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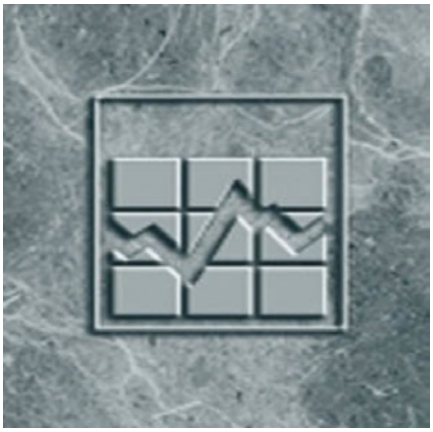
Association between Food Security and Stressful Life Events among Canadian Adults



by Alexander El-Hajj and Emmanuel Benhin

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Association between Food Insecurity and Stressful Life Events among Canadian Adults

by **Alexander El-Hajj** and **Emmanuel Benhin**

Abstract

This study investigates the extent to which stressful life events may increase the likelihood of food insecurity among the Canadian adult population. Data from the Wave 4 (2018) of the Longitudinal and International Study of Adults (LISA) and multivariable logistic models were used for the analyses, taking into account the complex survey design and adjusting for other socio-demographic and socio-economic variables known to be associated with food insecurity. The results show that work and health-related stressful life events significantly increase the likelihood of exposure to food insecurity. The results also show that adults who reported having two or more stressful life events were about four times more likely to experience food insecurity than those who reported zero stressful life events.

Introduction

There is increasing evidence that stressful life events contribute to the likelihood of experiencing food insecurity (Temple, 2018; Martin et al., 2016; Hadley & Patil, 2006). Temple (2018) provided results that indicated a strong association between stressful events and food insecurity in the context of the Australian population. This paper, in the context of the Canadian adult population, investigates the association between stressful life events and adult food insecurity. The study has two components: first, to investigate the association between each stressful life event experienced and food insecurity and second, the association between experiencing multiple stressful life events and food insecurity. The latter attempts to demonstrate that experiencing multiple stressful life events may significantly increase the likelihood of an individual reporting food insecurity, compared to experiencing one or no stressful life event.

Health Canada (2012) defines household food insecurity as "the inability to acquire or consume an adequate diet quality or sufficient quantity of food in socially acceptable ways, or the uncertainty that one will be able to do so." Research on food insecurity has increased significantly over the last decade, establishing a wide array of evidence demonstrating the impact food insecurity has on Canadians' mental, physical, and social health, as well as considerable costs to the Canadian healthcare system (PROOF Food Insecurity Policy Research, 2018).

At the core of Canadian food policy is the *Universal Declaration of Human Rights* of 1948, which sets out to ensure that everyone has the right to a quality of life adequate for the well-being of themselves and their family, including food and medical care (Article 25 of United Nations, 1948). Canada confirmed its position as a leader in supporting the right to food when it signed the *International Covenant on Economic, Social and Cultural Rights* in 1976, which recognized the fundamental human right for everyone to have adequate food and to be free from hunger (Standing Committee, 2017). In 2015, Canada and all 192 United Nations Member States ratified the 2030 *Agenda for Sustainable Development*, which is a global initiative with 17 goals, including reducing inequality, eliminating poverty, and ending hunger (i.e., "zero" hunger) by 2030 (Global Affairs Canada, 2018). More recently, Budget 2019 announced a $134.4M investment in new funding over the next five years to support the first-ever Food Policy for Canada (Government of Canada, 2019). This budget tackles food insecurity through two of the four key visions: ensuring access to healthy food for Canadian communities and supporting food security in Northern and Indigenous populations. The remaining two visions include making Canadian food the preference domestically and abroad, and decreasing food waste. The Government of Canada also established a Canadian Food Policy Advisory Council that will enable a diverse range of collaborations and discussions on gaps in policies and data pertaining to the food-related dilemmas of the present and the future.

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The number of studies on the association between stressful life events and food insecurity are sparse, with the majority of them coming from outside Canada (Temple, 2018; Drucker, 2015; Melchior et al., 2009; Hadley & Patil, 2006; Laraia et al., 2006). What constitutes stressful life events may vary from one country to the other or from one study to the other. Studies based on the Canadian population (Martin et al., 2016; Olabiyi & McIntyre, 2014; Gucciardi et al., 2009) typically use the Canadian Community Health Survey (CCHS) variable self-perceived stress, along with other indicators, such as smoking, alcohol consumption, gambling and self-perceived community belonging. In this study, we define stressful life events as either anticipated or unexpected events that can have adverse effects on the welfare of individuals and their families (e.g., an unexpected layoff or being victim of a crime). For this paper, the authors used six LISA questionnaire modules to create a total of ten potential (stressful) life events.

Data from the Wave 4 (2018) of the LISA and multivariable logistic regression models, taking into account the complex survey design as well as adjusting for socio-demographic and socio-economic variables known to correlate with food insecurity, were used to examine the association between stressful life events and food insecurity among the Canadian adult population.

Methods

Data

This study uses data from the Longitudinal and International Study of Adults (LISA), a biennial household survey that collects data (socio-economic, socio-demographic, health and perceptions) from a nationally representative sample of the Canadian population, excluding the territories. LISA households were sampled using a stratified, multi-stage, multi-phase design.[1] All members of the sampled households aged 15 years and older were eligible for the LISA questionnaire. The longitudinal reference population is the Canadian population in 2012. Between January 2018 and June 2018, Wave 4 survey data was collected from 10,640 respondents remaining in the longitudinal sample.[2] The food security questionnaire module, adopted from the Canadian Community Health Survey (CCHS), was first introduced in Wave 4 (2018), whereas the questionnaire module on life events has been included in LISA Wave 2 (2014), Wave 3 (2016) and Wave 4 (2018).[3] Data from Wave 4 on stressful life events, food security and selected control variables form the basis of the analyses reported in this study. It should be noted that even though the survey is longitudinal, the food insecurity data was only available for the Wave 4 (2018) and so the analyses reported in this paper are essentially cross-sectional.

