addition to the child's parent(s). Households that included adults other than the child's parents or siblings were classified as "In other living arrangements."

[3] Includes children living in households with neither parent, and children living in a household that includes one or both parents along with other adults who are not siblings of the child.

[4] Education variables refer to education of the most highly educated adult in the household. Secondary graduation includes either high school (or GED in the U.S.), with no further education. Post-secondary graduation includes 2-year-degree holders.

Sources: Canadian Community Health Survey Cycle 2.2 (2004); Current Population Survey Food Security Supplements, 2003-05.

middle-income adequacy range, employed full time, living in a household in which the most educated person had completed secondary schooling (high school or GED) but had no further education. The prevalence of adult food insecurity for this reference subpopulation is reflected in the log-odds for each of the reference categories.[18] The Canada-U.S. difference for the reference population was relatively small (17.0 percent in Canada compared with 16.3 percent in the U.S.) and was not statistically significant (p=.753).[19]

The subpopulations with lower prevalence of food insecurity in Canada than in the U.S., holding constant the other characteristics in the model at reference cate-

[18]The coefficients shown in other categories were calculated as the sum of the intercept and the regression coefficient for that category. The size of the difference in log-odds depends on the selection of the reference population, but the ranking of differences is invariant to this specification.

[19]Percentages are calculated from log-odds (the metric of the coefficients in the logistic regression) as follows: Percentage = 100/(1+1/exp(Log-odds)).

Table 7

Coefficient on residence in Canada from logistic regressions of children's food insecurity[1] on selected sets of individual and household characteristics [2]

Model	Description of model ("X" indicates that variables representing the characteristic or construct are in the model)				Coefficient on *Canadian residence*		
	Age	Household living arrangements	Income	Education	Odds ratio	Logistic coefficient	Std. Error of logistic coefficient
Model 1 (Baseline)					0.506	-0.681	0.041
Model 2 (Full model)	X	X	X	X	.600	-.510	.044
Model 3		X	X	X	.609	-.496	.044
Model 4	X		X	X	.604	-.504	.044
Model 5	X	X			.539	-.618	.041
Model 6	X	X		X	.693	-.367	.042
Model 7	X	X	X		.532	-.631	.042

[1] Children aged 0 to 17 were the units of analysis, and food insecurity (low or very low food security) among children was the dependent variable. There were 105,721 observations, but the U.S. observations were down-weighted to the number of households, resulting in an effective N for the combined Canada-U.S. sample (used to calculate variances) of 62,873. The Canadian sample includes a small proportion of 18-year-olds. In both countries, the child-referenced food security questions were administered only to households with at least one child age 17 or younger. However, 18-year-old siblings of younger children are indistinguishable from children ages 14-17 in the CCHS 2.2 public-use data because age is identified only in ranges. In the U.S. CPS-FSS data, where age is reported in single years, including or omitting 18-year-old siblings results in only negligible changes in the estimated prevalence of food insecurity in this age range.

[2] See table 6 for specific variables representing each characteristic or construct.

Source: Canadian Community Health Survey Cycle 2.2 (2004); Current Population Survey Food Security Supplements, 2003-05.

gories, are identified by more negative values in the next-to-right-hand column in table 8 Those with substantially lower prevalence in Canada included:

- All age groups older than 19-24 (possibly excepting ages 25-35, for which the difference is only marginally statistically significant), and especially those ages 46-55 and ages 66 and older. These differences were not due to differences in income, employment, education, or household living arrangements, since those factors were controlled in the regression analyses;

- Single men with children (although the number of such cases in the CCHS 2.2 was so small that its effect on the national-level prevalence was negligible, and the estimation of the coefficient is somewhat suspect);

- People with incomes in the upper-middle income adequacy range;

- People employed part-time, or unemployed and looking for work; and

- People in households in which no one had completed high school.

On the other hand, some subpopulations had higher prevalence rates of food insecurity in Canada than in the U.S., holding constant other factors at the reference values. These included:

- Men or women living alone,

- Couples with children (marginally statistically significant), and

- Those with incomes in the lowest and lower-middle income adequacy range.

Table 8

Predicted log-odds of food insecurity of adults based on logistic regression of food insecurity on individual and household characteristics in Canada and the United States[1]

