A National View of Household Food Insecurity: An Analysis of the Canadian Community Health Survey, Cycle 2.1.

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"Another world is not only possible, she's on her way. Maybe many of us won't be here to greet her, but on a quiet day, if I listen very carefully, I can hear her breathing." Arundhati Roy, 2002.

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List of Acronyms Used

AOR	Adjusted Odds Ratio
CAP	Canada Assistance Plan
CHST	Canada Health and Social Transfer
LICO	Low Income Cut Off
DALY	Daily Adjusted Life Year
CFS	Community Food Security
CAPFS	Canada's Action Plan for Food Security
WFS	World Food Summit
FAO	Food and Agriculture Organization of the United Nations
RDA	Recommended Dietary Allowance
CCHIP	Community Childhood Identification Project Hunger Index
NPHS	National Population Health Survey
FSM	Food Security Module
CCHS	Canadian Community Health Survey
BMI	Body Mass Index
PUMF	Public Use Microdata File
CAI	Computer Assisted Interview
CATI	Computer Assisted Telephone Interview
CAPI	Computer Assisted Personal Interview

1. Introduction

Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life (Rome Deceleration of World Food Security, 1996). The most recent report on food insecurity shows that an estimated 3.7 million Canadians (14.7% of the population) nationwide experienced food insecurity in 2000-2001 (Ledrou & Gervais, 2005). Ledrou & Gervais (2005) reported seven percent of Canadians experienced the most severe form of food insecurity: they or someone in the household did not have enough to eat because of a lack of money. Since 1989, there has been an increase of more than 184, 309 hungry children and a 118% increase in the use of food banks throughout Canada (Canadian Association of Food Banks, 2005).

Canada recognized the importance of food security in April 2005 by voting in favour of the UN Commission on Human Rights 'right to food resolution'. This pledge supports a previous commitment that includes Canada's signing of The Rome Declaration on World Food Security along with 186 other countries in 1996. Signing this non-binding treaty galvanized the Canadian government into action and resulted in the creation of Canada's Action Plan for Food Security (1998) and a government branch called the Food Security Bureau. However, after several years, food security conditions have failed to improve throughout Canada.

Food security is recognized as an important determinant of health (McIntyre, 2004; Public Health Agency of Canada, 2005). Numerous studies note the relationship between inadequate nutrient intake, poor health and food insecurity (Kendall, Olson and Frongillo, 1996; Rose & Oliveira, 1997a; Rose, 1999; Tarasuk and Beaton, 1999; Klesges, Pahor, Shorr et al., 2001; McIntyre, Glanville, Raine et al., 2003; Olson, 1999; Hamelin, Habicht and Beaudry, 1999; McIntyre, Connor and Warren, 2000; Sarlio-Lahteenkorva and Lahelma, 2001; Che and Chen,

2001; Rainville and Brink, 2001; Alamio, Olson and Frongillo, 2001a; Townsend, Peerson, Love et al., 2001; Vozoris and Tarasuk, 2003; Stuff, Casey, Szeto et al., 2004; Casey, Szeto, Robbins et al., 2005). A growing body of empirical research examining the negative associations between food insecurity and well-being signifies the emergence of food security as a public health concern. Further, the negative cost externalities associated with the effects of food insecurity may contribute to rising health care costs. In order to improve the health of Canadians, it is imperative that conditions of food insecurity throughout the country are well understood. A population health approach, addressing determinants of health such as food insecurity has the potential to reduce material and social inequalities within the population and improve overall health outcomes (Public Health Agency of Canada, 2005). For these reasons, the following research questions are examined:

1. What is the prevalence and distribution of household food insecurity in Canada?

2. What associations exist between household food insecurity and household level sociodemographic characteristics?

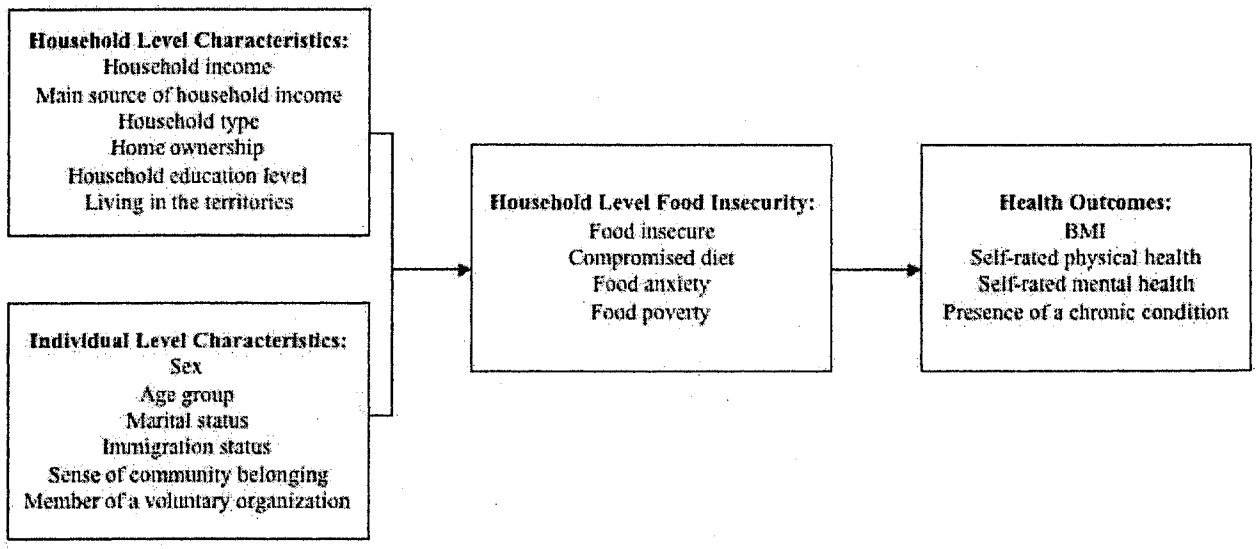
3. What associations exist between household food insecurity and individual level socio-demographic and other selected characteristics?

4. What is the likelihood of experiencing selected health outcomes based on each dimension of household food insecurity status?

The conceptual framework developed for this research encompasses both household and individual level characteristics, and seeks to establish relationships among these variables, food insecurity and health outcomes (Figure 1.1). The variables included in this model are of interest because of their previously documented relationships with food insecurity and hypothesized associations (Che and Chen, 2001; Rainville and Brink, 2001:Vozoris and Tarasuk, 2003). Household level sociodemographic characteristics and individual level characteristics are

examined as potential explanatory variables for household level food insecurity. Household food insecurity is measured via four different dimensions: *food insecure, compromised diet, food anxiety* and *food poverty*. Each dimension is then examined in relation to selected health outcomes.

Figure 1.1. Conceptual framework of household food insecurity and its relation to selected household and individual level characteristics and selected health outcomes.



The body of this analysis contains five sections. A thorough review of the food security literature outlines background topics such as the socio-political context of food insecurity in Canada as well as the conceptualization of food security. A chronological evaluation of the tools used to measure food insecurity is conducted and the current gold standard measure is reviewed. Results of the analysis are then presented to showcase the associations of food insecurity in relation to sociodemographic, health and psychosocial characteristics. Research findings are discussed relative to the research questions answered and those that are raised.

2. Literature Review

2.1 The Socio-Political Context of Food Insecurity in Canada

2.1.1 The Welfare State

The post World War II era in Canada was the first time that the concept of a comprehensive social security system was introduced (Guest, 1997). By the mid 1960s, Canada had a strong social security system and myriad social programs in place. Reinforcement of these programs was achieved by establishing the Canada Assistance Plan (CAP), a federal cost-sharing scheme with the provincial governments, espousing the principles of the right to adequate and dignified benefits (Guest, 1997; Riches, Buckingham, MacRae et al., 2004). Obligations under CAP required provinces to make welfare assistance available to all in need, with no minimum waiting period or residency requirements. The replacement of the CAP in 1996 with the Canadian Health and Social Transfer (CHST), essentially gave provincial authorities autonomy over allocation of funds for health, education and social programs and subsequently eliminated federal monitoring of national welfare assistance standards and rights (Riches et al., 2004). Since CHST's introduction, several provincial policies have directly violated pre-existing terms of CAP, such as the introduction of a three week waiting period in BC for welfare (Riches et al., 2004). Other significant changes to social security programs throughout the 1990's have further weakened Canadians' social safety net:

- Unemployment Insurance reform – now known as Employment Insurance, resulting in an overall decreased number of workers eligible for benefits (75% in 1990 vs. 38% in 2001), and decreased benefit levels and reduced benefit periods;
- Decreased federal transfers for education, social services and health care;
- The 'claw back' of the National Child Benefit in several provinces;

- Disproportional increase in Federal taxation on low-income Canadians; and,
- Cancellation of federal social housing programs

(Dietitians of Canada, 2005)

The introduction of welfare reform in the mid 1980's has failed to provide basic needs to citizens of Canada (Riches, 1999). Currently, no province or territory in Canada has social assistance or minimum wage rates set at or above the *low-income cut-off* (LICO; Canadian Association of Food Banks, 2005), which equates to $28, 870 (net income) for a four-person family in a large Canadian city (Canadian Council on Social Development, 2000). The LICO standard is widely recognized as the de facto poverty line in Canada (Hunter and Miazdyck, 2003). Research has shown that those working at minimum wage or on social assistance do not have an adequate income to purchase food that contributes to a healthy diet (Dietitians of Canada BC Region, 2002; Vozoris and Tarasuk, 2002).

The weakening of social security programs and increasingly severe economic vulnerability led to the opening of the first food bank in Edmonton in 1981. Since then, there has been a steady rise in the number of charitable programs providing basic needs to citizens. Between 1997 and 2002, 1,800 new food banks opened in Canada (Wilson and Tsoa, 2002 cited in McIntyre, 2004). Once established as a stopgap measure, food banks have now become an institutionalized, charity driven social program in every province and territory in Canada, relieving the government of its duties to provide basic needs to its citizens (Riches et al., 2004).

2.1.2 The Right to Food

An important concept in the food security dialogue is 'the right to food'. The right to food as defined by Eide (cited in Reddekopp, 1999) contains three items: to respect, to protect and to fulfill. Riches et al. (2004) outline 3 reasons as to why Canada should respect the right to food:

Canadians pride themselves on human rights, Canada has signed international obligations to this effect, and, Canada is still food insecure despite its wealth (Riches et al., 2004).

There is little agreement in defining the right to food internationally and determining associated legal obligations. In fact, there has been a resistance to thinking of food as a right (Reddekopp, 1999). Historically, the International Covenant on Economic, Social and Cultural Rights (1966) can be interpreted as the first document to declare food as a right. Ratified in Canada in January 1976, Article 11 "recognize(s) the right of everyone to an adequate standard of living for himself and his family, including adequate *food* (emphasis added), clothing and housing, and to the continuous improvement of living conditions" (p. 4). More recently, the International Ottawa Charter for Health Promotion, signed by Canada in 1986, outlined food as a basic prerequisite to improve health, further suggesting that health promotion should aim to counteract the pressures of bad nutrition (Ottawa Charter for Health Promotion, 1986). Moreover, defining the right to food was recognized as a problem at the World Food Summit in Rome and was included as objective 7.4 of the 'Plan of Action' which states the need "to clarify the content of the right to adequate food and the fundamental right of everyone to be free from hunger" (Rome Declaration on World Food Security, 1996, p. 32).

In total, there have been an extensive number of documents confirming a commitment to food security and related issues such as rights of children:

- International Covenant on Social Economic and Cultural Rights (1976);
- Charter of Rights and Freedoms (1982);
- World Declaration on Nutrition (1992)
- Convention on the Rights of the Child (1992);
- World Summit for Social Development (1995);
- Declaration on World Food Security (1996);
- Canada's Action Plan for Food Security (1998);
- Quebec's Act to Combat Poverty and Social Exclusion (2002);

- Declaration on World Food Security – Five Years Later (2002);
- UN Commission on Human Rights, 'Right to Food Resolution' (2005); (Riches, 2002; Riches et al., 2004).

Inspite the signing of these national and international agreements, Canada has yet to fulfill its commitments to providing the basic needs of Canadian citizens.

Furthermore, the overwhelming number of federal statutes that affect food insecurity (Reddekopp, 1999) demonstrates the disjointed nature of food policy in Canada (Riches, 2004). In addition, several authors have argued that the prevalence rates of food insecurity in Canada are proof that legislation and policy are failing (Riches et al., 2004; Quebec's Act to Combat Poverty and Social Exclusion, 2004). Given the international and national commitments Canada has signed, the right to food has been recognized; yet, there is no federal legal framework or coherent implementation strategy to realize a food secure Canada (Riches et al., 2004).

Despite the difficulty of establishing the right to food in Canada, it has happened elsewhere. In 1992, the Municipality of Belo Horizonte in Brazil declared their position on food security: *"All Citizens have the right to adequate quantity and quality of food throughout their lives, and it is the duty of governments to guarantee this right"* (SMAB, 2005). This position statement has guided numerous policies, programs and government officials towards successfully improving food security in Belo Horizonte (Rocha, 2001). In 2002, Luiz Inacio Lula da Silva, President of Brazil, implemented a nation-wide food security program called *Fome Zero* or *Zero Hunger.* The following statement highlights the commitment of the government of Brazil in recognizing the right to food.

