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**Neighborhood matter: Variation in food insecurity not explained by household characteristics**

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## **Abstract**

This study investigated the relationship between the social and economic contexts of neighborhoods and household food insecurity. Four years of data (2007 through 2010) drawn from the nationally representative Canadian Community Health Survey, which measures food insecurity using the Household Food Security Survey Module, were matched with the 2006 Census. Economic and social indicators from Census tracts were aggregated to the level of provincial and territorial health regions. Using random intercept logistic multi-level modeling in a Bayesian environment, with household characteristics and health region characteristics as level 1 and level 2, respectively, it was found that 14% of the variations in food insecurity prevalence lies between neighborhoods. After controlling for relevant household-level predictors, the prevalence of female-lone parent led households in a neighborhood raised the population prevalence of food insecurity by 2% as did low average household income. Therefore, the social and economic contexts in which households reside contribute independently to increased food insecurity among their residents. They reveal important differences in quality of life across Canadian provinces and territories.

## **I. Introduction**

Canada has one of the highest per capita incomes in the world but a significant proportion of its population regularly reports food insecurity or better still, lacking access to safe and nutritious food due to inadequate income and sometimes resorting to extraordinary means to acquire it. An examination of the 2012 Canadian Community Health Survey (CCHS) data reveals that about 13% of Canadians were food insecure in the previous 12 months. While much of the discourse in understanding drivers of this serious public health concern is at household level (Nord 2007; Rainville and Brink 2001; Che and Chen 2001; Tarsuk 2005), where it occurs, evidence from nationally representative Canadian surveys, particularly CCHS, has consistently shown striking variations in prevalence rates of food insecurity among vulnerable populations within and across Canadian provinces and territories.

The 2007-08 CCHS revealed that provincial household food insecurity was least intense in Saskatchewan (6.3%) but it affected one out of three Nunavut residents (32.6%). Even wider variation in prevalence rates is apparent among specific sub-groups, particularly those with low or fixed income. The prevalence among lone-parent female-led families averaged 25% nationally but ranged from 15.8% in Quebec to 38.7% in Manitoba, 33.4% in Nova Scotia and 56.4% in Nunavut. It is important to stress that economic and social environments are not the same across Canadian provinces. For instance, from 2010 to 2011, food costs increased by 4.2% in British Columbia, 3.1 % in Alberta, 4.1% in Saskatchewan, 3.1% in Manitoba, in 4% in Ontario, 3.5% in Quebec, 4.6% in New Brunswick, 4.6% in Nova Scotia, and 4.4% in Prince Edward Island.<sup>1</sup> This supports the conjecture that factors other than or in addition to household-level

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<sup>1</sup> <http://www.statcan.gc.ca/tables-tableaux/sum-som/101/cst01/econ09a-eng.htm>

characteristics lead to household food insecurity in Canada. Although few Canadian studies have explored the significance of area-level characteristics on food insecurity, their unit of analysis was census metropolitan areas (Sriram and Tarasuk 2015; 2016). This paper uses health regions rather than census metropolitan areas to define and capture neighborhood-level effects. Thus, this paper investigates the relationships between economic contexts in which households reside as well as household-level characteristics and food insecurity in Canada. The outline of the paper is as follows. We begin in section II with review of existing literature. We describe data and methodology in section III while results are discussed in section IV. We conclude in section V.

## **II. Literature review**

Current research on food insecurity is centered on understanding the determinants of this growing public health concern as well as investigating its effects on different measures of wellbeing. Although many of the Canadian studies on the aforementioned public health issue emphasized household-level variables few have examined how macroeconomics variables or social attributes in which households reside shape the likelihood of being food insecure. Some of the common risk factors identified in the literature as aiding the likelihood of household food insecurity are inadequate income, living in rented dwelling, main source of income being social assistance, female-headed lone parent household structure, and low educational attainment. Using data from the Ontario Share File of the 2004 Canadian Community Health Survey, Tarasuk and Vogt (2009) found that the risk of being food insecure increased sharply with low-income adequacy. Carter et al. (2010) revealed that New Zealanders in economically

disadvantaged households (that is those in the lowest income bracket) were four times more likely to be food insecure than were households with income in the higher range. Nord et al. (2007) identified low-income households to be more likely to experience food insecurity than their counterparts in high-income brackets.