Characteristic	Canada		U.S.		Canada-U.S. difference	
	Log-odds	S.E.	Log-odds	S.E.	Log-odds	p
Age 19-24 (reference)	-1.59	0.153	-1.64	0.043	0.05	.753
Age 25-35	-1.75	.105	-1.55	.033	-.20	.068
Age 36-45	-1.98	.111	-1.61	.034	-.37	.001
Age 46-55	-2.33	.117	-1.71	.036	-.62	.000
Age 56-65	-2.33	.140	-2.00	.044	-.34	.022
Age 66 or older	-3.42	.233	-2.40	.061	-1.02	.000
Male living alone[2]	-1.01	.141	-1.50	.044	.49	.001
Female living alone[2]	-1.08	.133	-1.43	.041	.34	.013
Male or female with spouse or partner only[3] (reference)	-1.59	.153	-1.64	.043	.05	.753
Couple (married or cohabiting) with one or more child[4]	-1.28	.122	-1.52	.034	.24	.061
Single male with one or more child[4]	-2.06	.507	-1.02	.060	-1.04	.042
Single female with one or more child[4]	-.92	.171	-1.08	.062	.16	.381
Other male	-1.37	.124	-1.39	.034	.02	.899
Other female	-1.26	.124	-1.38	.035	.12	.356
Lowest income adequacy	-.12	.111	-1.05	.035	.94	.000
Lower-middle income adequacy	-.64	.096	-1.12	.031	.48	.000
Middle income adequacy (reference)	-1.59	.153	-1.64	.043	.05	.753
Upper-middle income adequacy	-2.68	.088	-2.42	.030	-.26	.005
Highest income adequacy	-3.86	.139	-3.67	.040	-.19	.178
Income not reported	-2.97	.159	-2.55	.031	-.42	.010
Employed full time (reference)	-1.59	.153	-1.64	.043	.05	.753
Employed part time	-1.86	.113	-1.49	.033	-.37	.002
Unemployed (looking for work)	-1.04	.113	-.79	.039	-.25	.034
Disabled, not in labor force	-.83	.120	-.77	.036	-.06	.616
Retired, not in labor force	-2.05	.189	-1.98	.054	-.08	.695
Not in labor force for other reasons	-1.57	.105	-1.54	.031	-.03	.790
Education less than secondary graduation[5]	-1.79	.120	-1.34	.031	-.44	.000
Education secondary graduation[5] (reference)	-1.59	.153	-1.64	.043	.05	.753
Education some post-secondary[5]	-1.69	.126	-1.66	.027	-.04	.778
Education post-secondary graduation[5]	-2.08	.086	-2.14	.027	.06	.496
Number of cases (number of households in U.S.)	20,177		140,340			
Somers' D	.722		.622			

[1] Adults age 19 and older were the units of analysis. Food insecurity (low or very low food security) among adults was the dependent variable. Separate models were estimated for Canada and the U.S. The coefficient for the intercept (constant) is shown for each reference category and was added to the coefficients for the other variables.

[2] No other person lived in these households.

[3] These are two-person households.

[4] No other adults lived in these households unless they were an adult child of the individual in the sample.

[5] Education variables refer to education of the most highly educated adult in the household. Secondary graduation includes high school graduation (or GED in the U.S.), with no further education. Post-secondary graduation includes 2-year-degree holders.

Sources: Canadian Community Health Survey Cycle 2.2 (2004); Current Population Survey Food Security Supplements, 2003-05.

Characteristics Differently Associated With Food Insecurity of Children in Canada and the U.S.

Logistic regression models of children's food insecurity estimated separately for the two countries are compared in table 9 to examine whether any characteristics were differentially associated with food insecurity in the two countries, holding constant effects of other characteristics in the models. The log-odds presented in table 9 are those for the specified subpopulation with other characteristics held constant at reference categories. The reference population was

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Table 9

Predicted log-odds of children's food insecurity based on logistic regression of food insecurity on individual and household characteristics in Canada and the United States[1]

Characteristic	Canada		U.S.		Canada-U.S. difference	
	Log-odds	S.E.	Log-odds	S.E.	Log-odds	p
Age 0-3	-2.51	0.130	-2.01	0.050	-0.50	<.001
Age 4-8	-2.51	.118	-1.81	.046	-0.70	<.001
Age 9-13	-2.26	.111	-1.67	.044	-0.60	<.001
Age 14-17 (reference)	-2.65	.140	-1.63	.050	-1.01	<.001
With two parents (reference)[2]	-2.65	.140	-1.63	.050	-1.01	<.001
With single parent[2]	-2.09	.094	-1.14	.041	-0.95	<.001
In other living arrangements[3]	-2.65	.120	-1.32	.039	-1.32	<.001
Lowest income adequacy	-1.87	.158	-1.18	.052	-0.69	<.001
Lower-middle income adequacy	-1.61	.099	-1.06	.045	-0.54	<.001
Middle income adequacy (reference)	-2.65	.140	-1.63	.050	-1.01	<.001
Upper-middle income adequacy	-4.13	.131	-2.55	.055	-1.58	<.001
Highest income adequacy	-5.35	.220	-3.88	.074	-1.47	<.001
Income not reported	-3.66	.161	-2.53	.054	-1.12	<.001
Education less than secondary graduation[4]	-2.56	.146	-1.33	.046	-1.23	<.001
Education secondary graduation[4] (reference)	-2.65	.140	-1.63	.050	-1.01	<.001
Education some post-secondary[4]	-2.37	.147	-1.67	.044	-0.70	<.001
Education post-secondary graduation[4]	-2.71	.109	-2.06	.045	-0.64	<.001
Number of cases (number of households in U.S.)	14,187		48,683			
Somers' D	.672		.592			

[1] Children ages 0 to 17 were the units of analysis, and food insecurity (low or very low food security) among children was the dependent variable. The Canadian sample includes a small proportion of 18-year-olds. In both countries, the child-referenced food security questions were administered only to households with at least one child age 17 or younger. However, 18-year-old siblings of younger children are indistinguishable from children ages 14-17 in the CCHS 2.2 public-use data because age is identified only in ranges. In the U.S. CPS-FSS data, where age is reported in single years, including or omitting 18-year-old siblings results in only negligible changes in the estimated prevalence of food insecurity in this age range. The coefficient for the intercept (constant) is shown for each reference category and was added to the coefficients for the other variables.