> *"We will make it possible for people in our country to eat three square meals a day, every day, with no need for hand-outs from anyone. Brazil cannot go on living with so much inequity. We must overcome hunger, extreme poverty and social exclusion. Our war is not to kill anyone, it is to save lives."* (Ministry of Social Development and Hunger Alleviation, n.d.).

2.1.3 The Role of Food Policy in Pubic Health

Health disparities in Canada continue to increase in parallel with growing income inequality. Based on a population health perspective, a recent report by the Health Council of Canada (2005) recommends that sectors outside of health need to engage in order to shrink the health disparity gap. An immediate weakness identified in the food policy literature is the growing divide between food policies, public health policies and health promotion (Coveney, 2003). For example, health promotion has driven efforts to change individual behaviour and lifestyle choices putting an increasing burden on the individual (Coveney, 2003; Yeatman, 2003; Caraher and Coveney, 2004). Analysts argue that focusing on individual behaviours actually diverts attention from existent determinants, such as the social environment (Caraher and Coveney, 2004), and that this is where interventions should be aimed (Marmot, 1998).

Advocates argue that food policy should be designed to make social infrastructure conducive to good food choices or to make healthy choices easy choices (Coveney, 2003; Caraher and Coveney, 2004). But in order to make either of these situations plausible, the following issues must be addressed: issues of who controls the food supply and who influences the food chain choices at the community (Coveney, 2003; Caraher and Coveney, 2004). The idea of creating upstream policy solutions in food is similar to early work accomplished by those working in health promotion vis-à-vis tobacco. Moreover, it is estimated that the cost of poor nutrition is actually greater than that of smoking, calculated using daily-adjusted life years (DALYs) at 9.7% and 9.0% respectively (cited in Caraher and Coveney, 2004). The negative cost externalities associated with current food systems place the economic burden on nation states. Examples of negative externalities include: health care costs due to the negative health consequences associated with energy dense high fat diets, environmental impacts via land degradation, food transportation, packaging, and pollution associated with transportation of food (Caraher and

Coveney, 2004). Such negative externalities support the need for related food policies concerning public health. For example, the taxation of foods that are high fat and energy dense has been suggested because of the causal association between fats, sugar and obesity (Darmon and Drewnowski, 2004). Potential positive effects of this 'obesity tax' could drive consumers to choose healthier products by narrowing the cost gap. However, negative consequences of this policy that are important to consider include the potential for further societal alienation of those who are already food insecure and unable to purchase satisfying food items or food items that achieve a social norm.

Although it is recognized that upstream policy development is needed, downstream community action is also necessary for the success of any upstream policy (Yeatman, 2003; Bellows and Hamm, 2003). Yeatman (2003) found that policies are more likely to succeed if individuals in power are able to mobilize support at the grassroots level. This provides strong caution against imposing only a top-down policy agenda. Instead, synergistic efforts of upstream and downstream solutions appear to create the most effective changes in food policy. Potential solutions offered in the literature for steering food policy include: increases in real incomes; addressing affordable housing and daycare; poverty reduction through improved access to employment programs, health care and recreation; protection for the affordability of food; and a hunger and food security monitoring system (McIntyre, 2003; Caraher and Coveney, 2004).

2.2 What is Food Insecurity?

2.2.1 Characterization of Household and Individual Level Food Insecurity

Food insecurity can be understood as the circumstances in which the availability of nutritionally adequate and safe foods, or the ability to acquire food in socially acceptable ways is limited and uncertain (Andersen, 1990). Current understanding of household and individual food insecurity derives from predominantly qualitative research focusing on low-income families

(Radimer, Olson and Campbell, 1990; Tarasuk and MacLean, 1990; Campbell, 1990; Hamelin, Habicht and Beaudry, 1999; Kendall, Olson and Frongillo, 1995; Radimer, Olson, Greene et al. 1992). Influential work carried out by Radimer and colleagues from Cornell University during the 1980s and early 1990s has largely shaped the present understanding of the complex and multi-dimensional phenomenon known as food insecurity. The primary focus of their research was to develop indicators and an operational definition to directly measure the occurrence and severity of hunger (Radimer et al., 1992). Based on qualitative analysis of women's descriptions of hunger, they proposed two levels of food insecurity: individual and household. Each of these levels has four components: quantitative, qualitative, psychological and social as summarized in Table 2.1.

Table 2.1. Levels and components of food insecurity (Radimer et al., 1992).

	Level	
Component	**Individual**	**Household**
Quantitative	Insufficient intake	Food depletion
Qualitative	Nutritional inadequacy	Unsuitable food
Psychological	Lack of choice and feelings of deprivation	Food anxiety
Social	Disrupted eating patterns	Food acquisition in socially unacceptable ways

In summary, the components that distinguish hunger at the individual level are: insufficient intake, nutritional inadequacy, lack of choice and feelings of deprivation, and disrupted eating patterns; while household level food insecurity is characterized by food depletion, food anxiety and food acquisition in socially unacceptable ways. Fundamental to this conceptual framework is the notion of "hunger as a managed process" (Radimer, et al. 1992, p. 36S). As a result, both individuals and households employ varying coping strategies that result in household members experiencing hunger in different ways.

Four key conceptual elements of household and individual level food insecurity have evolved over decades of research (Tarasuk, 2001a):

1. Food insecurity is defined differently at the individual and household level. Acquisition and management of the food supply characterize household food security; individual-level food insecurity is closely related to the consumption and allocation of food.
2. The nature of food insecurity is dynamic, characterized by the frequency, duration and periodicity of the experience.
3. There is a wide range of severity of food insecurity. The least severe experience creates anxiety resulting in qualitative compromises in food selection and consumption. As resources become further depleted, severity escalates to quantitative compromises in food intake and the presence of physical hunger. The most severe from of food insecurity is absolute food deprivation.
4. Food insecurity is experienced in different ways for individuals within a household. Hunger is viewed as a managed process; therefore, household members experience food insecurity in both different degrees and frequency of occurrence.

2.2.2 Evolution in Food Insecurity Thinking

A study of 98 low-income households in the region of Quebec City resulted in fundamental changes in the characterization of food security (Hamelin, Habicht and Beaudry, 2002). While the quantitative and qualitative components of food insecurity (Table 2.1) roughly correspond to the 'shortage of food' and 'unsuitability of food and diet' core characteristics (Table 2.2), major differences exist at the level of the psychological and social components (Hamelin et al., 2002). Table 2.2 summarizes the viewpoints of Hamelin et al.

Table 2.2. Characterization of household food insecurity (Hamelin et al., 2002)

CORE CHARACTERISTICS		POTENTIAL REACTIONS		
A lack of food in the present and in the future	Alienation			
Shortage of food Unsuitability of food and diet Preoccupation with access to enough food	Lack of control over the food situation and the need to hide it	Socio familial perturbations	Hunger and physical impairment	Psychological suffering
DYNAMIC NATURE OF THE WHOLE EXPERIENCE				
General sequencing of events A strong patient-child vector Variation over time				

These major conceptual differences between the early conceptualization of food insecurity by Radimer et al. (1992) and Hamelin et al. (2002) findings are:

- Monotony of diet;
    - Although this was considered in the research questions of Radimer et al. (1992), monotony was not clearly identified. Findings by Hamelin et al. (2002) showed that for her sample of low-income households, food acquired by respondents was not satisfying, enhanced the feelings of deprivation and made socializing difficult.
- Alienation;
    - The concept of *food anxiety* as described by Radimer et al. (1992), was not apparent in the research of Hamelin et al. (2002). In contrast, a new and distinct manifestation emerging from this study was the strong sense of alienation common among respondents.

- Food acquisition in socially unacceptable ways;
    - Constructed as a social component of the household-level food insecurity experience by Radimer et al. (1992), it was found to be secondary to the core characteristics described by Hamelin et al., (2002). Further, the social unacceptability of acquiring food from food banks in this more recent study seems less evident than in previous research.

This ongoing debate over whether the social and psychological elements of food insecurity are indeed conceptual elements of food insecurity itself or consequences (Hamelin et al. 1999; 2002) has not been adequately researched (Tarasuk, 2001a).

2.2.3 Broader Approaches to the Conceptualization of Food Security

Alongside gains made in understanding both an operational definition of food insecurity at the individual and household level, a variety of alternative definitions have emerged from a range of disciplines and differing perspectives. For example, the concept of *community food security* (CFS) originated in the United States as an alternative approach to understanding food security (Lezberg, 1999 as cited in Dietitians of Canada, 2005) and is defined as the "condition in which all community residents obtain a safe, culturally acceptable, nutritionally adequate diet through a sustainable food system that maximizes community self-reliance and social justice" (Ham and Bellows, 2003). Broadly speaking, Bellows and Hamm (2003) re-frame food security in terms of how it can be experienced, acted upon and defined as a function of poverty, of diet and exercise behaviors, and as an outcome of agricultural land use and foreign policy. The evolutionary changes in the conceptualization of food security led the Center for Studies in Food Security (2003) at Ryerson University to outline the following five principles:

- Availability: adequate and reliable food supplies
- Accessibility: distribution and access to food

- Acceptability: culturally acceptable food and distribution systems, respectful of human dignity and social and cultural norms
- Adequacy: all levels of production, distribution, consumption and waste are considered to guarantee a sustainable and democratic food system
- Agency: identifies the policies and processes that enable (or disable) the achievement of food security

These five elements incorporate a system's approach to food security and are inclusive to such wide-ranging ideas as: environmental sustainability, access to resources such as land for household food production and negative externalities of global food production, into the definition of food security. Therefore, how food security is defined, understood by policy makers and how it relates to public health varies extensively (Bellows and Hamm, 2003). As a result, solutions to food insecurity are approached differently and "can even be seen as antithetical to each other" (Dietitians of Canada, 2005, p.2).

2.3 Why Measure Food Insecurity?

It is important to monitor food insecurity because it is a risk factor for myriad health concerns. In addition, the psychological and social implications strongly associated with food insecurity underscore the vast public health concerns related to this issue. Food security is fundamental to health (American Dietetic Association, 2002).

Canada's Action Plan for Food Security (CAPFS) is a strategic document outlining the priorities and role of the federal government in food security and was developed in response to agreements reached at the World Food Summit in Rome in 1996. The urgent need to establish indicators for monitoring household food security in Canada is a priority in the CAPFS (1998). Canada is required to report progress on implementing commitments outlined in the CAPFS, to the Committee on World Food Security (WFS) and the Food and Agriculture Organization (FAO) of the United Nations every two years. Paradoxically, these progress reports have

repeatedly emphasized the lack of data available in Canada to monitor food security (Agriculture and Agri-Food Canada, 1998; 1999; 2002; 2004).

2.4 How is Food Insecurity Measured?

Rigorous research in the 1990s led to methodologically sound and empirically strong measurement scales for food insecurity and hunger (Kennedy, 2003). Due to the multidimensional nature of food insecurity, no single indicator is sufficient in capturing the experience of food insecurity. For example, hunger in itself is a potential but not necessary consequence of food insecurity (Andersen, 1990). Therefore, a variety of specific conditions must be used as indicators to determine the severity of the condition (Bickel, Nord, Price, et al., 2000). The following tools described here are all reliable measures of food security when used in population-based surveys (Keenan, Olson, Hersey & Parmer, 2001) and are presented in chronological order of development.

2.4.1 Food Sufficiency

The earliest attempt to measure food insecurity status at the population level was the food sufficiency question (Tarasuk, 2001a) and has been included on each USDA food survey since 1977 (Kennan et al., 2001). Food insufficiency is measured using the direct question presented below and can be interpreted as a relatively severe form of household food insecurity as it corresponds to food deprivation (Tarasuk, 2001a).

Which of the following statements best describes the food eaten in your household?

- *Enough of the kinds of food we want to eat,*
- *Enough but not always the kinds of food we want to eat,*
- *Sometimes not enough to eat, or*
- *Often not enough to eat*

Although single-item indicators are still being used to measure food security at the population level in Canada, more sophisticated multiple-indicator measurement scales have been developed. Three major scales that have repeatedly been used in Canada and the U.S. are described here: Community Childhood Hunger Identification Project Hunger Index (CCHIP), Radimer/Cornell Measure of Hunger and Food Insecurity, and the Food Security Module (FSM).

2.4.2 Community Childhood Hunger Identification Project Hunger Index (CCHIP)

The CCHIP uses an eight question instrument reflecting the qualitative and quantitative dimensions of food insecurity to assess household food insecurity in families with a minimum of one child under 12 (Keenan et al., 2001). Respondent scores indicate whether members of the household (adults or children) are food insecure due to limited resources (Keenan et al., 2001). It is an additive scale resulting in three categorizations: *no hunger, at risk for hunger*, and *hungry* (Wheler, Scott & Anderson, 1992 as cited in Tarasuk 2001a).

2.4.3 Radimer/Cornell Measure of Hunger and Food Insecurity

This is a scale measure of food security and hunger at the household level consisting of a 12-item instrument with three subscales: *household food insecurity*, *women's food insecurity* and *hunger*, and *child hunger* (Keenan et al., 2001). A thirteenth question measures the quality of food supplies in the household (Keenan et al., 2001). The CCHIP and Radimer/Cornell scale measures of food insecurity have shown strong agreement when compared; thus, although questions differ, the overall concept being measured is similar (Tarasuk, 2001a).