It should be noted that 0.9% of the LISA sample did not provide data for the food security module and, hence, were excluded from the descriptive statistics and statistical analyses. An investigation was done to verify that excluding these respondents from the analyses did not impact the overall results of the analyses. The approach taken was to conduct analyses with and without the missing data imputed. The odds ratios calculated from these two analyses were found not to be significantly different. For simplicity, only the results from the non-imputed data are presented in this paper.

1. Supplementary details on the sampling methods can be found in the User Guide of the Longitudinal and International Study of Adults, 2018.
2. These are individuals who have responded continuously from Wave 1 (2012) to Wave 4 (2018).
3. An additional life event question was introduced in Wave 3 (2016): Received income worth $5,000 or more that was non-taxable, such as money gifts from persons outside your household, cash inheritances or life insurance settlements.

Measurement

Food Security

The food security module used in this study was based on the Household Food Security Survey Module (HFSSM) classification, a module originally derived from the U.S. Department of Agriculture (USDA)[4] and first implemented in the Canadian Community Health Survey Cycle 2.2 – Nutrition (2004)[5] component. The food security data was collected from one household member, i.e., the person considered to be the most knowledgeable member (PMK) of the household.[6] The HFSSM contains 18 questions about income-related food security experiences in the household over the previous 12 months: ten of these questions were related to the adult food security experiences and eight were related to the child food security experiences. The ten adult food security questions were used to create adult food security scale with three categories – severely food insecure, moderately food insecure and food secure.[7] This means that each PMK response was re-classified into one of these three categories. To achieve reliable estimates, the moderately and severely food insecure categories were combined into one category, food insecure. Resulting in two categories for the food security measure – food insecure and food secure.

The Longitudinal and International Study of Adults (LISA) survey and bootstrap weights necessary for any valid person-level statistical analyses were created for all responding adults in the household. However, the food security data was only collected from one responding adult of the household, the PMK. In order to produce valid statistical analyses using the LISA data, the PMKs' data were first assigned to the other responding adult members of the household (see El-Hajj & Benhin [2020] for further discussion). The key assumption here is that the adult food security experiences of the PMK are similar to the other adult members of the household. This is a similar assumption made by having the PMK to provide the household-level food security data.

Stressful Life events

The stressful life events used for this study are derived from six LISA modules, namely Life Events, Marital Status Changes, Labour Market Activities Minimal, Classification of Retirement, Intentions to Have Children, and Parental History. Out of these modules, we were able to build ten life events: lost a job; major worsening in financial situation; victim of a non-violent crime or physical violence;[8] serious injury or illness to a close relative, friend or to self; death of a family member or friend; marriage or common-law; divorced or separated or widowed; unemployed; retired; and new child.[9] These components of stressful life events were adopted to be consistent with other studies such as Temple (2018) and Yap et al. (2012). As noted in Table A1 of the Appendix, some analogous life events were grouped together as to maintain reliable estimates. The stressful life events used in this analysis have a reference period from January 2016 to the date of the interview (2018). Life events not initially within this reference period were processed to maintain consistency.[10]

4. See Bickel et al. (2000).
5. See Health Canada (2007).
6. This decision of designating a person-most knowledgeable (PMK) was made in order to reduce response burden.
7. As of 2020, an additional food insecurity category namely, marginal food insecurity had been added by Health Canada. This is the situation in which households were worried about running out of food but without experiencing food insecurity yet. Over time, households in this category may experience food insecurity if their financial or social situation does not change (Health Canada, 2020). This paper used the food security categories prior to the Health Canada 2020 updates.
8. Instances of non-violent crimes could be a theft or property damage. Physically violent crimes could include assault.
9. See Table A1 of Appendix A.
10. The following life events went through a processing phase: marriage or common-law; divorced, separated or widowed; unemployed; new child; and retirement. Processing consisted of parsing the vector variables into month and year then filtering out dates not within the reference period.

Control variables

To control for potential confounding effects, variables known to be associated with food insecurity from other Canadian research studies (Tarasuk et al., 2019) were included in this study's multivariable logistic regression models. The control variables include: (1) Age groups; (2) Sex – male, female; (3) Education level – high school education or less, trades or college diploma, bachelor's degree or higher; (4) Equivalized household income:[11] 0-20%, 20-100%+ (Eurostat Statistics Explained, Online publication, 2018); (5) Self-rated health – poor or fair health, good or very good or excellent health; (6) Household ownership – renter, owner; (7) Region – Atlantic provinces, Quebec, Ontario, Prairies and British Columbia; (8) Immigrant status – Immigrant, born in Canada; (9) Main source of income – wages or salaries, pension or benefits, social assistance, other (see Table A2 in the Appendix for the derivation method); and (10) Household configuration: single, couple alone or couple with children, other.

Self-assessed mental health status was dropped from the analysis due to collinearity with self-assessed health status. Also due to collinearity, the control variable self-reported health status was excluded from the regression model that investigated the association between experiencing an injury and illness life event and food insecurity.

One-parent households had an insufficient number of respondents and therefore was combined with the 'other' category. This was unfortunate since one-parent households are known to be associated with food insecurity (Tarasuk et al., 2019; Olabiyi & McIntyre, 2014) but could not be analyzed separately in this study.