Research has shown that household assets such as liquid asset, home ownership and a household's ability to borrow and save tend to moderate household food security status. Using homeownership as a measure of household asset, Tarasuk and Vogt (2009) indicated that households living in rented dwellings were more likely to experience food insecurity than households living in owned dwellings. After controlling for socio-demographic characteristics, Ribar and Hamrick (2003) and Guo (2011) found that liquid assets and homeownership buffered against the experience of food insecurity. Homeownership has some added advantages mitigating the risk of being food insecure. Gundersen and Gruber (2001) showed that, in the face of income variability, living in one's owned dwelling can draw on accumulated equity to smooth out consumption and thereby reduce the likelihood of food insecurity.

Another factor that influences the experience of food insecurity is income variability. Gundersen and Gruber (2001) demonstrated that, in the absence of household assets, negative income shocks tend to expose households to the risk of being food insecure irrespective of level of income. This is because income variability tends to have significant negative effect on food expenditure (Blundell and Pistaferri 2003). Using data from the Fragile Families and Child Wellbeing Study, Hernandez and Ziol-Guest (2009) revealed that a significant decline in household income led families to cycle in and out of eligibility status for food assistance.

The relationship between household structure and the risk of food insecurity has been well documented by researchers. Ratcliffe and McKernan (2010) found that lone parent households, i.e., female-headed and male-headed households, were more likely than couple households to be food insecure. Relatively, female-headed lone parent households tend to be more vulnerable to food insecurity than male-headed lone parent households. Using the 2000/2001 Canadian Community Health Survey, Ledrou and Gervais (2005) reported that male-headed lone parent households were less likely than female-headed lone parent households to experience food insecurity. Mason (2006) inferred that vulnerability to food insecurity is higher in female-headed lone parent households because they often attempt to fulfill two conflicting roles, that is: nurturer and provider.

The main source of household income also plays an important role in the likelihood of being food insecure. Tarasuk and Vogt (2009) found that pension or senior benefits buffer, whereas reliance on social assistance increases households' vulnerability to the risk of being food insecure. On the other hand, Carter et al. (2010) documented that recipients of any mean-tested government benefits were more likely to be food insecure than non-recipients in New Zealand. Using the 1995 – 1999 March Supplement of the US Current Population Survey, Borjas (2004) found that reducing the number of households relying on social assistance either through changes in program requirement or eradication of some of the existing programs by a 2% percentage point increased prevalence of food insecurity by 1% percentage point. For a well-known vulnerable population in Canada, Willows et al. (2008) showed that paid employment was an important protecting factor against the risk of being food insecure in Aboriginal households.

In addition to household-level attributes, evidence from US studies reveal that neighborhood attributes can make or mar household food security status. Bartfeld et al. (2006) enumerated that the experience of household food insecurity tends to be higher in places where there is low average wage, high rental cost of housing, high unemployment rate, and high tax burden on low-income households. Using a pooled data of Current Population Survey Food Security Supplement (CPS-FSS) spanning 1999 to 2001 mapped on 2000 Census Survey, Tapogna et al. (2004) found that states in which families live in different houses, renters paying more than 50% of income on gross rent, and where job loss rates are higher than usual are more prone to higher rates of food insecurity than states where the abovementioned elements are missing. Kimbro, Denney, and Panchang (2012) revealed that poor neighborhood characteristics increase the likelihood of food insecurity among kindergarten and third graders. Explicitly, they found kindergarten students residing in black/low socioeconomic status (SES) neighborhood and Hispanic/foreign-born neighborhood are 2 times and about 3 times more likely to report being food insecure than their counterparts residing in a white/high SES neighborhood.

Focusing on the social contexts of neighborhoods in which households reside, Chung et al. (2011) explicated that the design of neighborhoods cannot be overemphasized in the fight against hunger among elders with lower income. They posited that designs that encourage walking might mean greater accessibility to affordable food outlets. They found no significant effect of social cohesion on the experience of food insecurity. In contrast, Brisson (2012) found that social cohesion was an important neighborhood factor in moderating the experience of food insecurity among low-income mothers residing in Boston, Chicago, and San Antonio. Based on the



foregoing, it is important to examine how both household- and neighborhood levels characteristics moderate food insecurity in Canada.