Development of the Radimer/Cornell measure was based on in-depth interviews with thirty-two women in upstate New York regarding their experience with food problems and hunger (Radimer et al., 1990). Results showed two concepts of hunger: narrow and broad. The narrow concept included quantitative aspects of food insecurity such as reduced food intake and the physical sensation of hunger. The broader concept of hunger included two dimensions,

individual and household; each composed of quantitative, qualitative, psychological and social components. Survey items were then designed and tested for validity and reliability among a sample of 189 low-income women in upstate New York (Radimer et al., 1990).

Kendall et al. (1995) conducted a study with a random sample survey of 193 households with women and children in rural New York State to validate the Radimer/Cornell measure. This research illustrated the ability of this tool to distinguish increasing severity of food insecurity amongst households (Kendall et al., 1995). The constructed measures were able to identify both household and individual levels of food insecurity, and households with hungry children (Kendall et al., 1995).

2.4.4 Food Security Module

The national food security measure for the United States is the Food Security Module (FSM), developed by a group of experts and based on early research completed by the Radimer/Cornell research team and members of the CCHIP (Bickel et al., 2000). The 18-item Food Security Module (FSM) is a continuous linear scale measure that works systematically to measure the severity of food insecurity experienced by the household, or alternatively, can be used to categorize households based on 4 levels of food security status (Bickel et al., 2000; Hall, B., 2004):

1. Food secure – Households shows no, or minimal evidence of food insecurity
2. Food insecure without hunger - Food insecurity is evident in household members' concerns about adequacy of the household food supply and in adjustments to household food management, including reduced quality of food and increased unusual coping patterns. Little or no reduction in members' food intake is reported.

3. Food insecure with hunger (moderate) – Food intake for adults in the household has been reduced to an extent that implies that adults have repeatedly experienced the physical sensation of hunger. In most (but not all) food insecure households with children, such reductions are not observed at this stage for children.

4. Food insecure with hunger (severe) – All households with children have reduced children's food intake to an extent indicating that the children have experienced hunger. For some other households with children, this already has occurred at an earlier stage of severity. Adults in households with and without children have repeatedly experienced more extensive reductions in food intake.

This is the "most comprehensive instrument yet developed for measuring food insecurity and hunger in US households and population groups" (Keenan et al., 2001, p. S54). A key strength of the FSM is that the multiple indicator questions are able to capture and discriminate the differing levels of severity of food insecurity (Bickel et al., 2000). However, the 18-item measure is not able to distinguish among episodic patterns of household food insecurity nor elicit the coping strategies used (Bickel et al., 2000). It has been suggested that a more detailed indicator set may be able to achieve this. The FSM scale is suitable for use at the community, state and national levels allowing for comparison with benchmark figures. However, the FSM does not differentiate between individuals in a household; therefore inferences cannot be derived on the number of individuals in the household experiencing food insecurity (Bickel et al., 2000).

A shorter, 6-item FSM questionnaire was developed with only a slight loss in specificity or sensitivity (Bickel et al., 2000), although the 18-item FSM provides greater reliability and precision (Kennedy, 2003). In addition, the 6-item FSM cannot distinguish between 'food insecure with hunger' categories.

A weakness of the FSM is that the category level of food insecurity is determined based on patterns of affirmative responses, regardless of the content of items. For example, 27% of households identified as 'food secure' by the FSM had answered affirmatively to 'unable to afford to eat balanced meals' item; whereas, only 50% of households that were classified as food insecure with moderate hunger by the FSM had responded affirmatively to the 'respondent hungry' item (Derickson, 2001a). Findings of research conducted by Derickson et al. (2001a) conclude that the FSM categorical measure is neither "reliable nor accurate in categorizing food insecure households based on the face validity of affirmative responses".

2.4.5 Limitations of Food Insecurity Measurement in Canada

A common characteristic of food security scales is that questions are framed within a context of financial constraints (i.e. due to a lack of money). The geography of Canada includes sparsely populated and remote communities. Therefore, measurements that neglect to account for household food insecurity due to circumstances other than financial constraint could underestimate food insecurity. For example, households that are located in remote or rural areas may have problems accessing reliable food. Moreover, environmental degradation and extensive land development may limit availability and accessibility to traditional food sources (e.g. porcupine caribou).

The food security scales discussed above do not measure all dimensions of household food insecurity. More specifically, the social and psychological dimensions of food security such as the social acceptability of food sources are not considered in the FSM (Bickel, 2000). Validation of food security scales have found that food insecurity is significantly correlated with measures such as dietary intake, income and household food expenditures (Kennedy, 2003).

Moreover, the food security scales discussed above are household level measures that do not reflect variability within the group (Barrett, 2002) and do not measure individual level status.

However, work is underway to address the current lack of measurement scales to assess food security at the individual level (Tarasuk, 2001a).

The subjective and self-reporting nature of food security measurements are another common element to the instruments previously described. This introduces several potential factors that could influence participant responses. Distress due to financial or emotional circumstances may influence the perception of food insecurity and social desirability may impact prevalence rates (Hampl and Hall, 2002). Further, previous personal experiences may impact how one interprets the questions.

2.4.6 Measurement of Food Insecurity in the Canadian Context

The majority of research undertaken to develop indicators for measurement of food insecurity has taken place in the United States. Notwithstanding the many similarities between the Canadian and American populations, geographical and cultural differences exist and should be considered in the measurement of food security in Canadian households.

Research by Derickson et al. (2001a), within the Hawaiian population, has shown that cultural differences influence the interpretation of some questions used to measure food insecurity. In addition, research conducted by Jensen (2003) found differences in interpretations of questions among minority groups when compared with others. Therefore, testing and validation of indicators used to measure food insecurity are needed when applied to countries with diverse populations, such as Canada. Still, results show that those who are food insecure share many common elements across cultures (Derickson et al., 2001b). Currently, no tool has been validated to measure food security among Aboriginal populations in Canada (Lawn and Harvey, 2004).

Household food security status in Canada has been measured predominantly by the CCHIP, Radimer/Cornell, and FSM instruments, and by a series of single-item indicator

questions coined 'red-flag' approaches (Tarasuk, 2001a). The Canadian Community Health Survey (CCHS) has included three questions on food security, specifically targeting the conceptual items of quality of food, quantity of food, and worry about enough food, in both the 1.1 and 2.1 cycles. Although these surveys provide important information about food security in Canada, they lack the analytical framework needed to derive results on the range of severity of food insecurity, and do not allow for comparison between different surveys (Tarasuk, 2001a).

2.5 Status of Food Insecurity in Canada

2.5.1 Prevalence

Worldwide the FAO of the United Nations estimates that 852 million people were undernourished in 2000-2002; 9 million of these in industrialized countries including Canada (FAO, 2004). The cost of hunger is tremendous. At present levels, 5 million children die each year in developing countries and billions of dollars are lost in earnings and productivity (FAO, 2004).

Historically, estimates from food bank usage have been used as the indirect measures of food insecurity in Canada. Since 1989, there has been an increase of more than 166, 242 hungry children and a 123% increase in the use of food banks throughout Canada (Hunger Count, 2004). However, it is impossible to infer changes in the prevalence of food insecurity in Canada from this measure. It is possible that the increased demand for food bank services is due to the swelling number of food banks across the country or to the increasing social acceptability of food bank usage (Dietitians of Canada, 2005). Nevertheless, previous research has shown that food bank usage as an indicator of food insecurity may underestimate the actual prevalence because not all food insecure individuals use charitable food services (Vozoris and Tarasuk, 2003; McIntyre, Conner and Warren, 2000; Rainville and Brink, 2001; Che and Chen, 2001). Nevertheless, although measures of food bank use indicate an increasing demand for charitable

food services, it is unclear whether conclusions regarding prevalence rates of food insecurity can be derived from these figures.

The first national estimates of household food insecurity in Canada, resulting from the 1996/1997 National Population Health Survey (NPHS), estimated that 4% of Canadians were living in food insufficient households (Vozoris and Tarasuk, 2003). An analysis of the 1998/1999 NPHS suggests that approximately 10% of Canadians live in food insecure households (Rainville and Brink, 2001; Che and Chen, 2001). The most recent nation-wide data, resulting from the CCHS cycle 1.1 (2000/2001) shows that an estimated 3.7 million Canadians (14.7% of the population) experienced food insecurity in the 12 months prior to the survey (Ledrou & Gervais, 2005). CCHS cycle 1.1 also indicated 7% of Canadians experienced the most severe form of food insecurity: that they or someone in the household did not have enough to eat because of a lack of money (Ledrou & Gervais, 2005). Unfortunately, significant changes in the food security questionnaire used render it impossible to compare the specific findings from earlier estimates. However, the 'red flag' questions used in CCHS 1.1, 2.1 and the 1999 NPHS were all consistent. Caution should be taken in interpreting all of these Canadian findings as those most vulnerable to food insecurity (e.g. homeless, on-reserve First Nations etc.) were excluded from the sample. These findings underscore the need for a consistent and coordinated approach to measuring food security in Canada.

2.5.2 Risk Factors for Household Food Insecurity in Canada

Income is the most significant determinant of food insecurity; however, food insecurity is not exclusive to those in low-income households (Rose, 1999; Che and Chen, 2001; McIntyre, Walsh and Conner, 2001; Ledrou and Gervais, 2005). In Canada, 44% of low-income households reported food insecurity in 2000/2001 compared to 42% of lower-middle, 24% of middle, 11% of upper-middle and 4% of high income households (Ledrou and Gervais, 2005).

Because food is the most flexible item in the budget, food security status is most affected by income (Calderon and Gorence, 1998). Sudden financial constraints such as job loss or medical expenses are possible sources of stress on household budgets and could explain why those in higher income groupings may experience food insecurity (Rose, 1999; Hampl and Hall, 2002).

Other risk factors for food insecurity include: lone-parent families headed by women, young adults, those dependent on social assistance, tenants and off reserve Aboriginal peoples (Ledrou and Gervais, 2005; Che and Chen, 2001; Rainville and Brink, 2001; McIntyre et al., 2001). The risk of food insecurity among Aboriginal peoples throughout Canada is significantly higher than non-Aboriginal peoples, estimated as 1.5 to 4 times greater odds (Che and Chen, 2001; McIntyre et al., 2001).

Nation wide food security measurement has rarely collected representative data from the Northern Territories. Recent representative data collected there shows that the prevalence of food insecurity in northern Canada is staggering. Residents of northern communities are particularly vulnerable with over half of the population of Nunavut reporting some food insecurity, 28% of the Northwest Territories and 21% of the Yukon (compared to the national average of 14.7%; Ledrou & Gervais, 2005). Of perhaps more dire concern is the severity of food insecurity in northern Canada: 68% of food insecure households in Nunavut had experienced at least one occasion in the past year where they did not have enough food, 49% in the Northwest Territories and 30% in the Yukon (Ledrou & Gervais, 2005). Community-based studies in remote northern communities have revealed even higher rates of food insecurity and hunger. A study of Inuit women living in Kugaaruk, Nunavut found that between 83 and 92% of all households had experienced food insecurity and that 44% did not eat for an entire day in the previous 3 or more months as they were not able to afford food (Lawn & Harvey, 2003). In 52% of the households, children went hungry at times because the household could not afford food

(Lawn & Harvey, 2003). In a similar study conducted in the remote community of Fort Severn, Ontario on the shore of Hudson Bay, 67% of households were food insecure, with one-quarter of families experiencing hunger in the past 12 months, and in 24% of households, children experiencing hunger (Lawn & Harvey, 2004). Living in northern communities clearly puts you at risk of food insecurity.

2.6 Consequences of Food Insecurity

2.6.1 Nutrient Intake

Research from both the U.S. and Canada has demonstrated that food insecurity is associated with lower nutrient intake among some members of food insecure households (Kendall, Olson and Frongillo, 1996; Rose & Oliveira, 1997a; Rose, 1999; Tarasuk and Beaton, 1999;Starkey, Gray-Donald and Kuhnlein, 1999; Klesges, Pahor, Shorr et al., 2001; Dixon, Winkleby and Radimer, 2001; McIntyre, Glanville, Raine et al., 2003). In the U.S., Rose and Oliveira (1997a) found lower nutrient intake levels among individuals in households characterized as food insecure, compared with those in food secure households. Likewise, in a study of Toronto women receiving food assistance, Tarasuk (1999) found that nutrient intake and energy intake are systematically lower for women who reported hunger. More specifically, prevalence (> 15%) of inadequate nutrient intake was identified for Vitamin A, folate, iron and magnesium (Tarasuk, 1999).

McIntyre et al. (2003) undertook a study to determine whether low-income mothers in Atlantic Canada compromised their own diets to spare their children. They found that over the course of a month, mothers' dietary intakes were inadequate for most nutrients examined. In contrast, children's nutrient intake was adequate with the exception of zinc and folate (McIntyre et al., 2003). These findings are consistent with Rose & Oliveira's (1997a) research that showed preschoolers' low nutrient intake was not significantly associated with household food

insufficiency; yet, low intake of eight nutrients was significantly associated with women and the elderly who reside in food insufficient households. This confirms the concept that children are often the last to suffer the effects in food insecure households (Connell, Lofton, Yadrick et al., 2005), reinforcing the idea that food insecurity is experienced differently for each member of the household.