[2] Some of these households included an adult sibling of the child in addition to the child's parent(s). Households that included adults other than the child's parents or siblings were classified as "in other living arrangements."

[3] Includes children living in households with neither parent present, and children living in a household that include one or both parents along with other adults who are not siblings of the child.

[4] Education variables refer to education of the most highly educated adult in the household. Secondary graduation includes high school graduation (or GED in the U.S.), with no further education. Post-secondary graduation includes 2-year-degree holders.

Sources: Canadian Community Health Survey Cycle 2.2 (2004); Current Population Survey Food Security Supplements, 2003-05.

specified as children age 14-17 living with both parents (or a parent and his or her spouse or partner), with income in the middle income adequacy range, living in a household in which the most highly educated adult had completed secondary (high school or GED) but had no further education. The prevalence of children's food insecurity for this reference subpopulation is reflected in the coefficients for each of the reference categories.[20]

Canada-U.S. differences in predicted prevalence rates of children's food insecurity varied somewhat across subpopulations, but all subpopulations had lower prevalence rates in Canada, given the reference characteristics specified in this analysis. The prevalence rates of children's food insecurity for the reference population were 6.6 percent in Canada and 16.3 percent in the U.S.[21] The Canada-U.S. differences were:

- Greater for older children (ages 14-17) than for those ages 13 and younger;

[20] The coefficients shown in other categories were calculated as the sum of the intercept and the regression coefficient for that category. The size of the difference in log-odds depends on the selection of the reference population, but the ranking of differences is invariant to this specification.

[21] Percentages are calculated from log-odds (the metric of the coefficients in the logistic regression) as follows: Percentage = $100/(1+1/\exp(\text{Log-odds}))$.

- Somewhat greater for children in complex living arrangements than for those living with one or both parents and siblings only;

- Considerably greater for those living in households with upper-middle or highest income adequacy than for those with lower incomes; and

- Somewhat greater for those in households in which the most highly educated adult had not completed high school, or had completed high school but had no further education.

Almost all subpopulations of children that can be identified by combinations of characteristics measured in both surveys had lower predicted prevalence rates of food insecurity in Canada than in the U.S. Only for a subpopulation selected to minimize the Canada-U.S. differences in every category in table 9 was the predicted prevalence of children's food insecurity higher, or about the same, in Canada as in the U.S.[22] Estimated prevalence rates of children's food insecurity for that subpopulation—age 3 years or younger, living with one or both parents, lower-middle or lowest income adequacy, most-educated adult a post-secondary graduate or with some post-secondary education—were, in fact, nearly the same in Canada (15 percent) and the U.S. (17 percent). However, that subpopulation comprised only about 1 percent of children in each country.

Robustness of Reported Results

U.S. incomes may, on average, be understated somewhat in the analyses reported here. Household income in the CPS is reported in 14 ranges, and U.S. households were assigned to income adequacy categories based on the midpoint of the range in which they reported their income. However, in the lower half of the income distribution (where food insecurity is most prevalent), the distribution of households within each income category is likely to be concentrated in the upper part of the income range for the category rather than distributed uniformly or symmetrically. The mean income in each range, then, is likely to have been somewhat higher than the midpoint of the range.

The descriptives and regressions were reestimated with income adequacy categories for U.S. households assigned at the three-quarters point of each income range rather than at the midpoint. This resulted in about 4 percent of U.S. respondents moving to the next- higher income adequacy category, but changes in the descriptives were negligible. In the full models, the odds ratios for the *Residence in Canada* variable were 0.656 for adults and 0.566 for children. These were both lower (farther from 1.0) than the corresponding coefficients in the full model reported in tables 4 and 6. These findings strengthen the conclusions that population composition accounted for only a small proportion of the overall Canada-U.S. difference in the prevalence of food insecurity and that differences in income between the two countries acted to reduce the Canada-U.S. difference in food security rather than contributing to the difference. The differences between the Canada and U.S. coefficients when the models were estimated separately did not vary in any important way from those reported in tables 8 and 9.

To examine whether income adequacy categories appeared to be adjusting correctly for household size, a set of dummy variables representing the number of persons in the household was added to the regression models.

[22]This inference depends on the associations reflected in the regression coefficients being purely additive. Interactions among characteristics— interactions that were not modeled in the logistic regression—could reduce the combined association to a value lower than that implied by the sum of the coefficients. Actual prevalence rates in the identified "least different" subpopulation were, however, nearly the same in the two countries, consistent with associations being purely additive, suggesting that effects of interactions were modest at most.

Coefficients on the income adequacy variables did not change appreciably with controls for the number of persons in the household, and the coefficient on the *Residence in Canada* variable was unchanged.

To examine the effects of the imprecise control for income that results from using only five income adequacy categories, the full logistic regression models were reestimated for the U.S. sample using a set of dummy variables for nine income-to-poverty categories in place of the income adequacy variables. Changes in coefficients for non-income variables were modest at most. The differences that were observed suggest that the results reported in table 4 slightly understate the extent to which men living alone and women living alone are at greater risk of food insecurity than couples with no children, overstate the extent to which couples with children are at greater risk of food insecurity than couples without children, and overstate the protective effect of post-secondary graduation.