### **III. Data**

This study used combined data from cycles 4.1 (2007 – 2008) and 5.1 (2009 – 2010) of the CCHS (Thomas and Wannell 2009). The coverage for both cycles was different. Cycle 4.1 was administered in all Canadian provinces and territories but the cycle 5.1 was optional. As a result, eight provinces (British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, Nova Scotia, and Newfoundland and Labrador) and the three territories (Nunavut, Northwest Territories and Yukon) selected the household food security survey module.

The CCHS is a cross-sectional survey that collects information from a nationally representative sample of Canadian population about health determinants, socio-demographic characteristics, and disease status. The survey targets people aged 12 or older who live in private dwellings in the provinces and territories. Residents of Aboriginal reserves, Crown lands, institutions and certain remote areas, and fulltime members of the Canadian Armed Forces are excluded. The survey covers approximately 98% of the population in the provinces; and data were collected by computer assisted telephone and in-person interviews; 30% to 40% of the interviews were conducted in person. To account for neighborhood factors, combined data of cycles 4.1 and 5.1 of CCHS matched with the 2006 Census of Canada using health regions. This process produced information regarding 225,882 households over 228 health regions across Canada.

## Methodology

Our dataset comprised of two levels. Level 1 consists of household-level variables and these are nested into level 2, i.e., health region characteristics. Using intraclass correlation coefficient (ICC), we examined the proportion of food insecurity prevalence variation that occurs across health regions (i.e., level-2 units). Thereafter, a two-level random intercept multilevel logistic regression model was developed in MLWin 2.28 and processed from within STATA 12 (Leckie and Charlton 2013; Leyland and Groenewegen 2003; Peugh 2010). The technique was chosen for it allowed the prevalence of food insecurity to vary across level-2 units (i.e., health regions). The two-level household food insecurity-within-health regions variance components model is written as

$$food_{ij} \sim \text{Bernoulli}(\pi_{ij})$$

$$\text{logit}(\pi_{ij}) = \alpha_0 + \alpha_j X_{ij} + \mu_j$$

$$\mu_j \sim N(0, \sigma_\mu^2)$$

where  $food_{ij}$  is the binary response for whether a household  $i$  in health region  $j$  was food insecure,  $X_{ij}$  are household-level characteristics,  $\alpha_0$  is the intercept measuring the log-odds of food insecurity prevalence in the average health region and  $\mu_j$  is a health region random effect, which follows a Normal distribution with zero mean and constant variance  $\sigma_\mu^2$  (Lopez-Carr, Grant, Weeks, and Lopez-Carr 2010). Average household income, proportion of: female-lone parent households, male-lone parent households, postsecondary graduates, Aboriginal population, immigrant, and senior population were entered at the health regional level.

**Table 1: Multilevel logistic regression of food insecurity in Canada (N = 225, 882 households from 228 health regions)**

Variable	Null model		Household-level model		Household & Health region model	
	Coefficient	P-value	Odds Ratio	P-value	Odds Ratio	P-value
Intercept	0.07***	(0.000)	0.042***	(0.000)	0.053***	(0.000)
<b>Health region characteristics</b>					1.018***	(0.000)
Female-lone parent household (%)					1.024***	(0.003)
Male-lone parent household (%)					0.997**	(0.011)
Postsecondary graduates (%)					1.003***	(0.003)
Immigrants (%)					0.997***	(0.004)
Senior population (%)					0.962***	(0.000)
Average household income (\$'000)					1.002	(0.307)
Unemployment rate (%)						
<b>Household-level characteristics</b>						
Home ownership			0.404***	(0.000)	0.427***	(0.000)
Household size			1.223***	(0.000)	1.221***	(0.000)
Senior in the household			0.282***	(0.000)	0.285***	(0.000)
Aboriginal household			1.549***	(0.000)	1.519***	(0.000)
Lone parent			1.415***	(0.000)	1.398***	(0.000)
Immigrant household			1.041	(0.180)	1.003	(0.919)
<i>Smoker (Ref Non smoker)</i>						
Occasional smoker			1.421	(0.000)	1.418***	(0.000)
Regular smoker			1.792	(0.000)	1.779***	(0.000)