Moreover, fruit and vegetable consumption in relation to food security status has been researched using self-reported measures in Canadian studies. Findings from Cancer Care Ontario (2005) show that food insufficiency was not significantly associated with consumption of less than five fruits or vegetables per day for men but was significantly associated when compared to women. Further, research by Dixon et al. (2001) found that adults from food insufficient households consumed significantly less fruits and vegetables than recommended amounts. A study of women in families seeking charitable food assistance in Toronto found significant differences in fruit and vegetable consumption based on household food security status (Tarasuk, 2001b).

In Canada, it is difficult to establish the link between food security status, nutritional status and long-term health due to a lack of adequate data. Analysis of dietary intake in the Canadian studies cited, neglect to account for frequency, duration, and severity of food insecurity and have heavily relied on the use of self-reported measures of dietary intake data (Tarasuk, 2004). The upcoming release (January 2006) of nutritional data from the CCHS 2.2 will provide an unprecedented opportunity to examine the relationship between nutrient intake and food security across Canada.

2.6.2 Physical Health

Numerous studies have identified health problems associated with food insecurity (Olson, 1999; Hamelin, Habicht and Beaudry, 1999; McIntyre, Connor and Warren, 2000; Sarlio-

Lahteenkorva and Lahelma, 2001; Che and Chen, 2001; Rainville and Brink, 2001; Townsend, Peerson, Love et al., 2001; Vozoris and Tarasuk, 2003; Stuff, Casey, Szeto et al., 2004; Casey, Szeto, Robbins et al., 2005). An analysis of the 1996/1997 NPHS survey found that those living in food insufficient households had higher odds of reporting poor/fair physical health, heart disease, diabetes, high blood pressure and food allergies as compared with those living in food sufficient households (Vozoris and Tarasuk, 2003). Similarly, Che and Chen (2001) found that food insecurity was significantly associated with multiple chronic conditions, obesity, and poor/fair physical health through an analysis of the 1998/1999 NPHS data. Data from the National Longitudinal Survey of Children and Youth (1994) revealed that self-reported health differed significantly between hungry children and children that did not experience hunger (McIntyre et al., 2000). Caution should be taken in interpreting these results, as it is impossible to infer causality due to the use of cross-sectional data.

An evolving body of research investigating the association between body mass index (BMI) and food insecurity has revealed contradictory findings in Canada, the U.S. and other international studies (Olson, 1999; Che and Chen, 2001; Sarlio-Lahteenkorva and Lahelma, 2001; Alaimo, Olson and Frongillo, 2001b; Townsend, Peerson, Love, Achterberg and Murphy, 2001; Hampl and Hall, 2002; Vozoris and Tarasuk, 2003; Basiotis and Lino 2003; Drewnowski and Specter, 2004; Laraia, Siega-Riz, and Evenson, 2004). For example, an analysis of the 1998/1999 NPHS data revealed that food-insecure individuals were 1.5 times more likely to be obese (BMI>29) compared to residents of food secure households even when age, sex and income were taken in to account (Che and Chen, 2001). However, an examination of this same question by Vozoris and Tarasuk (2003) using data from the earlier 1996/1997 NPHS, found no significant association between household food insufficiency and BMI in women, and a significantly decreased odds of overweight (BMI = 25.0-29.9) in men. Similarly confusing findings have been uncovered in U.S. studies. For instance, a study with a representative sample

of U.S. households found that food insecurity was positively associated with being overweight (BMI > 27.3) in women (Townsend et al., 2001). These findings are supported by another U.S. study that found women in food insufficient households have a greater prevalence of overweight (BMI > 25) and poorer diet quality (Basiotis and Lino, 2003). Conversely, a study of adults in New York and Louisiana found that after controlling for education, income, race/ethnicity, marital status and general health, there was no association between concern about enough food and overweight and obesity (Laraia, 2004). Further contradictory findings from an analysis of the Third National Health and Nutrition Examination in the U.S. demonstrated that younger food insufficient girls had less risk of being overweight compared to food sufficient girls, while older non Hispanic white girls, characterized as food insufficient, had greater odds of being overweight as compared to food sufficient girls (Alaimo et al., 2001b).

It is clear from the above results that differences in the measurement of food insecurity, cut off points for overweight and obesity, as well differences in consideration of confounding variables, add both confusion and complexity to delineating the relationship between food insecurity and BMI. Contradictory results in both Canada and the U.S. highlight the limitations of using cross-sectional data, reliance on self-reported measures of height and weight, and the appropriateness of household level food insecurity data used to interpret individual level measures (Tarasuk, 2004). In addition, the current measure of household food insecurity is inadequate in describing severity, frequency and duration of food insecurity, all of which are likely to impact BMI (Tarasuk, 2004). Longitudinal studies, both qualitative and quantitative in nature must be used to better understand the relationship between BMI and food insecurity (Alamio, et al., 2001).

2.6.3 Psychosocial Health

The impacts of hunger are not limited to nutritional and physical health risks (Sidel, 1997) as strong associations with food insecurity and psychosocial health are evident (Tarasuk and MacLean, 1990; Olson, 1999; Alamio, Olson and Frongillo, 2001; Che & Chen, 2001; Klesges et al., 2001; Vozoris and Tarasuk, 2003; Stuff, Casey, Szeto et al., 2004; Connell, Lofton, Yadrick and Rehner, 2005; Casey, Szeto, Robbins et al., 2005). A few notable Canadian studies have reported significantly higher odds of depression and distress in individuals from food insecure and food insufficient households (Che & Chen, 2001; Vozoris and Tarasuk, 2003). As discussed earlier, a qualitative research study of 98 low-income households experiencing food insecurity in Quebec, conducted by Hamelin et al. (2002) exposed the manifestations of food insecurity as psychological suffering, socio-familial perturbations and hunger and physical impairment. They identified alienation as an emerging concern as this leads to feelings of powerlessness, frustration and inequity (Hamelin, et al., 2002).

Further, studies have noted the effects of food insecurity and hunger on children's well-being and psychosocial functioning (American Dietetic Association 2002, 1998, 1990; Calderon & Gorence, 1998; Kleinman, Murphy, Little et al., 1998; Alamio, Olson, & Frongillo, 2001; Casey, Szeto, Robbins et al., 2005; Connell, Lofton, Yadrick and Rehner, 2005). Several studies have demonstrated that hungry children are at risk of not being able to concentrate, have difficulty getting along with other children and thus have difficulty learning, which manifests in lower test scores, and greater odds of repeating a grade (American Dietetic Association 2002 & 1998; Alamio et al., 2001).

Consequences of food insecurity transcend individual health and nutrition, having a profound impact on individuals' behaviours and feelings (Tarasuk, 2001a). Table 2.3 describes

consequences of food insecurity in 'food rich' countries, and outlines the pervasive and broad implications for those who are food insecure (Rainville and Brink, 2001).

Table 2.3. Consequences of food insecurity for individuals and households (Rainville and Brink, 2001)

Food Secure	**Food Insecure**
Focus efforts on desired goals	Focus efforts on survival, lack of time
Seize opportunities, take risks	Lack of resilience, no fall back
Future orientation	Live from moment to moment
Develop social and human capital	Have difficulty investing in themselves
Ability to develop support system	Poorer social network
Adequate earned income	Working poor, unemployment
Generally good health	Disability, chronic conditions

The burden of food insecurity can compromise an individual's ability to achieve a sense of well-being, and feelings of alienation have a significant impact at the community level because increasing social inequalities can deteriorate social cohesion (Tarasuk, 2001a). A study of households in Hartford, Connecticut found that social capital at both the household and community level was significantly associated with decreased odds of hunger (Martin, Rogers, Cook and Joseph, 2004). Exploration of the relationship between food security and social capital has not been adequately researched (Martin, et al., 2004) but may provide information on how to ameliorate the negative social impacts of food insecurity.

Integral to the experience of food insecurity are the determinants that affect how and what we choose to eat. Yet, the psychosocial factors that influence what we eat are only partially understood. Households that are food insecure generally deal with food shortages by rationing, lowering quality and missing meals, whereas charitable food assistance is sought last (MacLean and Tarasuk, 1990). In trying to achieve a social norm, the head of the household will put a

higher priority on food quantity as opposed to food quality (Fitchen, 1988; MacLean and Tarasuk, 1990). Moreover, parents may provide their children with whatever food they desire, to avoid feelings of deprivation (Fitchen, 1988).

Research has revealed that inadequate financial resources is the main barrier to a healthy diet (Beaudry, et al., 1999; Klesges, et al. 2001; Power, 2005). Those in low-income households spend more than a third of their monthly income on food compared to 10% for average Canadian households (Thunder Bay District Health Unit, 2003). Studies in the U.S., Canada and France all concluded that either food cost or food availability was a determinant of healthy eating (Anderson, Cogdon, MacLean, Travers and Wright, 1997; Colson, Hebert, Horowitz, and Lancaster, 2004; Darmon, and Drewnowski, 2004). Qualitative studies have shown that food insecure participants may have a good understanding of nutrition but don't feel they can afford nutritious food (MacLean and Tarasuk, 1990). For example, "We have soft drinks instead of milk...I know it is not really what my children should eat" (Hamelin, Beaudry & Habicht, 2002, p. 123). In fact, research has demonstrated that neither nutritional knowledge or food skills significantly affect healthy eating and that those in low-income household actually purchase more nutrients per food dollar as compared to those in higher incomes (Power, 2005).

3. Methodology

3.1 Canadian Community Health Survey Cycle 2.1

This analysis is based on data from the Canadian Community Health Survey (CCHS) Cycle 2.1, public use micro data file (PUMF). The CCHS is a cross-sectional survey that collects information on health status and health determinants of the Canadian population at the sub-provincial, provincial and territorial level.

Data for Cycle 2.1 was collected between January 2003 and December 2003. The target population covered approximately 98% of the Canadian population, for all persons aged 12 and older who reside in private dwellings in the provinces and territories. Persons excluded from this survey include: those living on Reserve Land; Crown land; residents of institutions; residents of specific remote regions; and, members of the Canadian Forces. The CCHS Cycle 2.1 questionnaire consisted of: approximately 25 minutes of common content questions; 5 minutes of sub-sample content; and, approximately 10 minutes of questions selected from the optional content modules (Appendix A; Statistics Canada, 2003)

3.1.1 Sampling Design

Three different sampling frames were used to select households for the CCHS Cycle 2.1: 48% (area), 50% (telephone number) and 2% (Random Digit Dialing (RDD); Statistics Canada, 2003)). The area frame sampling replicates the methodology used by the Canadian Labour Force Survey, which is based on a multistage stratified cluster design. Provinces were first stratified by region (i.e. urban centre, cities and rural) and then divided by geographic and socio-economic characteristics. Sampling of households in the three territories was stratified by population, geography and percent Inuit and/or Aboriginal and median household income (Statistics Canada, 2003).

A list frame of telephone numbers from The Canada Phone Directory was linked to Health Region information to create the telephone number sampling frame. There was one list frame stratum created for the majority of Health Regions. RDD was used for the five Health Regions that did not use the telephone list frame, and for the three territories. The sampling method from the General Social Survey was used for creating the RDD sampling frame of telephone numbers.

3.1.2 Data Collection and Response Rates

Data was collected in 126 Health regions nation-wide using computer-assisted interviewing (CAI; Statistics Canada, 2003). For those households selected using the telephone list frame, questionnaires were administered using computer-assisted telephone interviewing (CATI), whereas households selected from the area frame completed questionnaires via computer-assisted personal interviewing (CAPI). A final response rate of 92.6% at the individual level was obtained with 134, 072 individuals (one per household) completing the survey (Statistics Canada, 2003). There was an overall response rate of 87.1% at the household level and a combined response rate of 80.7% (Statistics Canada, 2003).

The food insecurity module for the CCHS 2.1 was optional content (See Appendix A). Optional content modules were designed to give the health region the decision-making authority as to the inclusion of certain questions. In contrast, common content was collected in each health region. Data on food insecurity was collected in all provinces and territories except for Manitoba and Prince Edward Island. A total of 83, 807 respondents completed this module (63% of total respondents). Limited sample sizes represent Ontario (20% of all respondents) and Saskatchewan (16%; Table 3.1).

Table 3.1 Percent of respondents, by province/territory, that completed the optional food insecurity module

Province/Territory	%
Total	63
Newfoundland and Labrador	100
Prince Edward Island	0
Nova Scotia	100
New Brunswick	100
Quebec	100
Ontario	20
Manitoba	0
Saskatchewan	16
Alberta	100
British Columbia	100
Yukon, Northwest Territories & Nunavut	100

Using the CCHS 2.1 PUMF file, it was not possible to separate the Yukon, Northwest Territories and Nunavut data.