Descriptive statistics

Table 1 presents basic statistics about adults in Canada who were either food insecure or food secure, with respect to their socioeconomic characteristics. It should be emphasized that the LISA sample from 2018 (Wave 4) used to produce these statistics is a representative sample of the Canadian adult population in 2012 and not entirely representative of the Canadian adult population in 2018. For example, in 2018, this LISA sample does not include a representative sample of immigrants to Canada arrived after 2012. Therefore, the LISA sample from 2018 is only partially (though significantly) representative of the Canadian adult population in 2018. Whenever a reference to the 2018 Canadian adult population is made, this more accurately refers to the 2012 Canadian adult population that was followed over time and then observed in 2018. In Wave 4 (2018), 5.2% of the LISA Canadian adult population were food insecure and 93.9% were food secure. The average age of a food insecure adult is 43.4 years and 50.7 years for a food secure adult. Among the adults who were food insecure, 44.2% were males and 55.8% were females; 41.3% had up to a high school education versus 16.8% with a University degree or higher; 39.3% were household owners versus 60.7% renters. Furthermore, among the food insecure adults in Canada, 11.2% lived in the Atlantic region, 40.6% lived in Ontario, 15.1% lived in Quebec, 20.1% lived in Alberta and 13.0% lived in British Columbia; 25.6% were immigrants versus 74.4% who were born in Canada. For both the food insecure and food secure adults, the main source of income is wage or salary (57.4% vs. 61.4%).

There are noticeable differences when comparing the socioeconomic characteristics of food insecure adults to food secure adults. For example, 60.7% of food insecure adults were renters compared to only 19.9% of food secure adults who were renters. On the other hand, food secure adults were more likely (66.6%) to live as couples with or without children compared to food insecure adults where only 35.0% lived as couples with or without children. Moreover, 81.5% of food secure adults fall into households whose income is in the top 80% of the distribution of equivalized household income, compared to only 45.9% of food insecure adults. Finally, 89.9% of food secure adults self-assessed themselves as being in good to excellent health compared to only 66.3% of the food insecure adults.

11. Equivalized household income is a measure of household income that takes account of the differences in a household's size and composition. It is calculated by dividing the household's total income from all sources by its equivalent size. The equivalent size is derived using the modified OECD equivalence scale, which assigns weights to all members of the household as follows: 1.0 for the first adult, 0.5 for the second and each subsequent person aged 14 and over, and 0.3 to each child aged under 14. The equivalent size is the sum of the weights of all members of a given household. This paper employed this procedure to derive the equivalized household income. The income data was from the most recent five years of T1 Family Files (derived from income tax returns). Income data used to represent each respondent was averaged for the prior 5 years. The equivalized household income then follows as described. The equivalized household income categories, 0 to 20% and 20% to 100% were then derived from percentiles of the equivalized household income distribution.

Table 1
Food insecurity/security by socioeconomic characteristics

	Adult food Security					
	Full sample (n = 10,640)		Food insecure (n = 470)[1]		Food secure (n = 10,080)[2]	
Category	percent	standard error	percent	standard error	percent	standard error
Age, mean	50.3	0.1	43.4	1.4	50.7	0.1
Sex						
Male	48.9	0.2	44.2	3.9	49.2	0.3
Female	51.1	0.2	55.8	3.9	50.8	0.3
Education						
High school or lower	27.9	0.7	41.3	4.3	27.2	0.7
Trades or college	36.7	0.7	41.9	4.3	36.4	0.7
University degree or higher	35.3	0.8	16.8[E]	3.2	36.3	0.8
Equivalized Household Income						
0%-20%	79.6	0.6	54.1	4.7	18.5	0.6
20%-100%	20.4	0.6	45.9	4.7	81.5	0.6
Household ownership						
Owner	77.2	0.6	39.3	3.9	80.0	0.6
Renter	21.9	0.6	60.7	3.9	19.9	0.6
Region						
Atlantic	7.0	0.1	11.2	1.7	6.8	0.1
Ontario	38.7	0.2	40.6	5.5	38.4	0.4
Quebec	24.0	0.2	15.1	2.4	24.5	0.2
Prairies	17.2	0.2	20.1	2.8	17.0	0.3
British Columbia	13.2	0.2	13.0[E]	3.0	13.2	0.3
Immigrant status						
Immigrant	23.7	0.7	25.6[E]	4.6	23.5	0.7
Born in Canada	76.3	0.7	74.4	4.6	76.5	0.7
Main income						
Wage or Salary	61.2	0.6	57.4	3.9	61.4	0.6
Pension or Benefits	24.3	0.4	16.2	2.2	24.8	0.4
Social Assistance	3.7	0.3	17.4[E]	3.6	3.0	0.3
Other	10.8	0.4	8.9[E]	1.9	10.9	0.4
Household composition						
Single	18.7	0.5	36.3	4.3	17.9	0.5
Couple with or without children	64.9	0.7	35.0	4.5	66.6	0.7
Other	16.3	0.6	28.7	4.5	15.5	0.6
Self-assessed health						
Fair or poor	11.4	0.4	33.7	3.6	10.1	0.4
Excellent-Good	88.6	0.4	66.3	3.6	89.9	0.4

[E] use with caution
1. Proportion of food insecure adults in the study population (5.2%).
2. Proportion of food secure adults in the study population (93.9%).

Notes: Estimates may not sum to 100 due to rounding. Percentages take survey weights into account.
Source: Statistics Canada, Longitudinal and International Study of Adults (2018).

Statistical Modeling

Statistical analyses were conducted using SAS 9.4[12] with statistical significance set at $p < 0.05$. Longitudinal survey weights[13] and a corresponding set of 1,000 bootstrap replicate weights were used to produce weighted estimates and their corresponding sampling variance estimates, respectively. For this study, the reference population of interest is the Canadian population of all individuals 15 years of age and older in 2012: a representative sample of the 2012 Canadian population was followed every two years for data collection. The data used for this study were collected in 2018, the fourth wave of the LISA survey. First, the study produced some descriptive statistics to examine the prevalence of adult food insecurity/security with respect to stressful life events.

12. PROC SURVEYLOGISTIC with the option MISSING was implemented. The option MISSING treats the missing data as its own category so as to lead to valid variance estimation.
13. All-waves responding person weights (AWRPW) are longitudinal weights assigned to individuals who were considered to have responded to the LISA questionnaire from Wave 1 (2012) to Wave 4 (2018). See Benhin (2018) for more information on LISA weights.