<i>Sources of income (ref wages and salaries)</i>					
Self-employment	0.649***	(0.000)	0.663***	(0.000)	
Employment insurance	1.972***	(0.000)	1.955***	(0.000)	
Social benefits	2.857***	(0.000)	2.795***	(0.000)	
Senior benefits	0.979	(0.545)	0.981	(0.588)	
Others	1.155***	(0.002)	1.162***	(0.001)	
<i>Household income (ref \$60,000 - &lt;\$70,000)</i>					
<\$10,000	7.626***	(0.000)	7.500***	(0.000)	
\$10,000 - <\$20,000	6.341***	(0.000)	6.217***	(0.000)	
\$20,000 - <\$30,000	3.837***	(0.000)	3.758***	(0.000)	
\$30,000 - <\$40,000	2.509***	(0.000)	2.469***	(0.000)	
\$40,000 - <\$50,000	1.705***	(0.000)	1.685***	(0.000)	
\$50,000 - <\$60,000	1.292***	(0.000)	1.279***	(0.000)	
\$70,000 - <\$80,000	0.774***	(0.001)	0.778***	(0.001)	
\$80,000 - <\$90,000	0.610***	(0.000)	0.616***	(0.000)	
\$90,000 - <\$100,000	0.513***	(0.000)	0.521***	(0.000)	
\$100,000 - <\$250,000	0.252***	(0.000)	0.264***	(0.000)	
\$250,000 - \$500,000	0.137***	(0.000)	0.154***	(0.000)	
Unknown	1.572***	(0.000)	1.576***	(0.000)	
<i>Education (Ref High School)</i>					
Less than high school	1.381***	(0.000)	1.372***	(0.000)	
Some post secondary	1.290***	(0.000)	1.296***	(0.000)	
Trade School	1.136***	(0.000)	1.143***	(0.000)	

Cert or diploma >= Baccalaureate		1.067** 0.645***	(0.035) (0.000)	1.079** 0.671***	(0.014) (0.000)
<i>Location (Ref Ontario)</i>					
Atlantic		1.082	(0.159)	1.045	(0.455)
Quebec		0.566***	(0.000)	0.558***	(0.000)
West		0.939	(0.136)	0.929*	(0.089)
Territories		1.146	(0.187)	1.191	(0.127)
Variance component	0.043		0.043		0.044
Intra-class correlation coefficient, %					
Level-1 units	0.03				
Level-2 units	0.14				

\*p < 0.1; \*\*p < 0.05; \*\*\* p < 0.01

#### **IV. Results**

Table 1 presents the multilevel regression estimates of household- and neighborhood-level characteristics on household food insecurity. Our analysis showed that when all coefficients are equal to zero, the average prevalence of household food insecurity in each health region was 0.07 (plus or minus 0.04). In other words, the likelihood of a health region containing a majority of food secure households is lower than that of it having a majority of food insecure households. Overall, 14% of variations in household food insecurity were influenced by social and economic contexts in which households reside or better still health region characteristics. We did find that household-level characteristics such as home ownership and having senior(s) in the household provide a protective effect on the likelihood of being food insecure.

Specifically, homeownership reduces the probability of being food insecure by 57%. In the same vein, households with at least one senior member of the society (anyone whose age is 65 years and older) are 71% less likely to report being food insecure. In contrast, household size, lone parent households, and Aboriginal households contribute significantly to the likelihood of being food insecure. Explicitly, the likelihood of experiencing food insecurity in lone parent households, Aboriginal households, and households with higher members increases by 40%, 52%, and 22%, respectively.

The experience of household food insecurity is not unconnected to inadequate income and income shocks. Findings from this study revealed that household income above CAD\$70,000 buffers against the odds of being food insecure. Generally, higher household income had a cascading positive effect on the probability of food insecurity while lower household income had an increasing negative impact on the probability of

being food insecure. Reliance on employment insurance as source of income increased the odds of being food insecure by 98%. However, the risk of exposure to food insecurity was significantly higher for households whose main source of income is social assistance than their counterpart whose main source of income is either wages or salaries. In these aforementioned households, the odds of food insecurity was about 3 times higher than the referenced source of income, i.e., wages and salaries. On the other hand, self-employment buffers against the likelihood of household food insecurity. Households whose main source of income is self-employment were 34% less likely to report being food insecure than the referenced source of income.