3.1.3 Weighting

A survey weight was given to each survey respondent that corresponds with the number of persons in the Canadian population that they represent. Weighting reflects the sampling frame used, seasonal affects whereby an adjustment was employed so that each season represents 25% of respondents for each Health Region and post-stratification which was completed to ensure that sampling weight were correctly calculated for populations estimates at the Health Region level (Statistics Canada, 2003).

3.2 Dimensions of Household Food Insecurity

The CCHS 2.1 includes 3 questions on household food insecurity:

In the past 12 months, how often did you or anyone else in your household:

Q1...Worry that there would not be enough to eat because of a lack of money?

Q2...Did not have enough food to eat because of lack of money?

Q3... Not eat the quality or variety of foods that you wanted to eat because of lack of money?

For this analysis, four dimensions of household food insecurity were defined based on responses to each question, and were modified and adapted from previous research (see Table 3.2; Che and Chen, 2001; Rainville and Brink, 2001).

Table 3.2 Dimensions of household food insecurity

Food insecure		Food anxiety		Compromised diet		Food Poverty	
Q1	Yes to at least 1 question	Q1	Yes	Q1	Yes/No	Q1	Yes/No
Q2		Q2	Yes/No	Q2	Yes/No	Q2	Yes
Q3		Q3	Yes/No	Q3	Yes	Q3	Yes/No

Although these categorizations of food insecurity allude to severity, caution must be taken when interpreting these dimensions. Each question was developed as a single-indicator measure rather than a scale measure. Moreover, the four dimensions of household food insecurity are not mutually exclusive categorizations.

3.3 Analytical Techniques

All statistical analyses were completed using SPSS 11.0.3 (SPSS Inc., 2004). In this analysis, all p values < 0.05 were considered significant and a 95% confidence interval was calculated for all odds ratios. For those categories where sample sizes were too small to provide reliable estimates, the item was not included in the analyses. The following analytical techniques were used to answer each research question:

1. What is the prevalence and distribution of household food insecurity in Canada?

Weighted cross-tabulations were used to estimate the prevalence of household food insecurity based on the dimension of household food insecurity and province. Two-tailed *z* approximation tests were conducted to assess whether the population proportion of food insecure households for each province was significantly different than the national estimate.

2. What associations exist between household food insecurity and household level socio-demographic characteristics?

Weighted cross-tabulations were used to estimate the prevalence of household food insecurity compared to household income, main source of income, type of household, education level, whether the household was located in the territories and by home ownership. Pearson Chi-square tests were used to see whether significant differences within categories existed. Multivariate logistic regression analysis was then used to examine the strength and direction of relationships between selected characteristics and food insecurity.

3. What associations exist between household food insecurity and individual level socio-demographic and other selected characteristics?

Weighted cross-tabulations were used to estimate the prevalence of household food insecurity compared to age, sex, marital status, immigration status, sense of community

belonging and member of a voluntary organization. Differences within categorical level data were examined using a Pearson Chi-square test. Multivariate logistic regression analysis was then used to examine the strength and direction of relationships between selected characteristics and food insecurity.

4. What is the likelihood of experiencing selected health outcomes based on each dimension of household food insecurity status?

Weighted cross-tabulations were used to describe associations between food insecurity and four selected health outcomes: BMI, poor/fair health, poor/fair mental health, and presence of a chronic condition. Pearson Chi-square tests were used to see whether significant differences within categories existed. Multivariate logistic regression analysis was used to estimate the odds that an individual in a household characterized by dimension of food insecurity would experience selected health outcomes.

3.4 Definitions of Variables Used

3.4.1 Household Level Variable

Household income was based on Statistics Canada grouping methods as outlined below:

Table 3.3 Household income categories

Category	Number of people in the household	Total household income
Lowest Income	1 to 4	< $ 10,000
	5 or more	< $ 15,000
Lower Middle Income	1 or 2	$ 10,000 to $ 14,999
	3 or 4	$ 10,000 to $ 19,999
	5 or more	$ 15,000 to $ 29,999
Middle Income	1 or 2	$ 15,000 to $ 29,000
	3 or 4	$ 20,000 to $ 39,999
	5 or more	$ 30,000 to $ 59,999
Upper Middle Income	1 or 2	$ 30,000 to $ 59,999
	3 or 4	$ 40,000 to $ 79,999
	5 or more	$ 60,000 to $ 79,999
Highest Income	1 or 2	> $ 60,000
	3 or more	> $ 80,000

These household income categories include the total household income from all sources in the 12 months prior to the administration of the survey.

Main source of household income was categorized in five groups, as follows:

Table 3.4 Source of household income

Category	Source of Income
Employment	Wages, salaries, self-employment
Welfare/worker's compensation/employment insurance	Welfare, worker's compensation, employment insurance, social assistance
Senior's benefits	Canada or Quebec pension or retirement pensions or old age security, guaranteed income support (GIS)
Other	Dividends/interest or child tax benefits, or child support or alimony or other or no income
Not stated	N/a

Education level was categorized into 4 groups: less than secondary graduation, secondary graduation, some postsecondary and postsecondary graduation, and was based on the highest level of education acquired by any member of the household.

Household type was defined based on respondents living arrangements. Six categories were used: couple with child(ren) < 25 years old; single parent with child(ren) < 25 years old; couple without child(ren) < 25 years old; unattached individual; other; and, not stated.

Home ownership refers to whether respondents lived in a household where a member of the household owned the house or whether the respondent was a tenant.

A dichotomous variable was created to differentiate between all residents of the Territories (i.e. Yukon, Northwest Territories and Nunavut), and all other respondents who were classified as not *Living in the Territories*.

3.4.2 Individual Level Variables

Age of respondents was only available as a category variable in the CCHS PUMF file. Five age categories were used in this analysis and are based on collapsed categories from the available data: 12-19, 20-34, 35-44, 45-64 and 65+.

Marital status was defined within 3 categories based on responses from survey respondents: previously married (i.e. widowed, separated, or divorced) married/common-law; and, single.

Immigrant status was defined based on the respondents' place of birth, and their length of time in Canada since immigration. Three categories were defined: not an immigrant, immigrated 0-9 years ago, and immigrated > 9 years ago.

Sense of community belonging was measured as either very strong/somewhat strong or somewhat weak/very weak, based on how respondents described their sense of belonging to their local community.

Membership with a voluntary organization was measured based on affirmative responses to participation with any voluntary organization or association such as school groups, church social groups, community centres, ethnic associations or social, civic or fraternal clubs?

3.4.2 Health Variables

Respondents rated their health in terms of either: excellent, very good, good, fair or poor. Based on responses, *self-perceived health* was dichotomized as either excellent/very good/good or fair/poor.

Self-perceived mental health was also measured. For the multivariate analysis it was categorized into two groups: excellent/very good/good or fair/poor.

Body Mass Index (BMI) was based on self-reported measures of height and weight. To calculate BMI, weight (kg) was divided by the square of height (m). All respondents aged 20 and over, excluding pregnant women, were included in this variable. The cut-off points used to examine BMI in the research are based on the International Standard. BMI is a classification system used to categorize body weight according to health risk, and is defined as follows:

Table 3.5 Body mass index (BMI) classification

BMI Value	Classification	Health Risk
< 18.5	Underweight	Increased health risk
18.5 - 24.9	Normal weight	Least health risk
25.0 – 29.9	Overweight	Increased health risk
30.0 and greater	Obese – Class I, II, III	High health risk

Presence of a chronic condition was a dichotomous variable based on whether or not the respondent had been diagnosed by a health professional with one or more of the following chronic conditions: food allergies, allergies other than food, asthma, fibromyalgia, arthritis or rheumatism, back problems excluding fibromyalgia or arthritis, high blood pressure, migraine headaches, chronic bronchitis, emphysema or chronic obstructive pulmonary disease, diabetes, epilepsy, heart disease, cancer, stomach or intestinal ulcers, suffers from the effects of a stroke, urinary incontinence, bowel disorder such as Crohn's disease or colitis, Alzheimer's disease or any other dementia, cataracts, glaucoma, thyroid condition chronic fatigue syndrome, multiple chemical sensitivities, schizophrenia, mood disorder, anxiety disorder, autism or any other developmental disorder, learning disability, eating disorder, other long-term physical or mental health condition.

3.5 Regression Models

Logistic regression analysis was used to approximate the likelihood of the dependent variable given certain independent variables. All variables were entered using the standard 'ENTER' method in SPSS for each regression model. This method evaluates all variables in relation to all other independent variables as well as the dependent variable through partial correlation coefficients (Munro, 2001; Table 3.6; Table 3.7). All nominal level data was recoded into dummy variables (Appendix B). Dummy coding uses 1s and 0s to indicate whether or not the respondent fits under the defined category; thus, the number of dummy coded categories is equal to n-1.

Table 3.6 indicates the first regression model, which examines research questions two and three. The independent and dependent variables included in this model are listed in Table 3.6. The objective of this regression model was to examine whether any of these independent or explanatory variables were associated with an increased prevalence of household food insecurity.

Variables were identified and selected based on previous research on the determinants of food insecurity (Rainville and Brink, 2001; Che and Chen, 2001). Variables were grouped based on whether they applied at the household or individual level and the associations were reported in the same manner.

Table 3.6 List of independent and dependent variables used in regression model for research questions 2 and 3

Regression Model	Dependent variable	Independent variables
Research question 2 and 3	• Food insecure	• Household income • Source of household income • Household education level • Household type • Own dwelling • Living in the territories • Age group • Sex • Marital status • Immigration Status • Member of a voluntary organization • Sense of community belonging • Voluntary membership

The purpose of the regression models used to answer research question four (Table 3.7) was to estimate the odds of someone living in a food insecure household reporting each of the selected health outcomes. Education and income variables were included in each regression model to control for confounding effects due to the identified relationships between these variables and health (Lynch, Kaplan and Salonen, 1997; Humphries and van Doorslaer, 2000). Age and sex were also included in the regression model because of age and sex related differences in the health outcomes analyzed. Two models (a and b) were used to examine the independent variable, dimension of household food insecurity, in relation to health outcome. *Model a* estimated the odds of someone in a food insecure household reporting the specified health outcome. Whereas, *Model b* estimated the likelihood and independent contribution of someone in a household characterized as food anxious, compromised diet or food poverty

reporting selected health outcomes. Exploration of health outcomes based on Model *a*, allows for comparison with previous research conducted in Canada.

Table 3.7 List of dependent and independent variables used in regression models for research question 4

Regression Model	Dependent variable	Independent variables		Confounding variables
Research Question 4	• Self perceived poor/fair health	*Model a:* • Food insecure	*Model b:* • Food anxiety • Compromised diet • Food poverty	• Age group • Sex • Household income • Education
	• Self perceived poor/fair mental health	*Model a:* • Food insecure	*Model b:* • Food anxiety • Compromised diet • Food poverty	• Age group • Sex • Household income • Education
	• Presence of a chronic condition	*Model a:* • Food insecure	*Model b:* • Food anxiety • Compromised diet • Food poverty	• Age group • Sex • Household income • Education
	• Underweight	*Model a:* • Food insecure	*Model b:* • Food anxiety • Compromised diet • Food poverty	• Age group • Sex • Household income • Education
	• Overweight	*Model a:* • Food insecure	*Model b:* • Food anxiety • Compromised diet • Food poverty	• Age group • Sex • Household income • Education
	• Obesity	*Model a:* • Food insecure	*Model b:* • Food anxiety • Compromised diet • Food poverty	• Age group • Sex • Household income • Education

3.6 Data Limitations

The food security module was optional and therefore, was not asked in Manitoba or Prince Edward Island. Limited sample sizes represent Ontario and Saskatchewan with only 20% of participants responding to the Food Security module in Ontario, and 16% in Saskatchewan.

No conclusions regarding cause-and-effect relationships can be drawn from this data because of the cross-sectional design.

Individuals living on Indian Reserves and Crown Lands, members of the Canadian Armed Forces, institutional residents and homeless persons were excluded from this sample. It is possible that prevalence rates of food insecurity may be underestimated due to specific population exclusions.

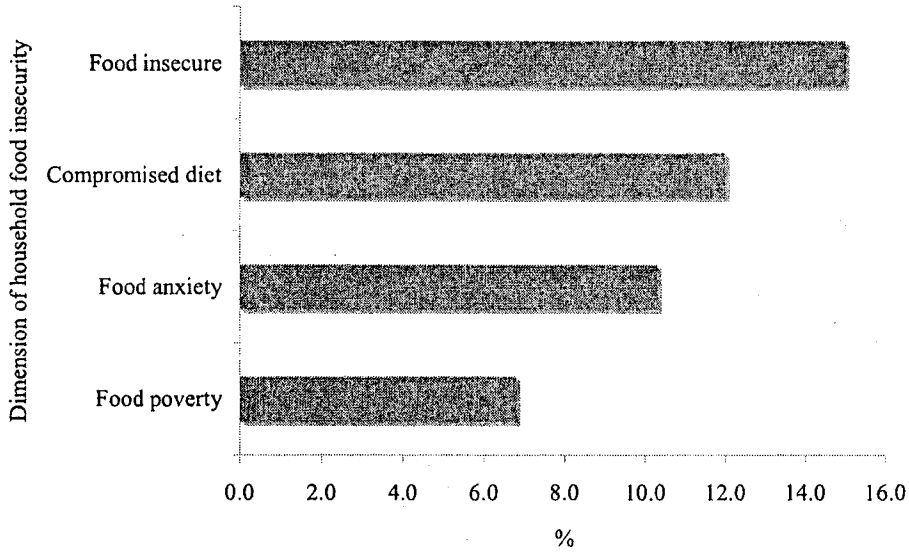
Data regarding Aboriginal status was not available in the PUMF CCHS, 2.1 data file. Therefore, no analysis examining relationships between food insecurity and Aboriginal status was conducted.