Second, analytical studies were conducted to examine the association between stressful life events and food insecurity by use of simple and multivariable logistic regression models. The first part of the statistical analyses was to investigate the association between each stressful life event and food insecurity. The second part was to study the association between the number of stressful life events (zero, one, two or more) experienced by an adult and food insecurity.

Examine the association between each stressful life event and food insecurity

Simple logistic regression models were fitted between each stressful life event (explanatory variable, no control variables) and food insecurity (dependent variable). The fitted models were used to calculate unadjusted odd ratios. Multivariable logistic regression models were fitted between each stressful life event, plus control variables and food insecurity. The resulting fitted models were used to calculate adjusted odds ratios. The multivariable models and the adjusted odds ratios included controls such as socioeconomic, demographic and health related variables, whereas the simple models and the unadjusted odds ratios did not contain control variables. The adjusted odds ratios measure the likelihood that an individual will experience food insecurity given their exposure to a stressful life event when all other factors are controlled for. The unadjusted odds on the other hand do not control for these other factors.

Examine the association between the number of stressful life events and food insecurity

Here, a single iteration of the multivariable logistic regression model was used to determine whether exposure to multiple stressful life events would significantly increase the odds of an individual experiencing food insecurity. The explanatory variable used represents the number of stressful life events that an individual was exposed to. Three categories were created for the study: zero, one, and two or more stressful life events. Adult food insecurity were regressed on the multiple stressful life event variable, controlling for socioeconomic and sociodemographic characteristics.

Results

Food insecurity/security by stressful life events – Descriptive statistics

Table 2 presents simple descriptive statistics on food insecurity/security by stressful life events. The table shows the proportion of food insecure or food secure adults who experience stressful life event(s). Food insecure adults were more likely than food secure adults to report losing a job (19.8% vs. 6.2%), a worsening financial situation (38.5% vs. 4.9%), being a victim of a crime (10.0% vs. 3.0%), an injury or illness to one's self or a friend or family member (35.1% vs. 18.9%), a divorce, separation or widowhood (2.4% vs. 1.7%), or being unemployed (6.2% vs 2.5%).

Food secure adults were slightly more likely than food insecure adults to report a death in the family (30.8% vs 28.8%) or no stressful life events (44.6% vs. 25.0%).[14] On the other hand, food insecure adults were more likely to report multiple stressful life events (47.2% vs 19.3%). Overall, 75.1%[15] of food insecure adults reported experiencing one or more stressful life events between 2016 and 2018.

14. Estimates with overlapping confidence intervals were deemed to be statistically insignificant.
15. Combined proportion of food insecure adults who reported one stressful life event (27.9%) and two or more stressful life events (47.2%).

Table 2
Food insecurity/security by stressful life event

	Food sample			Food insecure			Food secure		
Stressefull life event	number	percent	standard error	number	percent	standard error	number	percent	standard error
Lost job	640	6.8	0.4	60	19.8[E]	4.6	580	6.2	0.4
Worsening finances	640	6.7	0.4	150	38.5	4.5	480	4.9	0.3
Victim of a crime	300	3.3	0.3	40	10.0[E]	2.1	260	3.0	0.3
Injury or illness to relative, friend, self	2,090	19.7	0.6	140	35.1	4.6	1,940	18.9	0.6
Death in family	3,440	30.6	0.7	160	28.8	3.4	3,250	30.8	0.7
Marriage or common-law	350	4.3	0.3	20	3.4[E]	0.9	330	4.3	0.3
Divorce, separation or widowhood	210	1.7	0.2	20	2.4[E]	0.7	190	1.7	0.2
Unemployed	290	2.7	0.2	30	6.2[E]	1.4	260	2.5	0.2
Retirement	560	3.8	0.2	20	3.6[E]	1.1	540	3.8	0.2
New child in household	410	5.3	0.4	20	4.6[E]	1.4	390	5.4	0.4
Number of stressful life events									
None	4,660	43.7	0.7	130	25.0	3.4	4,470	44.6	0.7
One	3,820	35.6	0.7	140	27.9	3.1	3,660	36.1	0.7
Two or more	2,160	20.7	0.6	200	47.2	4.1	1,950	19.3	0.6
Total	**10,640**	**100**		**470**	**100**		**10,080**	**100**	

[E] use with caution

Notes: Estimates may not sum to 100 due to rounding. Percentages take survey weights into account.
Source: Statistics Canada, Longitudinal and International Study of Adults (2018).

Association between food insecurity and each stressful life event

Table 3 shows the unadjusted and adjusted odds ratios calculated, respectively, from the fitted simple logistic regression models (without control variables) and multivariable logistic regression models (with control variables). The odds ratios tend to decrease once control variables are added to the models, meaning that the addition of these control variables are important for correct interpretation of the odds ratio estimates. From the table, it can be observed that adults who reported losing a job (AOR = 2.48, $p < 0.01$), an injury or illness to self, relative or friend (AOR = 2.34, $p < 0.001$), being a victim of non-violent crime or physical violence (AOR = 2.27, $p < 0.01$), or being retired (AOR = 2.13, $p < 0.05$) were two or more times more likely to be food insecure. Furthermore, those who reported a major worsening financial situation (AOR = 7.25, $p < 0.0001$) were seven or more times more likely to be food insecure. These results are similar to those from the simple descriptive statistics on Table 2.

Table 3
Odds ratios from simple and multivariable logistic regression models, weighted

	Unadjusted Odds			Adjusted Odds		
		95% confidence interval			95% confidence interval	
Life events	Estimate	Lower	Upper	Estimate	Lower	Upper
Lost job	3.76***	1.97	7.18	2.48*	1.29	4.78
Worsening finances	12.21***	8.21	18.14	7.25***	4.63	11.37
Victim of a crime	3.62***	2.21	5.92	2.27*	1.28	4.00
Injury or illness to relative, friend, self[1]	2.32***	1.52	3.54	2.34**	1.47	3.71
Death in family	0.91	0.65	1.27	1.04	0.70	1.53
Marriage or common-law	0.80	0.45	1.43	0.71	0.35	1.45
Divorce, separation or widowhood	1.46	0.81	2.65	1.12	0.57	2.21
Unemployed	2.62**	1.51	4.55	1.48	0.78	2.8
Retirement	0.96	0.51	1.78	2.13†	1.18	3.85
New child in household	0.85	0.44	1.63	0.80	0.36	1.78

* significantly different from reference category ($p < 0.01$)
** significantly different from reference category ($p < 0.001$)
*** significantly different from reference category ($p < 0.0001$)
† reference category ($p < 0.05$)
1. Adjusted odds ratio model does not include self-reported health status due to suspected collinearity.
Source: Statistics Canada, Longitudinal and International Study of Adults (2018).