The main regression analyses for adults were repeated with the dependent variable as very low food security rather than food insecurity. Differences in population composition between Canada and the U.S. contributed more substantially to the differences between the two countries in the prevalence of this more severe condition than to differences in overall food insecurity. About one-third of the Canada-U.S. difference could be accounted for by the greater proportions of more vulnerable populations in the U.S. than in Canada. For very low food security, as for food insecurity, the difference in educational attainment was the main factor favoring Canada, partially offset by less favorable income and employment characteristics. As was true of food insecurity, however, a substantial majority of the national-level difference in the prevalence of very low food security was due to differences between households with otherwise similar characteristics, so far as these were measured in the two surveys.

Conclusions

About 7.0 percent of Canadians and 12.6 percent of U.S. residents lived in food-insecure households in 2004 (an average of 2003-05 for the U.S.). These prevalence rates were calculated by applying the U.S. classification methodology to comparable data in the two countries.[23]

Similarities in Patterns of Food Security

Although the analyses in this report focused on differences in the patterns of food security between Canada and the U.S., in several important respects the patterns were similar. In both countries:

- Food security among adults generally improved with age. The percentage of adults living in households in which one or more adults were food insecure was highest for respondents ages 19-35, declined with age, and was lowest for those ages 66 and older.

- Single parents with children (and children living with a single parent) were more likely to be food insecure than persons in other living arrangements. Men living alone and women living alone also had prevalence rates above the national averages.

- Adults who were unemployed and looking for work or were out of the labor force because of disability were about three times as likely to live in households with adult food insecurity as were those who were employed full time. These associations weakened, but remained substantial, with controls for income, education, age, and living arrangements.

- Persons living in households in which one or more adults had completed a 2-year or 4-year college degree were much less likely to report food insecurity than those living in a household lacking that level of education. Only about half of this association was accounted for by measured differences in income, employment, age, and living arrangements.

Differences in Patterns of Food Insecurity

Differences in food insecurity across subpopulations in Canada and the U.S. provide insight into the types of policies and programs that may support food security. The findings, while not definitive with regard to any specific program or policy, indicate general types of policies and programs that may be influential by identifying subpopulations particularly affected by food insecurity.

About 15 to 20 percent of the Canada-U.S. difference in adult food insecurity and 20 to 30 percent of the difference in children's food insecurity could be a result of lower proportions in the Canadian population of certain subpopulations that are more vulnerable to food insecurity. The primary factors in this regard—indeed, the only aspects of population composition that were found to have contributed substantially to the national-level difference in food security—were education and, for children, living arrangements. The proportion of the population living in a household in which an adult had completed a 2-year or 4-year college degree was higher in Canada than in the U.S. (72 percent vs. 48 percent). A larger proportion of children lived with two parents in Canada than in the U.S. (73 percent vs. 61 percent).

[23]Rates based on the Canadian classification methodology were somewhat higher than those based on the U.S. methodology: 8.7 percent in Canada and 15.5 percent in the U.S. (see appendix A).

Differences in income distribution across income adequacy categories did not contribute to the Canada-U.S. difference in food security. The share of the population in the lowest income adequacy category was larger in the U.S. than in Canada, but so was the share in the highest category. These two factors were offsetting, and, on balance, the difference in income distribution reduced, rather than contributed to, the overall national-level difference.

The findings with regard to pretax income and income distribution have several implications. First, those findings, along with similar findings on employment, suggest that differences in employment and earning opportunities in the economies of the two countries were not responsible for the Canada-U.S. difference in food security. Using a more detailed measure of income might change this inference somewhat. But the change is unlikely to be large enough to reverse the associations observed in this study. Those associations imply that existing differences in the distribution of pretax income acted, on net, to reduce differences in food insecurity between the two countries. Any effects of differences in taxation policies—and thus, of differences in post-tax income—could not be examined using these data.[24]

The findings with regard to income also suggest, with some caveats, that differences in cash assistance programs were not responsible for any substantial proportion of the Canada-U.S. difference in food security.[25] Both the Canadian and U.S. surveys intended for any cash assistance to be included in the reported household income. The overall Canada-U.S. difference in food security was due to differences in food security *within* income adequacy categories, and, most markedly, within the middle- and upper-middle income adequacy categories, above the income range of most cash assistance recipients. A caveat is that cash received from an assistance program may be overlooked by some households when they report income in household surveys. A second caveat is that cash-like assistance administered through the tax system (such as tax credits) may or may not be reflected in cash income reported by a household. Both surveys intend to elicit pretax income, which would not include such resources, but it is not clear to what extent household reporting was consistent with this intent.

Similarly, pretax income findings suggest that the lower prevalence of food insecurity among the elderly population (ages 66 and older) in Canada compared with the U.S. did not result from differences in pensions (public and private combined).[26] Those, too, should have been included in households' reported cash income, which was controlled in the regression analyses, and such income is probably less likely than cash assistance to have been overlooked by respondents when they reported their income. Possible effects of differences in tax policies on elderly individuals' sources of income could not be examined in these data.

Most of the Canada-U.S. difference in food insecurity reflected differences between the two countries in rates of food insecurity for households with similar characteristics (so far as they could be measured in both of the surveys analyzed). Reasons for the generally lower rate of food insecurity in Canada cannot be determined from information collected in these surveys. A complete explanation will need to be consistent with at least six prominent patterns observed in the study:

[24]A possible complicating factor in comparing income effects on food insecurity is that the purchasing power parity index is based on average consumption weights and may not adjust purchasing power to parity for low-income households. This is beyond the scope of this report, but could be a fruitful area for further investigation.