4. Results

4.1 Food Insecurity in Canada

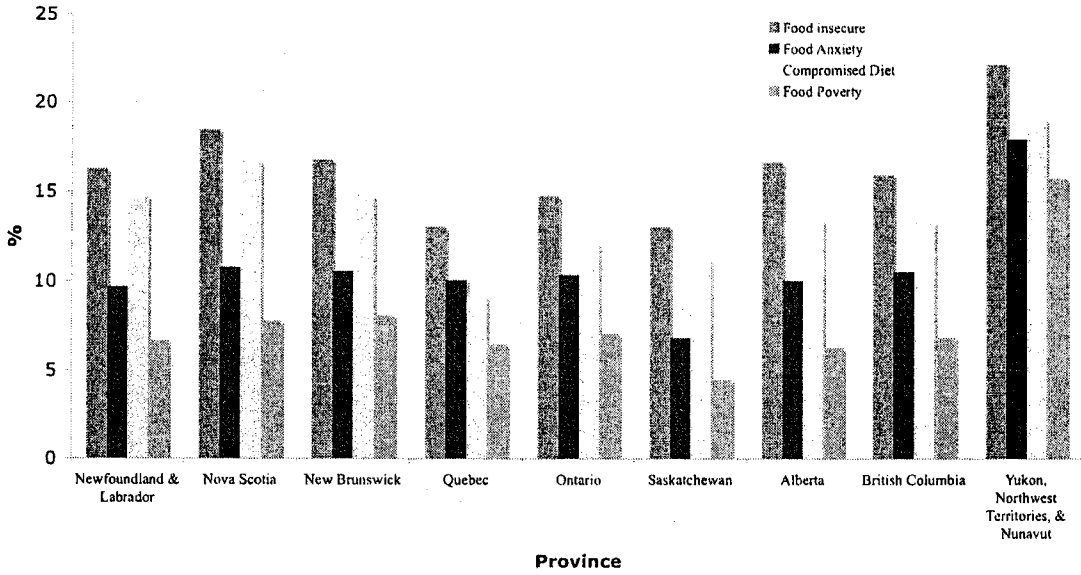
According to results from the analysis of the CCHS 2.1, 15.0% of the population lived in a food insecure household, affecting an estimated 2.3 million people. Nationwide, fewer households experienced food poverty (6.8%) than food anxiety (10.3%) or a compromised diet (12.0%) than food insecurity (Figure 4.1).

Figure 4.1 Prevalence of household food insecurity, by dimension; Canada, excluding Prince Edward Island and Manitoba, 2003.



Food insecurity was most prevalent in the Yukon, Northwest Territories and Nunavut (22.2 %) followed by Nova Scotia (18.5%; Figure 4.2; Appendix C). Both are significantly higher than the national average of 15.0%. Residents of the territories had significantly higher odds (Adjusted Odds Ratio (AOR)=1.55) of experiencing household food insecurity than residents of the provinces (Table 4.1). Moreover, residents of Quebec had rates of food insecurity (13.1%) significantly below the national average. The prevalence of household food insecurity in Newfoundland (16.3%), Saskatchewan (13.1%) and Ontario (14.8%) was not significantly different from the national average.

Figure 4.2 Prevalence of household food insecurity, by dimension and province, 2003



Food poverty was significantly higher in the Yukon, Northwest Territories and Nunavut, than in the provinces, with 15.8% of all households not having enough food to eat because of a lack of money. This rate is more than double that of Nova Scotia's food poverty rate (7.8%) which is the next highest in the country. Saskatchewan had the lowest food poverty rate (4.5%).

For all provinces except Quebec, prevalence trends of food insecurity relative to dimension followed national trends, i.e. the food insecure dimension was most prevalent followed by compromised diet.

4.2 Household Level Characteristics of the Respondents

4.2.1 Household Income

Almost half of low-income households (48.9%), and more than 40% of low-middle income households were food insecure (Figure 4.3). Further, for those respondents residing in low or lower-middle income households, the odds of food insecurity was almost 14 times greater than for those in higher-income households even after controlling for age, sex, source of income, and other confounding variables (Table 4.1). However, food insecurity was not exclusive to

those in lower income households; middle-income households also experienced food insecurity (26.1%). Moreover, 12.8% of upper-middle income and 4.1% of high-income households were food insecure.

Figure 4.3 Prevalence of household food insecurity, by dimension and household income; Canada excluding Prince Edward Island and Manitoba, 2003.

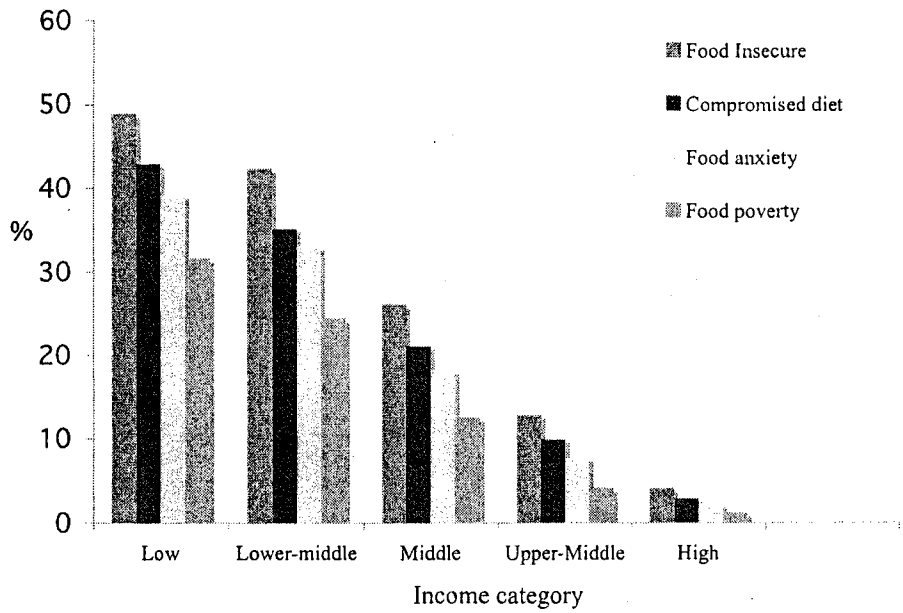


Table 4.1 Prevalence rates of food insecurity, and adjusted odds ratios for household food insecurity by selected household level characteristics; Canada, excluding Prince Edward Island and Manitoba, 2003.

		Food Insecurity			
		Estimated Population	% Food Insecure	Odds Ratio	95% CI
Household income	Low	196, 288	48.9*	13.86*	13.73, 13.99
	Lower-middle	387, 971	42.2*	13.80*	13.70, 13.91
	Middle	723, 183	26.1*	8.04*	7.99, 8.09
	Upper-middle	595, 367	12.8*	3.29*	3.27, 3.31
	High[+]	183, 403	4.1	1.00[+]	---
Main source of household income	Employment[+]	1, 594, 211	14.0	1.00	---
	Welfare/worker's compensation/employment insurance	298, 089	58.7*	2.85*	2.83, 2.87
	Senior's benefits	256, 082	10.9*	0.87*	0.87, 0.88
Dwelling Owned	Yes[+]	1, 236, 508	10.7	1.00	---
	No	1, 082, 600	28.2*	1.72*	1.71, 1.72
Household type	Couple with child(ren) < 25 [+]	845, 628	13.6	1.00	---
	Single	583, 455	21.1*	1.08*	1.08, 1.09
	Single parent with child(ren) < 25	293, 160	26.2*	1.36*	1.35, 1.37
	Couple alone	362, 352	9.2*	0.89*	0.89, 0.90
	Other	211, 982	17.1*	1.02*	1.02, 1.03
Education level	Less than secondary	320, 050	20.9*	1.06*	1.06, 1.07
	Secondary graduate	313, 443	17.6*	1.09*	1.09, 1.10
	Some post secondary	217, 125	21.7*	1.26*	1.26, 1.27
	Post secondary graduation[+]	1, 337, 166	12.9*	1.00	---
Living in the territories	Yes	15, 708	22.2*	1.55*	1.51, 1.58
	No[+]	2, 311, 240	15.0	1.00	---

[+] Reference category; * Significantly different from reference category ($p < 0.05$); --- Not applicable

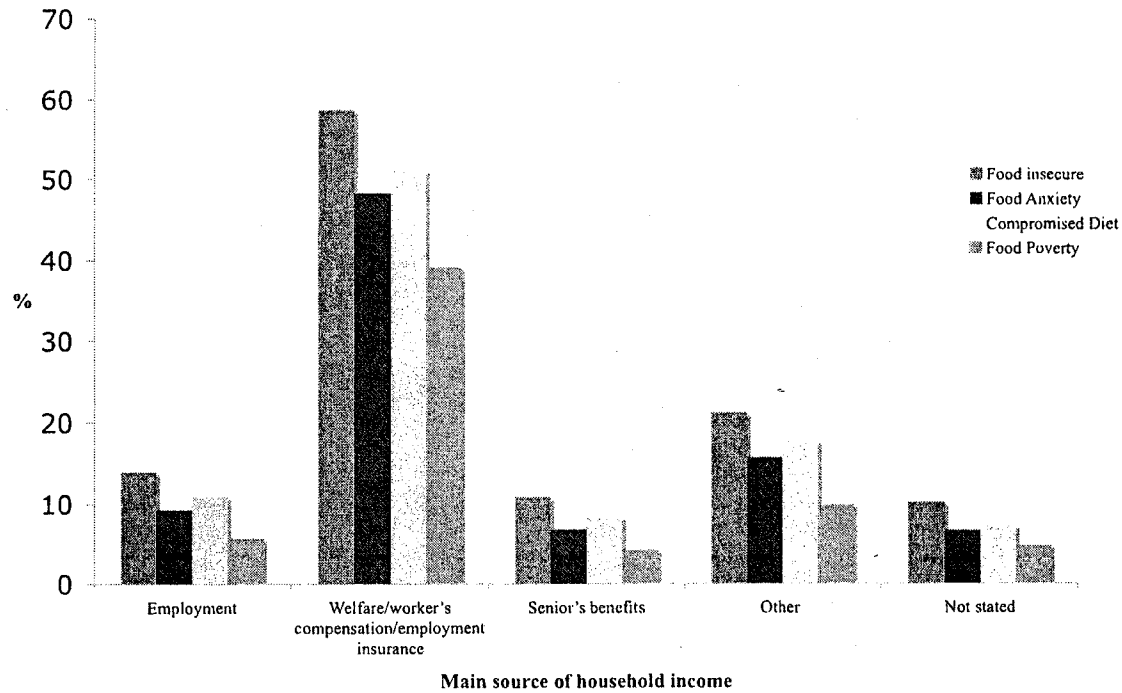
Note: A "missing income" category for household income was included in each model to maximize sample size, but the odds ratios are not shown; all variables controlled for are shown in Table 3.6.

Prevalence rates of food poverty, food anxiety and compromised diet, followed national level trends for each income category. In other words, as income increased, prevalence of food insecurity, compromised diet, food anxiety and food poverty decreased at a similar rate in all income groups.

4.2.2 Main Source of Household Income

Those relying on welfare, worker's compensation or employment insurance as their main source of household income were almost 3 times more likely to be food insecure as compared to those whose main source of income is from employment (Table 4.1). Almost 60% of respondents whose main source of income was welfare, worker's compensation or employment insurance reported food insecurity (Figure 4.4 & Table 4.1).

Figure 4.4 Prevalence of household food insecurity, by dimension and source of household income; Canada, excluding Prince Edward Island and Manitoba, 2003.



Those receiving senior's benefits were less likely to reside in a food insecure household (AOR = 0.87, Table 4.1) than those earning wages. In addition, prevalence of food insecurity was higher in households earning wages (14.0%) as compared to those relying on senior's benefits (10.9%).

4.2.3 Type of Household

Depending on the type of household, risk of food insecurity significantly differed. Single parents with child(ren) under 25 years of age had significantly higher odds (AOR=1.36) of residing in a food insecure household compared to couples with child(ren) under 25, even after controlling for income, source of income, age, sex, education and other factors (Table 4.1). Over one quarter of all single parent households reported household food insecurity. Couples with no children had significantly decreased odds of food insecurity, with 9.2% of these households classified as food insecure. 13.6% of households categorized as 'couple with child(ren) < 25 years of age' reported food insecurity.

4.2.4 Other Household Level Factors Affecting Food Insecurity

Household education, as defined by 'some post-secondary', was the household education category most likely to experience household food insecurity (AOR = 1.26, Table 4.1) with 21.7% (Table 4.1) of all households with 'some post-secondary education' reporting food insecurity. Tenants were 1.72 times more likely to experience food insecurity compared with those who owned their dwelling, with 28% of all tenants experiencing food insecurity compared to 10.7% of dwelling owners (Table 4.1).