Association between food security and the number of stressful life events

Table 4 presents the results from the multivariable logistic regression model used to analyse the association between food insecurity and exposure to multiple stressful life events. The results show that an adult with two or more stressful life events, compared with those with no stressful life events, were three or more times (OR = 3.44, $p < 0.0001$) more likely to be food insecure. Similarly, adults with one stressful life event, compared to those with no stressful life events, were about one-and-half times (OR = 1.54, $p < 0.05$) more likely to be food insecure.

The results from Table 4 also show that demographic and socioeconomic control variables continue to be important determinants of food insecurity. Exposure to food insecurity among adults is less likely for those with a university education (OR = 0.43, $p < 0.01$), or those living as a couple with or without children (OR = 0.51, $p < 0.01$). However, adults whose equivalized household income was in the bottom 20% of the income distribution were two or more times (OR =2.70, $p < 0.0001$) more likely to be food insecure. When compared with those who owned their dwellings, adults in rented dwellings were three or more times (OR = 3.08, $p < 0.0001$) more likely to be food insecure. Those who assessed their health to be fair or poor (OR = 2.92, $p < 0.0001$) and those who received social assistance (OR = 2.34, $p < 0.01$) were two or more times more likely to be food insecure. Finally, adults living in Quebec and Ontario, compared with those living in the Atlantic region, were less likely to be food insecure. There is no strong statistical evidence to draw conclusions for the comparisons between the Prairies and British Columbia versus the Atlantic region. There is also no strong statistical evidence to indicate that adults who have experienced one stressful life event or immigrants are more or less likely to be food insecure.

Table 4
Odds ratios from multivariable logistic regression model between food insecurity and number of stressful life events and control variables, weighted

	Odds ratio		
	Unadjusted Odds		
	Estimate	95% confidence interval	
		Lower	Upper
Number of stressors			
0 (Base)	1.00		
1	1.40	0.92	2.14
2 or more	3.57***	2.21	5.77
Control variables			
Region			
Atlantic (Base)[1]	1.00		
Ontario	0.55†	0.32	0.95
Quebec	0.35***	0.22	0.55
Prairies[2]	0.82	0.53	1.26
British Columbia	0.62	0.33	1.15
Gender			
Male (Base)	1.00		
Female	1.30	0.94	1.80
Age	0.98**	0.97	0.99
Education level			
High school or less (Base)	1.00		
Trades or college	1.11	0.74	1.68
Bachelor's degree	0.43*	0.23	0.78
Equivalized household income (0-20%)			
Yes	2.70***	1.72	4.25
Household ownership			
Owner (Base)	1.00		
Renter	3.08***	1.99	4.76
Immigrant status			
Yes	1.63	0.96	2.77
Main source of income			
Pension or benefits (Base)	1.00		
Wages or salary	1.54	1.00	2.40
Social assistance	2.34*	1.30	4.22
Other	1.35	0.73	2.50
Household structure			
Single (Base)	1.00		
Couple with or without children	0.51*	0.35	0.77
Other	0.98	0.59	1.63
Fair or poor self-rated health			
Yes	2.92***	2.07	4.13

* significantly different from reference category ($p < 0.01$)
** significantly different from reference category ($p < 0.001$)
*** significantly different from reference category ($p < 0.0001$)
† reference category ($p < 0.05$)
1. Atlantic includes Newfoundland and Labrador, Prince Edward Island, Nova Scotia, and New Brunswick.
2. Prairies includes Manitoba, Saskatchewan, and Alberta.

Source: Statistics Canada, Longitudinal and International Study of Adults (2018).

Discussion

This is the first study in the Canadian context to examine the association between stressful life events and food insecurity among Canadian adults. Based on 2018 (Wave 4) data of the Longitudinal and International Study of Adults (LISA), 5.2% of the Canadian adult population were food insecure and 93.9% were food secure. This study also found that five of the ten stressful life events were associated with food insecurity (Table 3). These include loss of a job, a worsening financial situation, victim of a crime, injury or illness to a relative, friend or self, and being unemployed (not adjusting for controls). Moreover, adults who experienced two or more stressful life events were significantly (three or more times) more likely to be food insecure compared with those with no stressful life events (Table 4). This means that the likelihood of being food insecure increases significantly as the number of stressful life events (as defined in this paper) increases. These findings are consistent with those from Temple (2018).

The findings also showed that the strongest associations between stressful life events and food insecurity were the life events related to health and the labour market. Losing a job, being in a worsening financial situation, and experiencing a serious injury or illness to a relative, friend or self were among the strongest associations with food insecurity.

Stressful life events that concern an individual's financial situation (lost job and worsening finances) were found to be the most significant associations with food insecurity. Kirkpatrick & Tarasuk (2003) demonstrated this association by finding substantial differences in food spending patterns (i.e., significantly fewer purchases of milk products and fruits and vegetables) among lower-income households compared with all other households in Canada. In addition, lower-income households with housing costs (i.e., rent or mortgage) purchased considerably lower amounts of milk and meat products when compared to their high-income counterparts. This change in consumption can be illustrated most effectively when an individual experiences income volatility, especially within lower-income households. Leete & Bania (2010) and Akter & Basher (2014) demonstrated that income volatility leads to an increased risk of reporting food insufficiency. McIntyre et al. (2014) explored food insecurity within the Canadian labour force and established empirical evidence of working households being vulnerable to reporting food insecurity, showing that income was a significant factor. This consistency across studies advances the notion that income fluctuations tend to have a noteworthy negative effect on food spending. Income fluctuations tend to harm a household's ability to consistently maintain the costs of daily living. The findings from the above mentioned literature confirm the importance of the results found in this study, as most of the life events that impact an individual's income are significant with food insecurity except unemployment when adjusting for controls. A possible explanation as to why unemployment (adjusted for controls) is insignificant could be that the Main Source of Income control variable comprises of a social assistance category (Appendix A, Table A2). It is possible that adults who are unemployed also receive social assistance such as Employment Insurance (EI) benefits. This behaviour could explain why unemployment is insignificant when adjusting for these controls.