[25]It is possible that differences in cash assistance offset differences in income from other sources. Data were not available to separately identify these sources.

[26]It is possible that differences in pension income could contribute to differences in food insecurity of the elderly, but be offset by differences in income from other sources. Data were not available to separately assess these effects.

1. The Canada-U.S. differences—holding other factors constant—were greatest for persons living in households with pretax incomes in the upper-middle income adequacy range (and, for children, in the highest income adequacy range). In the two lower income adequacy ranges, Canada-U.S. differences were smaller for children and reversed (i.e., lower prevalence of food insecurity in the U.S.) for adults.

2. Food insecurity was less prevalent in Canada than in the U.S. for households lacking a high school graduate. This was in addition to any indirect effects mediated through income and employment, which were controlled in the regression models.

3. Food insecurity was generally more prevalent in Canada than in the U.S. for men or women living alone, net of the effects of income, employment, age, and education.

4. Food insecurity of adults was less prevalent in Canada than in the U.S. across the entire age range, and the gap increased with age. The differences persisted with controls for income, employment, living arrangements, and education, except that in the youngest age range (19-24 in the regression model), the prevalence of food insecurity was essentially identical in the two countries.

5. Food insecurity among adults ages 66 and older was considerably less prevalent in Canada than in the U.S. Both countries provide publicly funded health insurance for this population, and any differences in public and private pension income should have been reflected in income, which was controlled in the regression models.

6. Food insecurity among children was less prevalent in Canada than in the U.S. in all age ranges and in virtually all subpopulations that could be identified by cross classification of economic and demographic variables available in both surveys.

Further research is needed to investigate factors that may account for these patterns. Questions suggested by these patterns include the following:

- **Do income and employment stability/volatility differ between the countries?** Analyses reported here used annual income, usual employment, and reference-week unemployment. But both income and employment can change substantially and frequently during the year. The extent of instability in income and employment may also affect food security.

- **Does the lower prevalence of food insecurity among unemployed workers in Canada than in the U.S. (other factors equal) result from differences in programs that support unemployed workers and employment transitions?**

- **Does government-provided universal health insurance in Canada contribute to that country's lower prevalence of food insecurity?** This might be suggested by several patterns: (1) the pervasiveness of the Canada-U.S. difference; (2) the smaller difference for younger adults, for whom medical costs are likely to be smaller; (3) the lower prevalence of food insecurity among adults who were working part time in Canada compared with those in the U.S. Part-time workers in both countries are

less likely than full-time workers to be covered by employer-provided health insurance, but in Canada the difference for part-time workers is in supplemental coverage, while in the U.S. it is often in overall coverage; and (4) the smaller difference in the prevalence of food insecurity in the lowest income range, because many U.S. households in that range are eligible for Medicaid. On the other hand, the Canada-U.S. difference in food insecurity is, proportionally, rather large for persons age 66 and older—a range in which both governments provide health insurance.

- **Does the lower prevalence of food insecurity in the U.S. than in Canada among adults in the lowest and lower-middle income adequacy categories (holding constant other factors) reflect, in part, the larger role of means-tested, in-kind assistance programs in the U.S. than in Canada?** Compared with Canada, the U.S. provides a larger share of means-tested benefits for low-income households through in-kind programs, such as food and nutrition assistance programs (the Supplemental Nutrition Assistance Program, formerly known as the Food Stamp Program; the National School Lunch and School Breakfast Programs; and the Special Supplemental Nutrition Program for Women, Infants and Children (WIC)), and programs for housing and energy assistance. The Canadian Government provides assistance to low-income households primarily in the form of income supports rather than in kind.[27] If money received through such cash assistance programs is included in reported income (as intended by the surveys), it may increase reported income rather than improve food insecurity within an income level.

- **To what extent do differences in tax and tax credit policies affect food security differently in the two countries?**

- **Do patterns of extended family relationships and support differ between the two countries, and do these account for any of the difference in food insecurity?** Data were not available to investigate this factor, but it should be kept in mind as a potential contributing factor, distinct from policies and programs.

Food security measurement in these two similarly industrialized countries provides an opportunity to explore the effects of national-level economic and social programs and policies. Differences in such programs and policies between countries, in combination with a measure of well-being with regard to a basic need like food security, may provide research tools for better understanding the effects of these programs and policies.

[27]The Canadian and Provincial governments also provide some forms of means-tested assistance in kind, such as subsidized housing and prescription drugs, and the U.S. and State Governments provide some assistance in the form of income supports, such as through the Temporary Assistance for Needy Families program. Overall, however, in-kind assistance is a substantially larger share of means-tested assistance in the U.S. than in Canada.

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Appendix A: Food Security Classification Used by Health Canada

Differences in measurement methods must be taken into account to meaningfully compare published food security statistics in Canada and the United States. The food security questions in the U.S. Current Population Survey Food Security Supplement (CPS-FSS) and the Canadian Community Health Survey Cycle 2.2 (CCHS 2.2) are essentially identical, but the way in which responses are combined to assign food security status, and the language used to describe ranges of severity of food insecurity, differ somewhat between the two countries.