4.3 Individual level characteristics of the respondents

4.3.1 Socio-Demographic Characteristics

The prevalence of food insecurity was significantly higher in females (16.4%) than males (13.7%) with a slight, yet significantly greater likelihood of experiencing food insecurity (AOR =1.12; Table 4.2). Over 20% of those aged 20-34 years of age were food insecure and were almost 4 times more likely to be food insecure, compared to those 65 and older. The highest age category (65+) had the lowest prevalence of food insecurity at 8.8%.

With respect to immigration status, prevalence of food insecurity was highest among recent immigrants (0-9 years) at 22.1% compared to older immigrants (more than 9 years; 15.1%,) and non-immigrants (14.7%). However, recent immigrants had significantly lower odds of food insecurity (AOR=0.74) than non-immigrants; whereas, older immigrants had significantly greater odds of experiencing food insecurity (AOR=1.17) compared with non-immigrants.

Table 4.2 Prevalence rates of food insecurity and adjusted odds ratios for household food insecurity, by selected individual level characteristics; Canada, excluding Prince Edward Island and Manitoba, 2003.

		Food Insecurity			
		Estimated Population	**% Food Insecure**	**Adjusted Odds Ratio**	**95% CI**
Sex	Male [+]	1, 042, 329	13.7	1.00	---
	Female	1, 284,619	16.4*	1.12*	1.12, 1.12
Age group	12-19	272, 978	14.4*	2.99*	2.95, 3.02
	20-34	757, 154	20.5*	3.81*	3.77, 3.84
	35-44	537, 711	17.7*	3.44*	3.41, 3.47
	45-64	571, 806	12.2*	2.11*	2.09, 2.13
	65+[+]	187, 298	8.8	1.00	---
Marital Status	Previously married	370, 064	20.1*	0.96*	0.96, 0.97
	Single	819, 078	17.9*	0.79*	0.78, 0.79
	Married[+]	1, 132, 691	12.6	1.00	---
Immigration Status	Not an immigrant[+]	1,915,962	14.7	1.00	---
	Immigrated 0-9 years ago	138, 032	22.1*	0.74*	0.73, 0.74
	Immigrate 10+ years ago	262, 978	15.1*	1.17*	1.16, 1.18
Sense of community belonging	Very weak/weak	1, 005, 917	18.3*	1.35*	1.34, 1.35
	Very strong/strong[+]	1, 223, 853	13.0	1.00	---
Member of a Voluntary Organization	No	1, 596, 661	16.0*	1.05*	1.04, 1.05
	Yes[+]	664, 788	13.0	1.00	---

[+] Reference category
* Significantly different from reference category ($p < 0.05$)
--- Not applicable
Note: All confounding variables controlled for are shown in Table 3.6.

4.3.2 Social Capital Characteristics

Two variables, sense of community belonging and member of a voluntary organization were analyzed as indicators of social capital. Respondents who reported a very weak/weak sense of community belonging were 35% more likely to reside in a food insecure household compared to those who reported a strong/very strong sense of community belonging. 13% of participants who belonged to a voluntary organization experienced food insecurity compared to 16% who did not belong to a voluntary organization. The odds of experiencing food insecurity were slightly greater (AOR=1.05) for those who did not belong to a voluntary organization after controlling for confounding variables.

4.4 Associated Health Outcomes

Four health outcomes: BMI, self-rated health, self-rated mental health and presence of chronic conditions were examined in relation to each dimension of household food insecurity. Each dimension of food insecurity resulted in different adjusted odds ratios for each health outcome measured. For certain health outcomes the odds ratio was both positive and negative depending on the dimension of food insecurity measured. Adjusted odds ratios showed the greatest difference when the food insecure dimension was compared to food secure households versus the food anxiety, compromised diet, or food poverty dimensions.

4.4.1 BMI

It is important to note that all respondents under age 20 as well as pregnant women were excluded from the BMI analysis. Over 18% of underweight individuals were food insecure (Table 4.3). Those residing in dwellings categorized as food anxious were 15% more likely to be underweight than individuals in food secure households after controlling for age, sex, income

and education (Table 4.4). This finding is consistent with respondents in food insecure households who also are more likely to be underweight (AOR=0.95).

Nearly 14% of overweight individuals were food insecure compared to almost 18% of obese respondents (Table 4.3). There was no significant relationship between food insecure and overweight, although those reporting a compromised diet were 1.12 times more likely to be overweight than those who were food secure. On the other hand, respondents in households characterized as food anxious and food impoverished were less likely to be overweight (AOR = 0.91 and 0.92 respectively).

There was a significant and consistent relationship between obesity and almost all dimensions of household food insecurity. Respondents characterized as living in households with food anxiety were 1.15 times more likely to be obese (Table 4.4); those in households with a compromised diet were 1.19 times more likely to be obese; and, finally individuals in food insecure households were 1.24 times more likely to be obese. No significant relationship was found between obesity and food poverty.

4.4.2 Physical and Mental Health

More than 35% of individuals who reported poor health lived in food insecure households. Food insecure individuals are 2.25 times more likely to report poor or fair health. Examination of the other dimensions of food insecurity revealed a consistent, positive and significant relationship between health, mental health and all dimensions of household food insecurity. Moreover, individuals with poor or fair mental health have significantly higher odds of living in a food insecure household (AOR=3.00). Almost half of all respondents with poor mental health reported food insecurity (Table 4.3).

Table 4.3 Prevalence of household food insecurity by selected health outcomes; Canada, excluding Prince Edward Island and Manitoba, 2003.

		Estimated Population	%
	Total	2, 326, 948	15.0
BMI	Underweight (<18.5)	54, 176	18.9*
	Normal (18.5-25)[+]	878, 274	14.7
	Overweight (>25-30)	661, 477	13.9*
	Obese (>30)	419, 353	17.9*
Self-rated health	Poor	142, 201	36.7*
	Fair	313, 182	24.0*
	Good	776, 349	16.8*
	Very Good[+]	735, 782	13.1
	Excellent	357, 167	10.1*
Self-rated mental health	Poor	59, 904	49.1*
	Fair	202, 984	35.5*
	Good	639, 248	20.1*
	Very Good	732, 322	13.7*
	Excellent[+]	622, 401	10.6
Presence of a chronic condition	Yes	1,743,573	16.5*
	No[+]	576, 391	11.9

[+] Reference category
* Significantly different from reference category ($p < 0.05$)

4.4.3 Chronic Conditions

The prevalence of food insecurity among individuals with a chronic condition (16.5%) was significantly higher than individuals with no chronic condition (11.9%; Table 4.3). The relationship between the four dimensions of food insecurity and chronic conditions is not clear. Those who were considered to reside in a food poverty household were less likely to have a chronic condition (AOR=0.93; Table 4.4). In contrast, those in a food insecure household were 1.63 times more likely to have a chronic condition.

Table 4.4 Adjusted odds ratios for selected health outcomes by dimension of household food insecurity status; Canada, excluding Prince Edward Island and Manitoba, 2003.

Health Outcome	Dimension of Household Food Insecurity	Adjusted Odds Ratio	95% confidence interval
Poor/Fair Health	Food anxiety	1.26*	1.25, 1.27
	Compromised diet	1.67*	1.65, 1.67
	Food poverty	1.56*	1.55, 1.58
	Food insecure°	2.25*	2.24, 2.26
	Food Secure+	1.00	---
Poor/Fair Mental Health	Food anxiety	1.76*	1.74, 1.77
	Compromised diet	2.01*	1.99, 2.03
	Food poverty	1.24*	1.23, 1.26
	Food insecure°	3.00*	3.00, 3.01
	Food Secure+	1.00	---
Presence of a Chronic Condition	Food anxiety	1.30*	1.30, 1.31
	Compromised diet	1.57*	1.56, 1.58
	Food poverty	0.93*	0.92, 0.94
	Food insecure°	1.63*	1.63, 1.64
	Food Secure+	1.00	---
Underweight	Food anxiety	1.15*	1.13, 1.17
	Compromised diet	0.83*	0.81, 0.84
	Food poverty	1.02*	0.99, 1.04
	Food insecure°	0.95*	0.94, 0.96
	Food Secure+	1.00	---
Overweight	Food anxiety	0.91*	0.90, 0.91
	Compromised diet	1.12*	1.10, 1.11
	Food poverty	0.92*	0.91, 0.93
	Food insecure°	1.00	1.00, 1.01
	Food Secure+	1.00	---
Obesity	Food anxiety	1.15*	1.14, 1.16
	Compromised diet	1.19*	1.18, 1.198
	Food poverty	1.00	0.99, 1.01
	Food insecure°	1.24*	1.23, 1.24
	Food Secure+	1.00	---

Adjusted for age, sex and household income and household level education;
+ Reference category;
* Significantly different from reference category ($p \leq 0.05$);
° A separate regression model with food insecurity as the dependent variable, controlling for age, sex, income and education.

5. Discussion

5.1 What We Know

This research provides estimates of household food insecurity in Canada, excluding Prince Edward Island and Manitoba for 2003, as well as prevalence estimates and odds ratios for associated sociodemographic characteristics and health outcomes at the household and individual level. In 2003, an estimated 15.0% of Canadian households were food insecure which is higher than nation-wide findings from 2000/2001 (14.7%; Ledrou and Gervais, 2005). Moreover, the NPHS conducted during 1998/1999, using the same three indicator questions for household food security, resulted in a prevalence rate of approximately 10% (Che and Chen, 2001; Rainville and Brink, 2001). Moreover, it is probable that all of these national estimates of household food insecurity are underestimated, as those who are most vulnerable to food insecurity (i.e. homeless people, residents of reserves) were not sampled.

Previous research has shown that food insecure people tend to first feel anxious about food supplies, followed by altering or compromising their diet and finally, deprivation of food intake (Tarasuk, 2001a). Yet, findings from this analysis may not reflect severity of household food insecurity as previously conceptualized. More than 12% of individuals in food insecure households compromised their diet, exceeding the 10.9% that worried about having enough to eat. However, the findings that 7.6% of Canadians did not have enough to eat supports the conceptual model, in that food deprivation is the most severe stage of food insecurity. These findings from CCHS 2.1 are consistent with recent findings by Ledrou and Gervais (2005), which relied on the same three single-indicator questions for measuring household food insecurity. Moreover, Hamelin et al. (1999, 2002) posited that certain social and psychological elements of food insecurity (food anxiety) are not conceptual elements but are in fact outcomes

of food insecurity. As such, the results of this analysis suggest that the questions used to measure household food insecurity may not adequately reflect the accepted conceptualization of food insecurity.

The prevalence and distribution of household food insecurity is not experienced equally throughout as based on the findings from research question one. The odds of living in a food insecure household are significantly greater, as is the severity of food insecurity as measured by food poverty for residents of the Yukon, Northwest Territories and Nunavut, which is consistent with previous research (Ledrou and Gervais, 2005). Yet, local research conducted in Kugaaruk Nunavut has shown much higher prevalence rates of food insecurity (83-92%) and severity; for example, 44% of respondents did not eat for an entire day (Lawn and Harvey, 2003). Exclusion of remote communities in the sampling strategy may have led to an underestimation of prevalence rates of food insecurity in the territories.

Strong associations exist between household food insecurity and several household level socio-demographic variables as examined by research question two. Food insecurity is most strongly associated with income, which is not unexpected given that the questions are framed within a financial context (i.e. ...because of a lack of money) and of the known association between poverty and income. Results that show the odds of food insecurity increasing dramatically as household income decreases is in agreement with other studies of food insecurity in the Canadian context (McIntyre et al., 2000; Che and Chen, 2001; Rainville and Brink; 2001; Vozoris and Tarasuk, 2003: Ledrou and Gervais, 2005). Also consistent with other research, is the finding that individuals who rely on welfare, worker's compensation or employment insurance as their main source of income, have higher odds of household food insecurity, even after controlling for income and other confounding variables (Che and Chen, 2001; Vozoris and Tarasuk, 2003).

Previous research in food security has almost always focused on income as the main determinant. In spite of this, food insecurity is still prevalent in middle and higher income households. This suggests that other factors contribute to food insecurity and should be further studied. Consistent with previous findings, respondents who rented their dwelling were significantly more likely to be food insecure as compared with those who own their home after controlling for income and other confounding variables (Che and Chen, 2001; Rainville and Brink, 2001; Vozoris and Tarasuk, 2003). A lack of home ownership may explain how those in a higher income category may be more vulnerable to food insecurity. Respondents who are tenants may be more susceptible to unexpected or sudden financial constraints impacting disposable income and thus, food security.

Based on findings from research question two and consistent with previous findings examining the interaction between the type of household and food insecurity, these results show that single parent households have significantly higher odds of food insecurity (McIntyre et al., 2000; Rainville and Brink, 2001; Che and Chen, 2001; Vozoris and Tarasuk, 2002).