We did find that having a smoker in any household increases the odds of food insecurity. Odds of food insecurity are 42% and 79% more in households with at least one occasional and regular smoker, respectively. Highest level of educational attainment did matter to the chances of becoming food insecure or otherwise. Our analysis showed that households whose highest level of educational attainment is Baccalaureate degree or higher have significant buffering capacity against food insecurity. The location of households did have immense effect on the likelihood of being food insecure. Residing in Quebec reduced the probability of household food insecurity by 46 percent.

Regarding variables of interest, neighborhood-level characteristics, we found that average household income, percent of senior population, percent of immigrant population, percent of postsecondary graduates, prevalence of female lone-parent households, and prevalence of male lone-parent household were significantly associated with food insecurity. Plainly, we found that a 1% increase in prevalence of female lone-parent households raises the odds of food insecurity by 2% in a neighborhood. However,

people living in neighborhoods with a 1% increase in postsecondary graduates or senior population were 1% less likely to report being food insecure. In the same vein, a \$10,000 increase in average household income reduces the probability of food insecurity by 4% in a neighborhood.

## **Discussion**

In this study, we examined the effect household-and neighborhood-level characteristics on food insecurity in Canada over four years from 2007 to 2010. Our result supported the view that household-level variables drive the prevalence of food insecurity. Household-level variables such as homeownership, having at least one senior in the household, self-employment as the main source of income, and residency in Quebec provide protective effect on the probability of being food insecure. On the other hand, higher household size, reliance on employment insurance or social assistance, living with occasional or regular smoker, highest household educational attainment below Baccalaureate degree, residency in other parts of Canada, and household income below CAD\$60,000 were associated with increased exposure to the threat of being food insecure.

More importantly, this study showed that neighborhood-level characteristics, as measured by health region characteristics, ought not be ignored in the fight against food insecurity in Canada. Our findings aligned with existing knowledge on the significance of neighborhood-level variables on the risk of being food insecure. It is instructive that households who live in neighborhoods with high concentrations of senior population were less likely to report being food insecure. This may be alluding to the existence of strong inter-relationship among residents particularly in old neighborhoods. Among other



things, old neighborhoods are known for long history of connectedness and strong sense of belonging, which, in turn cannot be discounted in the fight against food insecurity (Omariba 2010). In contrast, residents of neighborhoods with significant proportion of immigrant population are prone to report being food insecure. One reason could be because of uncoordinated or absence of social networks. Similarly, households in these neighborhoods are less likely to possess vital information necessary to assuage their risk of being food insecure.

Another important finding of this research is that living in neighborhoods with higher median income is beneficial to household food security status. This might be because of existence and unabated accessibility to poverty-reducing amenities, resources, and services. This view is corroborated by a commissioned study on strong neighborhoods by the city of Calgary. Findings of the commissioned study revealed that neighborhoods with higher median income are less likely to have payday loan companies and other retail outlets capable of promoting discretionary spending behaviors that could draw from household food expenditure (Family and Community Support Services [FCSS] 2014).

Another novel addition of this study centers on understanding the effect of higher concentration of lone parent households in any neighborhood on the likelihood of household food insecurity. Our findings revealed that food insecurity is strongly associated with higher concentration of either male or female lone parent households. One possible reason for the strong link is that higher prevalence of low-income cohorts among these families promotes poverty related indicators. Also time is a premium

resource in lone parent households hence it is not uncommon to experience low level of participation in community activities in these families (Beauvais and Jenson 2003).

## **V. Conclusion**

This study examined the impact of neighborhood level variables, in addition to household level variables, on household food insecurity. Our analysis revealed that food insecurity is not entirely due to household-level characteristics in general or inadequate income in particular. Nonetheless, some factors are within the realm of personal control and involving changes that households can affect to improve their food security status. The important finding of this paper is that neighborhood level variables moderate the experience of household food insecurity. In sum, findings of this study reinforce the view that food insecurity is a complex phenomenon, which is influenced by a host of household and contexture factors. Therefore, external interventions addressing variations in neighborhood level indicators are needed to contain the phenomenon.

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