In this report U.S. methodology was applied to data from both countries, so results are fully comparable between them. This appendix provides information that researchers will need in order to compare published U.S. statistics with those published by Health Canada (or by other researchers who use the Health Canada methodology). Researchers should also be aware that most food security research conducted in Canada prior to the 2007 Health Canada report used the U.S. classification methodology. When interpreting research results or prevalence statistics from Canadian surveys, it is important to determine which method was used.

The CCHS 2.2 food security questions were adapted from the 18-item U.S. Household Food Security Survey Module (HFSSM), which has been used as the basis of food security monitoring in the U.S. since 1995. Only minor changes in the wording of questions were made to adapt the HFSSM to the CCHS 2.2 survey context. Analysis of response data using statistical methods based on the Rasch measurement model confirmed that the questions were understood consistently and similarly in the two countries (Health Canada, 2007, Appendix B.3).

Both Health Canada and USDA determine the food security status of surveyed households based on the number of food-insecure conditions that households report in response to the questions in the HFSSM. There are two primary differences between the methods used by Health Canada and USDA:

- Health Canada assesses the food security of adults and children separately, using an adult scale and a child scale. For many monitoring and research applications, either scale may be used independently. Alternatively, the food security status of households with children may be characterized using information from both scales. If either adults or children (or both) in the household are food insecure, the household is classified as food insecure. If either adults or children (or both) in the household are severely food insecure, the household is classified as severely food insecure. The U.S. method combines the adult and child items in a single household scale.[1] Applied to the same data and absent any other changes, the Health Canada method would produce a somewhat lower estimate of the prevalence of food insecurity than the U.S. method.

- Health Canada classifies households as having adult food insecurity if the household reports two or more food-insecure conditions on the adult scale. This is less stringent than the corresponding threshold—three or more food-insecure conditions—in the U.S. method. Households that report two food-insecure conditions among adults and none among chil-

[1] U.S. researchers, including those at USDA, also use separate adult and child food security scales for many research purposes, but the measure used for official monitoring by USDA combines the adult and child items in a single, 18-item household scale.

dren would be classified as food insecure by the Health Canada method, but food secure by the U.S. method. This difference, absent any other changes, would result in somewhat higher prevalence rates of food insecurity, as measured by the Health Canada method compared with measurement by the U.S. method.

The effects of these two methodological differences are partially offsetting in households with children. Overall, and among households without children, the Health Canada methodology results in higher prevalence rates of food insecurity than the U.S. methodology.

Measurement of the more severe range of food insecurity (described as "severe food insecurity" by Health Canada and "very low food security" by USDA) is affected only by the first methodological difference. At the national level, the effect is slight, but effects may be substantial, and substantially different, for households with only very young children and for those with teenage children.[2]

Children's food security is measured by Health Canada using the same methods as those used by USDA—two or more affirmative responses indicate food insecurity among children, and five or more indicate severe food insecurity among children (described as "very low food security" by USDA).

The effects of the methodological differences on food security prevalence estimates were examined by applying both the Health Canada methodology and the U.S. methodology to the food security data from each country. Applying Health Canada methods to the U.S. CPS-FSS data resulted in a higher estimated prevalence of household food insecurity by about 3 percentage points and adult food insecurity by about 4 percentage points (table A-1). These figures represent increases in the estimated numbers of food-insecure persons of about 25 and 40 percent, respectively. The effect on household-level very low food security

[2]The U.S. method is known to bias comparisons among households with children of different ages, whereas the Health Canada method will avoid these biases (Nord, 2002; Nord and Bickel, 2002).

Table A-1
Percentage of persons living in households with food insecurity and very low food security: Comparison of estimates based on U.S. and Health Canada methods

Type of Analysis	Food insecure		Very low food security (described as severely food insecure by Health Canada)	
	Canada	U.S.	Canada	U.S.
Household food security	Percent of persons			
U.S. method	7.0	12.6	2.4	3.6
Health Canada method	8.7	15.5	2.4	3.7
Adult food security[1]	Percent of adults			
U.S. method	6.2	9.5	2.4	3.4
Health Canada method	8.1	13.4	2.4	3.4
Child food security[1]	Percent of children			
U.S. method	5.3	9.9	.44	.72
Health Canada method	5.3	9.9	.44	.72

[1] U.S. and Health Canada use identical methods for determining child food security status and adult very low food security (severe food insecurity).

Data sources: Canadian Community Health Survey Cycle 2.2 (2004); Current Population Survey Food Security Supplements, 2003-05.

(Canadian severe food insecurity) was slight—less than 0.1 percentage point. Differences between the methods when both were applied to the Canadian CCHS 2.2 data were smaller in percentage points, but similar proportionally. Health Canada and USDA use identical methodologies to assess food insecurity and severe food insecurity of children and severe food insecurity among adults.[3]

Prevalence statistics based on the household scale add relatively little information not conveyed by separate presentation of statistics based on the adult scale and child scale. In this report, therefore, statistics based on the household scale are reported only at the national level for the two countries. All subpopulation analyses are based on the adult food security scale or the children's food security scale.

[3]USDA does not routinely publish statistics based on adult food insecurity for households with children, but the methodology for this measure is specified for households with no children present and can also be applied to households with children. The measure is widely used in research in the U.S., and adult food security status based upon it is provided in several public-use data products, including the CPS-FSS (beginning with the December 2005 data), the National Health and Nutrition Examination Survey (NHANES) and the Early Childhood Longitudinal Studies kindergarten and birth cohorts (ECLS-K and ECLS-B).