Health-related life events, namely experiencing a serious injury or illness to a relative, friend or to self (physical or mental) were found to be associated with adult food insecurity. This is consistent with existing literature on health. Martin et al. (2016) presented evidence that additional social and stress factors among individuals with mental illness, can increase the risk of exposure to food insecurity. Tarasuk et al. (2013) demonstrated that adults with chronic conditions may increase their household's susceptibility to food insecurity. Using a longitudinal sample, McLeod & Veall (2006) found evidence of a correlation between changes in health status and changes in food insecurity.

As far as the authors of this research paper know, this is the first paper, with respect to the Canadian adult population, which has examined and found a strong association between being a victim of a crime (physical or non-violent) and food insecurity. Studies in Australia and the United States have also demonstrated similar findings (Temple, 2018; Breiding et al., 2017; Ricks et al., 2016; Caughron, 2016; Chilton et al., 2014). Notably, articles using data from the United States have consistently demonstrated the relationship between domestic violence and food insecurity. LISA does not currently incorporate data on domestic violence. The association between domestic violence and food insecurity in the Canadian context may be of particular future research interest. Using food insecurity as the predictor variable, Caughron (2016) demonstrated that food insecurity could increase in the violent crime rate by approximately 12%.

The findings presented in this paper revealed no statistical significance between the association of experiencing a death of a family member or close friend and food insecurity. These findings are different from those observed by Temple (2018) in the Australian context, who found a strong association between death of a family member or close friend and food insecurity. This study also found that there is a statistically significant measure of association between experiencing divorce, separation, or widowhood and food insecurity. This is also different from the results by Temple (2018). A possible explanation for these differences is that the data from LISA had an insufficient number of respondents for these explanatory variables to allow for reliable statistical analyses. Other studies have identified a relationship between divorce or separation and food insecurity (Temple, 2018; Che & Chen, 2001). It is noteworthy that these studies use divorce or separation as an explanatory variable whereas, in this study, the explanatory variable consists of divorce, separation or widowhood. It is possible this may have contributed to the observed differences in findings.

To the author's knowledge, no prior research has been conducted using a nationally-based longitudinal data while assessing the association between stressful life events[16] and food insecurity. Carter et al. (2012) used six years of data from the Quebec Longitudinal Study of Child Development to evaluate the longitudinal association between five environmental factors[17] and food insecurity. Renzaho et al. (2013) proposed an association between stressful life events and illness using longitudinal data obtained from the Household, Income and Labour Dynamics in Australia (HILDA) panel survey. Hadley et al. (2008) found food insecurity and stressful life events to be independently linked to symptoms of common mental disorders (depression, anxiety, and post-traumatic stress), while Yap et al. (2012) also used longitudinal HILDA data to identify a link between major life events and changes in life satisfaction.

Strengths and Limitations

The paper contributes to the existing literature on the association between stressful life events and food insecurity. It is the first paper, in the context of the Canadian adult population, to examine the association between stressful life events (as defined in this paper) and food insecurity. The paper examined not only the association between individual stressful life events and food insecurity, but also the association between experiencing multiple life events and food insecurity. Several simple (without control variables) and multivariable (with control variables) logistic regression models were analyzed. The resulting simple and multivariable models were used to estimate unadjusted and adjusted odds ratios, respectively.

There are a number of limitations to this study. First, the LISA adult population in 2018 (Wave 4) does not represent the cross-sectional Canadian adult population in 2018. Individuals not accounted for by the LISA 2018 sample data include new immigrants to Canada since 2012 when the LISA longitudinal survey began.

Second, the findings are not based on longitudinal statistical analyses since such analyses require at least three different time points (waves) of food security and stressful life events data. Unfortunately, at the time of this study, there was only one wave (2018) of food security LISA data available. Hence, the inability to perform the sort of causal statistical data analyses and inferences associated with the typical longitudinal data. Therefore, findings were primarily based on establishing associations between stressful life events and food insecurity as opposed to investigating whether stressful life events cause food insecurity.

Finally, this study was unable to comprehensively analyze each of the individual LISA questionnaire life events due to the small number of respondents. To overcome this limitation, a number of related LISA questionnaire life events were aggregated into one group to form a new composite life event (Table A1 of Appendix). A small subset of the control variables were also grouped together due to small number of respondents for the more detailed control variables.

Future work

There is the potential for longitudinal statistical analysis in the future. This may, however, require at least two additional waves of food security data. Future longitudinal analysis studies may help address research questions on causality; for instance, whether stressful life events causes food insecurity in the context of the Canadian adult population. Further understanding how the long-term impact of a stressful life event typically affects an individual would provide valuable insight for researchers and policymakers.

This paper suggested a potential association between a decrease in income (i.e., lost job or worsening financial situation) and food insecurity. Investigating this association further, one can explore the relationship between cyclical versus long-term low income and persistent food insecurity, as well as the multiple dimensions of poverty and its impacts on food security.

16. Using stressful life event measurements similar to those in the current literature.
17. Environmental factors are maternal and social deprivation, social cohesion, disorder, and living location.