Findings from this analysis highlight several strong associations between household food insecurity and individual level characteristics. Results show lower odds of household food insecurity found among individuals age 65 and older and is consistent with previous findings (Che and Chen 2001; Rainville and Brink, 2001). Further, those households with their main source of income as senior's benefits also had decreased odds of experiencing food insecurity. One potential explanation as to why seniors seem to be at a lower risk of food insecurity may be due to subjective interpretation of the three questions. Those aged 65+ were born in 1940 or earlier and undoubtedly experienced food restrictions due to the war during their childhood and youth (CBC Archives, 1942). Therefore, these experiences may have shaped their current perspectives regarding food quality, quantity and anxiety.

One would expect recent immigrants to Canada to be at an increased risk of food insecurity as the low-income rate among immigrants is 35% (Statistics Canada, 2004), and these findings agree: 22.1% of recent immigrants reported food insecurity. Still, less obvious was the finding that when other factors were controlled for, recent immigrants to Canada have lower odds of living in a food insecure household compared to non-immigrants, which is supported by previous findings (Rainville and Brink, 2001; Che and Chen, 2001). As previously mentioned, the questions are subjective in nature and interpretation may vary depending on respondents' previous experiences. This finding merits further research within immigrant communities throughout Canada regarding their perceptions and experiences with food insecurity.

Broader approaches to the individual determinants of food security were investigated vis-à-vis the concept of social capital. Two variables, sense of community belonging and voluntary membership were analyzed to indicate social capital. The emerging consensus among social scientists is that social capital can be defined as the "norms and networks that facilitate collective action" (Woolcock, 2001). Common indicators used to measure social capital include: social trust, civic engagement, organization membership, volunteering, reciprocity, community organizational life and religious participation (Kawachi, Kim, Coutts et al., 2004). There is no consensus as to whether social capital should be measured at the individual, household or community level. In this study, individual level measures of social capital were used. Although these indicators used to measure social capital lack comprehensive rigor, this analysis does show that those who belong to a voluntary organization or those with a strong sense of community belonging have significantly less odds of experiencing food insecurity. This is consistent with findings by Martin el al. (2004) in the United States that social capital is significantly associated with decreased odds of hunger. Tarasuk (2001b) also found that women who perceived themselves to be socially isolated had greater odds of reporting food insecurity. Strong community support has also been shown to protect against serious food shortages (Tarasuk and

MacLean, 1990). Exploration of the relationship between food security and social capital has not been adequately researched (Martin, et al., 2004) but may provide information on how to ameliorate the negative social impacts of food insecurity.

Findings from research question four reinforce previous contradictory results regarding BMI and food insecurity in the literature. No clear conclusions can be drawn concerning underweight, and overweight. Depending on the dimension of household food insecurity measured, the direction of the association with BMI changed significantly. Yet, one clear relationship was established. A consistent and significantly positive association between obesity and food insecurity, food anxiety and compromised diet was observed. Still, there was no significant relationship between food poverty and obesity. These findings are consistent with those of the 1998/1999 NPHS survey which revealed that food insecure individuals had greater odds of obesity compared to residents of food secure households (Che and Chen, 2001).

The prevalence of food insecurity among individuals with a chronic condition (16.5%) is significantly higher than individuals with no chronic condition (11.9%; Table 4.3). However, when controlling for income, age, sex and education, the relationship between the four dimensions of food insecurity and chronic conditions is not clear.

Based on these findings, those who reside in a *food impoverished* household are less likely to have a chronic condition (AOR=0.93; Table 4.4). Yet, when examining the other three dimensions of household food insecurity, results confirm previous research that food insecurity is strongly associated with the presence of chronic health conditions, (Rainville and Brink, 2001; Che and Chen, 2001; Vozoris and Tarasuk, 2002). Those residing in a food insecure household are 1.63 times more likely to have a chronic condition.

Findings from this research demonstrate the odds of reporting poor/fair health are significantly higher for respondents in food insecure households, consistent with previous research (McIntyre et al., 2000; Rainville and Brink, 2001; Che and Chen, 2001; Vozoris and

Tarasuk, 2002). These results also demonstrate that respondents in food insecure households have significantly higher odds of reporting poor/fair mental health. These findings are consistent with previous research that has shown higher odds of depression and distress in respondents from food insecure and food insufficient households as well as feelings of psychological suffering (Che & Chen, 2001; Hamelin, et al., 2002; Vozoris and Tarasuk, 2003).

5.2 What We Don't Know, and Need to Know

The household level measure of food insecurity used in this analysis does not reflect variability within the household. That is, food insecurity is a managed process and results in different members of the households experiencing different components of hunger at different times and to differing severity (Radimer et al., 1992). Measuring household level food insecurity may lead to an underestimation of the proportion of food insecure individuals in studied populations (Barrett, 2002). Thus, no conclusions can be drawn on how other members of the household experience food insecurity.

The appropriateness of a household level measure used to interpret findings of individual level characteristics is questionable (Tarasuk, 2004). Measures of food insecurity at both the individual and household level may help to clarify interpretations of the associated socio-demographic and health characteristics of food insecure individuals. In addition, this measure of food insecurity neglects to account for duration, severity or frequency of household food insecurity; all of which are important in understanding the interactions between food insecurity and health outcomes (Tarasuk, 2004). Knowledge of these factors may provide a better understanding of the pervasive nature of food insecurity and the associated risks. These findings underscore the need to form a coherent and coordinated approach to measuring food insecurity throughout Canada.

This analysis has inherent data limitations due to the cross-sectional design of the study and because of the indicators used to measure household food insecurity. Further, no residents of Manitoba, Prince Edward Island, First Nations Reserves or homeless people were included in the sample.

The subjective nature of the questions used to measure household food insecurity may influence the interpretation of these questions in population groups with differing perspectives and backgrounds. In particular, measurement tools to be used with First Nations, Métis, and Inuit communities have not been validated in Canada (Lawn and Harvey, 2004). Research conducted in Hawaii has shown that although the FSM is valid and reliable when used with Asians and Pacific Islanders, but the same is not true for Samoans (Derickson, Fisher, and Anderson, 2000). Cultural differences may influence the interpretation of questions used to measure food insecurity and should be further researched within the Canadian context.

Other considerations for food insecurity measurement should include geographical differences. The dispersed and remote nature of communities throughout Canada may lead to food insecurity due to access issues rather than monetary factors. Questions used in this research to measure food insecurity, did not consider access to food in the question construction. All questions were framed within the context of money. Neglecting to consider issues of access to food may lead to under-reporting of food insecurity in regions where access is a problem or with individuals who may be unable to access traditional food sources (i.e. by way of hunting or fishing).

Due to the non-exclusive relationship between income and food insecurity, further research must be undertaken to better understand the inherently complex nature of the food insecurity experience. To date, the majority of qualitative studies examining food insecurity have focused on low-income individuals. Thus, qualitative studies examining food insecurity across

differing household income categories may provide unique insights as to the explanation and experience of food insecurity for those in higher income categories.

6. Conclusion

Evidence from this research reinforces previous investigations exposing the consequences of food insecurity as broad and severe, affecting physical health and emotional well-being. Fifteen percent of respondents lived in households characterized as food insecure, with residents of the territories experiencing higher odds of food insecurity and a much higher prevalence of food poverty. Respondents who self-reported poor or fair mental health and physical health were over 2.25 and 3.00 times more likely to live in a food insecure household. Further, obese individuals were nearly 25% more likely to reside in a food insecure household. Based on these findings, the response and solutions to food insecurity must also be broad, incorporating many different sectors and levels of civic response (Marmot, 1998). Current initiatives addressing food security at the local, municipal and provincial levels such as the Toronto or Manitoba Food Charter highlight the importance attached to this issue by civil society. Ad hoc local food security programs such as Good Food Boxes and Community Gardens further reinforce civic action, going beyond provision of charitable food, and working toward more sustainable food systems.

Implementation of a coordinated food security strategy by the government of Canada could create a symbiotic partnership with current voluntary and local community efforts. Even more, a coherent national framework addressing food security will fulfill Canada's international commitments to providing the right to food for all citizens. In conjunction with this, and based on findings from this research, social policy must address adequate levels of social assistance and minimum wage. This analysis shows that almost 60% of households that rely on social assistance as their main source of household income were food insecure. Likewise, low-income Canadians are almost 14 times more likely to be food insecure. Research by Borjas (2004) in the United States found that for every 10-percentage point cut in the fraction of the population that

receives social assistance, the fraction of food insecure households increases by approximately 5 percentage points. Social spending trends over the past decade have eroded and weakened Canada's social welfare system to a point where neither social assistance nor minimum wage meets the basic needs of citizens as proven by this research. Therefore, these results reinforce repeated calls for strengthening the social welfare system to ameliorate food insecurity in Canada. Advancing a national strategy on food security could help to improve the health and well-being of Canada's most vulnerable populations.

A nation-wide food security monitoring system must be developed and implemented as outlined in Canada's Action Plan for Food Security. This research was not able to neither investigate nor interpret results of household food insecurity in terms of the duration or frequency. Moreover, findings of this analysis showing a high prevalence of household food insecurity among recent immigrants yet a decreased odds of household food insecurity as compared to non-immigrants highlights the need for a measurement tool that is sensitive to the unique linguistic and cultural diversity of Canada. In order to improve the health of all Canadians we must better understand the prevalence and consequences of such fundamental determinants of health as food security. The future monitoring system in Canada should be developed in accordance with these concerns.

Rising health care costs and growing health disparities in Canada cannot be addressed by health services alone (Health Council of Canada, 2005). Attention must shift to investing in preventative and social programs to improve food insecurity in Canada and in turn, the health of Canadians. Research has demonstrated that food insecurity can complicate disease management, and that a more cost effective strategy would be to address issues of food insecurity rather than increase health services (Nelson et al., 2001). The estimated cost of poor nutrition is actually greater than that of smoking (cited in Caraher and Coveney, 2004). Investments in preventative

health and social programs show great promise for alleviating food insecurity in Canada and in turn, improving the health of Canadians.

Although a stated human right, food is yet to be recognized as such within our social, cultural and political mainstream. A healthy population cannot subsist without access to sufficient, safe and nutritious food at all times. It is the responsibility of governments to ensure that basic needs of its citizens are met and a healthy life is attainable for all. Achieving a food secure Canada is possible and begins with the recognition of these findings, revealing that food insecurity and hunger exist in Canada, despite our wealth among the world's nations.

7. Appendices

Appendix A

Optional Topic Modules of CCHS 2.1

CCHS Cycle 2.1 Optional Topic Modules				
Alcohol dependence	Blood pressure check	Breast examinations	Breast self examinations	Colorectal cancer screening
Contact with mental health professionals	Dental visits	Depression	Dietary supplement use services Distress	Driving and safety
Eating troubles assessment	Food choices	Health care system satisfaction	Health status SF-36	Health utility index
Home safety	Illicit drug use	Leisure activities	Mastery	Medication use
Nicotine dependence	Oral health (2) – optional	Patient satisfaction	Physical check-up	Physician counseling-smoking
Problem gambling	Prostate cancer screening	Satisfaction with availability of health care	Satisfactions with life	Sedentary activities
Self-esteem	Smoking cessation aids	Social support	Stages of change (smoking)	Suicidal thoughts and attempts
Tobacco alternatives	Use of protective equipment	Work stress		

Appendix B.

List of variables used in regression models

Explanatory Factor	Type of Variable
Respondent aged 12-19	Dichotomous
Respondent aged 20-34	Dichotomous
Respondent aged 35-44	Dichotomous
Respondent aged 45-64	Dichotomous
Total Household income: Low	Dichotomous
Total Household income: Lower-middle	Dichotomous
Total Household income: Middle	Dichotomous
Total Household income: Upper-middle	Dichotomous
Total Household income: Missing	Dichotomous
Type of household: Couple alone	Dichotomous
Source of household income: Welfare/worker's compensation/employment insurance	Dichotomous
Source of household income: Senior's benefits	Dichotomous
Source of household income: Not stated	Dichotomous
Type of household: Single	Dichotomous
Type of household: Other	Dichotomous
Marital status of respondent: Widowed, divorced, separated	Dichotomous
Marital status of respondent: Single (never married)	Dichotomous
Respondent has been an immigrant for 0-9 years	Dichotomous
Respondent has been an immigrant for more than 9 years	Dichotomous
Living in the territories	Dichotomous
Sense of community belonging	Dichotomous
Member of a voluntary organization	Dichotomous
BMI: Underweight	Dichotomous
BMI: Overweight	Dichotomous
BMI: Obese	Dichotomous
Self-perceived health	Dichotomous
Self-perceived mental health	Dichotomous
Presence of chronic condition	Dichotomous

Appendix C.

Prevalence of household food insecurity by selected province, 2002/2003.

	Count	Estimated Population	Prevalence of Food Insecurity %
Total	12563	2, 326, 948	15.0
Province			
Newfoundland and Labrador	696	73, 418	16.3
Prince Edward Island	-----	----	-----
Nova Scotia	867	143, 924	18.5*
New Brunswick	819	104, 907	16.8*
Quebec	3448	775, 612	13.1*
Ontario[+]	1246	220, 157	14.8
Manitoba	-----	----	-----
Saskatchewan[+]	146	25, 223	13.1
Alberta	2119	416, 975	16.7*
British Columbia	2614	551, 023	16.0*
Yukon, Northwest Territories & Nunavut	581	15, 708	22.2*

* Significantly different from national average.
--- No data available
[+] Limited sample size available

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