Appendix B: Measurement of Food Security and Demographic and Economic Characteristics

In order to achieve unbiased estimates of food insecurity associations with demographic and economic characteristics of individuals and households, it was important to use measures of these characteristics that were identical, or as nearly identical as possible, in the two surveys. This appendix describes the calculation of variables used in the descriptive and multivariate analyses from the data elements available in the CCHS 2.2 and the CPS-FSS. Variable names are those in the public-use data sets. Percentages of adults and children with each characteristic in the Canadian and U.S. analysis samples are provided in tables B-1 and B-2.

Food Security

CCHS 2.2—The food security status of Canadian households was based on responses to the 18 questions in the food security module (FSCD_020—FSCD_160). Standard U.S. methods were used as described in Bickel et al. (2000), and Nord and Bickel (2002). Items with missing responses ("don't know" or "refused") were imputed as negative responses ("no" or "never"), provided that the respondent gave valid answers to other food security questions. Less than 1 percent of all cases had any item-specific nonresponse. Cases with no valid responses to any of the questions in the food security scales (about 0.2 percent) were omitted from all analysis.

CPS-FSS—The food security status of U.S. households was provided by HRFS12M1. Children's food security status was provided by HRFS12MC in 2005. In 2003 and 2004, a raw score of 2-4 on the child scale (HRFS12M6) was classified as low food security among children and a raw score of 5-8 as very low food security among children. Adult food security status was provided by HRFS12M8 in 2005. In 2003 and 2004, adult food security status for households without children was provided by HRFS12M1; for households with children, the raw score on the adult scale was calculated by subtracting the raw score on the child items (HRFS12M6) from the total raw score on all adult and child items (HRFS12M3). Classification was then based on the standard methods used for households without children (Bickel et al., 2000).

Age and Child/Adult Status

CCHS 2.2—Age in years is available only in ranges in the CCHS 2.2 (DHHDGAGE). People in the lowest three ranges (through age 13) were unambiguously children. Those aged 14-18 were classified as children provided their living arrangement (DHHDGLVG) identified them as a child, and provided the child food security questions were administered to the household. (The child questions were only administered if there was at least one child age 0-17 in the household. This will have resulted in a small number of 18-year-olds being classified as children because they were an adult child of an adult in the household and had a younger sibling for whom the food security questions were administered. Analysis of CPS-FSS data suggested that the number of such cases is very small and that the food security status of such households is similar to that of households with minor children).

Table B-1

Characteristics of adults[1] and their households in Canadian and U.S. food security analysis samples

Characteristic	Canada	U.S.
	Percent	
Food insecurity (self or other adult in household)	6.2	9.4
Age 19-24	11.2	11.2
Age 25-35	18.6	20.4
Age 36-45	21.7	20.6
Age 46-55	20.4	19.2
Age 56-65	13.2	13.3
Age 66 or older	14.9	15.4
Male living alone[2]	5.9	6.1
Female living alone[2]	8.3	8.0
Male or female with spouse or partner only[3]	27.6	28.4
Couple (married or cohabiting) with one or more child[4]	23.9	22.7
Single male with one or more child[4]	0.6	1.5
Single female with one or more child[4]	2.3	1.5
Other male	16.6	16.5
Other female	14.8	15.3
Lowest income adequacy	2.9	4.2
Lower-middle income adequacy	5.5	6.2
Middle-income adequacy	18.6	15.3
Upper-middle-income adequacy	32.3	20.8
Highest income adequacy	31.4	33.9
Income not reported	9.2	19.6
Employed full time	55.2	54.0
Employed part time	18.8	17.2
Unemployed (looking for work)	9.9	10.4
Disabled, not in labor force	4.4	3.4
Retired, not in labor force	3.8	4.5
Not in labor force for other reasons	7.9	10.6
Education less than secondary graduation[5]	10.2	7.8
Education secondary graduation[5]	5.2	14.0
Education some post-secondary[5]	6.8	19.5
Education post-secondary graduation[5]	70.0	48.1
Number of cases (unweighted)[6]	20,177	140,340

1 Adults age 19 and older were the units of analysis.

2 No other person lived in these households.

3 These are two-person households.

4 No other adults lived in these households unless they were an adult child of the individual in the sample.

5 Education variables refer to education of the most highly educated adult in the household. Secondary graduation includes high school graduation (or GED in the U.S.), with no further education. Post-secondary graduation includes 2-year-degree holders.

6 Number of cases shown for the U.S. sample is the number of households, some of which included more than one adult.

Sources: Canadian Community Health Survey Cycle 2.2 (2004); Current Population Survey Food Security Supplements, 2003-05.