A resiliency scale, or a sense of coherence scale (SOC),[18] may attempt to standardize measures of stress leading to some sort of robust definition of stressful life events. Unfortunately, scales of this nature are not currently available for the LISA data. Further, it is possible that implementing these scales may lead to improved statistical inferences between the association of food insecurity and stressful life events, as discussed in this paper. Richardson & Ratner (2005) found that a sense of coherence scale does moderate the impact of recent stressful life events on self-reported health status. Nevertheless, this study presented evidence that employment-related and health-related life events, as well as multiple stressful life events demonstrates a strong association with food insecurity.

18. The Sense of Coherence Scale (SOC) measures how people view life by assessing the ability to use their resources to overcome adversity and conserve and progress their well-being.

References

1. Akter, S., & Basher, S. (2014): The impacts of food price and income shocks on household food security and economic well-being: Evidence from rural Bangladesh. Global Environmental Change. Volume 25. 150-162. ISSN 0959-3780. https://doi.org/10.1016/j.gl

2. Benhin, E. (2018). Data Quality Report. Longitudinal and International Study of Adults, Wave 3. *Statistics Canada Internal Document*.

3. Bickel, G., Nord, M., Price, C., Hamilton, W., & Cook, J. (2000). Guide to Measuring Household Food Security, Revised 2000. Alexandria, VA: Food and Nutrition Service, United States Department of Agriculture. Available at: www.fns.usda.gov/fsec/files/fsguide.pdf.

4. Breiding, M. J., Basile, K. C., Klevens, J., & Smith, S. G. (2017). Economic Insecurity and Intimate Partner and Sexual Violence Victimization. American journal of preventive medicine, 53(4), 457–464. doi:10.1016/j.amepre.2017.03.021

5. Carter, M. A., Dubois, L., Tremblay, M. S., & Taljaard, M. (2012). Local social environmental factors are associated with household food insecurity in a longitudinal study of children. BMC Public Health 2012 12:1038.

6. Caughron, J. (2016). An Examination of Food Insecurity and Its Impact on Violent Crime in American Communities. All Theses. 2565. https://tigerprints.clemson.edu/all_theses/2565

7. Che, J., & Chen, J. (2001). Food insecurity in Canadian households. Health Rep 2001; 12(4):11–22.

8. Chilton, M., Rabinowich, J., & Woolf, N. (2014). Very low food security in the USA is linked with exposure to violence. Public Health Nutrition, 17(1), 73-82. doi:10.1017/S1368980013000281

9. Drucker, E. R. (2015). Food Security Status And Life Events Among Households With Children In The Midlands Of South Carolina. (Master's thesis). Retrieved from https://scholarcommons.sc.edu/etd/3718

10. El-Hajj, A., & Benhin, E. (2020). Validation of the Food Security Module in the 2018 Longitudinal and International Study of Adults. LISA Research Paper Series.

11. Eurostat. (2018). Glossary: Equivalised income. Retrieved from https://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Equivalised_income

12. Global Affairs Canada. (2018). The 2030 Agenda for Sustainable Development. Retrieved from https://www.international.gc.ca/world-monde/issues_development-enjeux_developpement/priorities-priorites/agenda-programme.aspx?lang=eng

13. Government of Canada. (2019). The Food Policy. Retrieved from https://www.canada.ca/en/campaign/food-policy/thefoodpolicy.html.

14. Gucciardi, E., Vogt, J.A., DeMelo, M., & Stewart, D. (2009). Exploration of the Relationship Between Household Food Insecurity and Diabetes in Canada. Journal of Diabetes Care, Volume 22, Number 12, December 2009.

15. Hadley, C., & Patil, C. L. (2006). Food insecurity in rural Tanzania is associated with maternal anxiety and depression. American Journal of Human Biology, 18(3), 359-¬-368.

16. Hadley, C., Tegegn, A., Tessema, F., Cowan, J. A., Asefa, M., & Galea, S. (2008). Food insecurity, stressful life events and symptoms of anxiety and depression in east Africa: Evidence from the Gilgel Gibe growth and development study. Journal of Epidemiology & Community Health; 62:980-986.

17. Health Canada. (2007). Canadian Community Health Survey, Cycle 2.2, Nutrition (2004): Income-Related Household Food Security in Canada. Retrieved from https://www.canada.ca/en/health-canada/services/food-nutrition/food-nutrition-surveillance/health-nutrition-surveys/canadian-community-health-survey-cchs/canadian-community-health-survey-cycle-2-2-nutrition-2004-income-related-household-food-security-canada-health-canada-2007.html

18. Health Canada. (2012). Household Food Insecurity in Canada: Overview. Retrieved from https://www.canada.ca/en/health-canada/services/food-nutrition/food-nutrition-surveillance/health-nutrition-surveys/canadian-community-health-survey-cchs/household-food-insecurity-canada-overview.html

19. Health Canada. (2020). Determining food security status. Retrieved from https://www.canada.ca/en/health-canada/services/food-nutrition/food-nutrition-surveillance/health-nutrition-surveys/canadian-community-health-survey-cchs/household-food-insecurity-canada-overview/determining-food-security-status-food-nutrition-surveillance-health-canada.html

20. Kirkpatrick, S., & Tarasuk, V. (2003). The relationship between low income and household food expenditure patterns in Canada. Public Health Nutrition, 6(6), 589-597. doi:10.1079/PHN2003517

21. Laraia, B. A., Siega---Riz, A. M., Gundersen, C., & Dole, N. (2006). Psychosocial factors and socioeconomic indicators are associated with household food insecurity among pregnant women. The Journal of nutrition, 136(1), 177---182.

22. Leete, L., & Bania, N. (2010). The effect of income shocks on food insufficiency. Review of Economics of the Household, Springer, vol. 8(4), pages 505-526. https://doi.org/10.1007/s11150-009-9075-4

23. Martin, M. S., Maddocks, E., Chen, Y., Gilman, S. E., & Colman, I. (2016). Food insecurity and mental illness: disproportionate impacts in the context of perceived stress and social isolation.