Table B-2

Characteristics of children and their households[1] in the Canadian and United States food security analysis samples

Characteristic	Canada	U.S.
	Percent	
Food insecurity (self or other child in the household)	5.3	9.9
Age 0-3	18.7	21.8
Age 4-8	25.9	26.9
Age 9-13	28.9	28.2
Age 14-17	26.4	23.0
With two parents[2]	73.3	61.4
With single parent[2]	14.0	14.9
In other living arrangements[3]	12.7	23.7
Lowest income adequacy	2.2	6.2
Lower-middle income adequacy	7.9	8.6
Middle income adequacy	20.8	20.0
Upper-middle income adequacy	28.5	16.2
Highest income adequacy	29.4	33.4
Income not reported	11.2	15.5
Education less than secondary graduation[4]	5.3	9.1
Education secondary graduation[4]	13.5	25.0
Education some post-secondary[4]	7.5	18.8
Education post-secondary graduation[4]	73.7	47.0
Number of cases (unweighted)[5]	14,190	48,683

[1] Children ages 0 to 17 were the units of analysis and food insecurity (low or very low food security) among children was the dependent variable. There were 105,721 observations, but the U.S. observations were down-weighted to the number of households, resulting in an effective N for the combined Canada-U.S. sample (used to calculate variances) of 62,873. The Canadian sample includes a small proportion of 18-year-olds. In both countries, the child-referenced food security questions were administered only to households with at least one child age 17 or younger. However, 18-year-old siblings of younger children are indistinguishable from children ages 14-17 in the CCHS 2.2 public-use data because age is identified only in ranges. In the U.S. CPS-FSS data, where age is reported in single years, including or omitting 18-year-old siblings results in only negligible changes in the estimated prevalence of food insecurity in this age range.

[2] Some of these households included an adult sibling of the child in addition to the child's parent(s). Households that included adults other than the child's parents or siblings were classified as "In other living arrangements."

[3] Includes children living in households with neither parent, and children living in households that include one or both parents along with other adults who are not siblings of the child.

[4] Education variables refer to education of the most highly educated adult in the household. Secondary graduation includes high school graduation (or GED in the U.S.), with no further education. Post-secondary graduation includes 2-year-degree holders.

[5] Number of cases shown for the U.S. sample is the number of households with a child, some of which included more than one child.

Sources: Canadian Community Health Survey Cycle 2.2 (2004); Current Population Survey Food Security Supplements, 2003-05.

CPS-FSS—The age of each person in the household is provided by PEAGE (PRTAGE in some data formats). Individuals ages 0-17 were classified as children provided they were not the household reference person, spouse of the household reference person, or an unmarried partner of the reference person.

In both data sets, individuals not classified as children were classified as adults. However, 18-year-olds were omitted from the regression analyses because there was some possibility of difference in classification between the two data sources.

Living Arrangements

CCHS 2.2—Living arrangements of each individual were based on DHHDGLVG. Single parents with children, unattached individuals living alone, and (in some analyses) "other" adults were further classified by sex based on DHHD_SEX.

CPS-FSS—Living arrangements were assigned consistent with those in CCHS 2.2, based on aggregating information from all individuals in each household, using variables PERRP, PESPOUSE, PESEX, PEAGE, PEMARITL, PEPARENT, PRFAMREL, PRFAMNUM, and PRFAMTYP. SAS code is available from the lead author.

Income Adequacy

CCHS 2.2—Classification by income adequacy is provided by INCDDIA5 and refers to total income from all sources for the 12 months preceding the survey.

CPS-FSS—Household income was assigned at the midpoint of the "Control card" income range (HUFAMINC), converted to 2004 dollars based on CPI-U, and then converted to Canadian dollars based on the Purchasing Power Parity Index for 2004 (1.23). That income, along with the number of persons living in the household, was used to assign income adequacy consistent with Statistics Canada criteria. Control card income is income from all sources for the 12 months prior to the household's first of four monthly surveys. It is updated 12 months later when they reenter the sample for four additional monthly surveys. In the December CPS-FSS, then, it represents income for 12 months ending in the current month, or at most 3 months earlier.

In both surveys, households that did not report income were treated as a separate category in both descriptives and multivariate models. Prevalence rates of food insecurity and coefficients in regression models suggest that households that did not report income were, on average, in the upper-middle income adequacy category.

Employment and Labor Force Status

CCHS 2.2—Individuals with LBFDDWSL = 1, 3, or 99 were classified as employed full time if LBFDDPFT = 1 or 9 and as employed part time otherwise. Those with LBFDDWSL = 2 or 4 were classified as unemployed (looking for work). Those with LBFDGRNW = 1 were classified as not in the labor force due to disability. Those with LBFDGRNW = 5 or 96 or older than 75 were classified as not in the labor force, retired. (CCHS 2.2 does not provide employment and labor force information for individuals older than 75.) Individuals not otherwise classified were classified as not in the labor force for other reasons.

CPS-FSS—Employment and labor force status were based on PEMLR, PRWKSTAT, and PEAGE. Individuals with PEMLR = 5 or older than 75 were classified as not in the labor force, retired. Otherwise, those with PRWKSTAT = -1, 2, 3, 4, or 5 were classified as employed full time, and those with PRWKSTAT = 6, 7, 8, 9, or 10 were classified as employed part time. Otherwise, those with PEMLR = 3 or 4 were classified as unemployed

(looking for work); those with PEMLR = 6 were classified as not in the labor force due to disability, and those with PEMLR = 7 were classified as not in the labor force for other reasons.

Education

CCHS 2.2—The educational attainment of the most highly educated adult in the household was provided by EDUDDH04.

CPS-FSS—All persons in the household were classified based on the adult in the household with the highest value on PEEDUCA, as follows: 31-38 = Less than secondary school graduation; 39 = Secondary school graduation; 40 = Some post-secondary (no diploma or degree); 41-46 = Post-secondary graduation.