24. McIntyre, L., Bartoo, A., & Emery, J. (2014). When working is not enough: Food insecurity in the Canadian labour force. Public Health Nutrition, 17(1), 49-57. doi:10.1017/S1368980012004053

25. McLeod, L., & Veall, M. (2006). The dynamics of food insecurity and overall health: evidence from the Canadian National Population Health Survey, Applied Economics, 38:18, 2131-2146, DOI: 10.1080/00036840500427429

26. Melchior, M., Caspi, A., Howard, L. M., Ambler, A. P., Bolton, H., Mountain, N., & Moffitt, T. E. (2009). Mental health context of food insecurity: a representative cohort of families with young children. Pediatrics, 124(4), e564–e572. doi:10.1542/peds.

27. Olabiyi, O., & McIntyre, L. (2014). Determinants of Food Insecurity in Higher-Income Households in Canada. Journal of Hunger and Environmental Nutrition. 9:4, 433-448, DOI:10.1080/19320248.2014.908450

28. PROOF Food Insecurity Policy Research. (2018). Household Food Insecurity in Canada. Retrieved from https://proof.utoronto.ca/food-insecurity/.

29. Renzaho, A., Houng, B., Oldroyd, J., Nicholson, J.M., D'Esposito, F., & Oldenburg, B. (2013). Stressful life events and the onset of chronic diseases among Australian adults: findings from a longitudinal survey. European Journal of Public Health, Vol. 24, Issue 1, 57-62.

30. Richardson, C. G., & Ratner, P. A. (2005). Sense of coherence as a moderator of the effects of stressful life events on health. Journal of epidemiology and community health, 59(11), 979–984. doi:10.1136/jech.2005.036756

31. Ricks, J., Cochran, S., Arah, O., Williams, J., & Seeman, T. (2016). Food insecurity and intimate partner violence against women: Results from the California Women's Health Survey. Public Health Nutrition, 19(5), 914-923. doi:10.1017/S1368980015001986

32. Standing Committee on Agriculture and Agri-food. (2017). A FOOD POLICY FOR CANADA - Report of the Standing Committee on Agriculture and AgriFood. Retrieved from http://www.ourcommons.ca/Content/Committee/421/AGRI/Reports/RP9324012/agrirp10/agrirp10-e.pd

33. Statistics Canada. (2019). Longitudinal Administrative Data Dictionary, 2017. Retrieved from https://www150.statcan.gc.ca/n1/pub/12-585-x/12-585-x2019001-eng.htm

34. User Guide (2018). Longitudinal and International Study of Adults (LISA) Wave 4. *Statistics Canada internal document*.

35. Tarasuk, V., Mitchell, A., McLaren, L., & McIntyre, L. (2013). Chronic Physical and Mental Health Conditions among Adults May Increase Vulnerability to Household Food Insecurity. The Journal of Nutrition, Volume 143, Issue 11, 1785–1793, https://doi.org/1

36. Tarasuk, V., Fafard St-Germain, A. & Mitchell, A. (2019). Geographic and socio-demographic predictors of household food insecurity in Canada, 2011–12. BMC Public Health 19, 12. doi:10.1186/s12889-018-6344-2

37. Temple, J. (2018). The Association between Stressful Events and Food Insecurity: Cross-Sectional Evidence from Australia. International Journal of Environmental Research and Public Health.

38. United Nations. (1948). The Universal Declaration of Human Rights. Retrieved from https://www.un.org/en/universal-declaration-human-rights/

39. Yap, S. C., Anusic, I., & Lucas, R. E. (2012). Does Personality Moderate Reaction and Adaptation to Major Life Events? Evidence from the British Household Panel Survey. Journal of research in personality, 46(5), 477–488. doi:10.1016/j.jrp.2012.05.005

Appendix A

Table A1
Stressful life events derivation

Life Events	LISA Module	LISA Variables
Lost job	Life Events (MELF)	Lost a job (lay off, job loss due to a business closure or a decline in business activities, etc.)
Worsening finances	Life Events (MELF)	Major worsening in financial situation
Victim of a crime	Life Events (MELF)	Victim of a non-violent crime (e.g., theft, property damage); Victim of physical violence (e.g., assault)
Injury or illness to relative, friend, self	Life Events (MELF)	Serious personal injury or illness to close relative or friend (physical or mental); Serious personal injury or illness to self (physical or mental)
Death in family	Life Events (MELF)	Death of a close relative or friend; Death of a parent; Death of a spouse or partner; Death of a child
Marriage or common-law	Marital Status Changes (FPMC)	Current marriage: Date started to live with spouse; Marital status: Current common-law union, Date started to live with common-law partner
Divorce, separation or widowhood	Marital Status Changes (FPMC)	Current marriage: Month and year separated; Marital status: Date of widowhood/divorce
Unemployment	Labour Market Activities Minimal (LMAM)	Current situation: Labour force status, 5 categories
Retirement	Classification of Retirement (RECR)	Retirement: Year
New child or pregnancy	Intentions to Have Children (HEIC), Update on Parental History (FCUH)	Parenthood: Currently pregnant; Child - Birthed, adopted or raised step child

Source: Statistics Canada, Longitudinal and International Study of Adults (2018).

Table A2
Main income derivation

Category	Tax variables
Salary/wages	Total employment income from T4 slips, Net business income, Net professional income, Net commission income, Net farming income, Net fishing income, Net income from self-employment, Indian exempt employment income
Benefits/pension	Old Age Security pension, CPP/QPP benefits, Net federal supplements, Universal Child Care Benefit, CPP/QPP disability benefits included in income, Pension and superannuation income, Child Tax Benefit
Social assistance	Social assistance income, EI benefits, Workers' compensation payments, Working Income Tax Benefit, Benefit for disabled children, Family benefits
Other	Dividends, Taxable amount of dividends from taxable Canadian corporations, Interest and investment income, Total amount of spousal and child support payments received, Net rental income, Other income, GST and FST credits, Provincial tax credits, Net limited partnership income, RRSP income, Net capital gains/losses, Alimony or support income, Other employment income

Source: Statistics Canada (2019).