

Statistics Report

Examining the Association between Food Insecurity and Mental Health and Wellbeing:

Analysis of Data from the Canadian Community Health Survey Cycle 2.2

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a. State your research question. In the following tasks, relevance of variables chosen will be assessed. (1 mark)

Our study will explore the association between food security and mental health during the pre-COVID time period with the use of data drawn from Canadian Community Health Survey (CCHS) conducted in 2004 and 2005.

b. List 1 dependent variable (DV) and 2 independent variables (IV) related to your study. Indicate the level of measurement of each variable (Ratio, nominal or ordinal). In addition to these variables, list age (variable 12) and sex (variable 14), and indicate the level of measurement. (5 marks)

Variable Concept in CCHS	Variable Name in CCHS	Independent/Dependent Variable	Level of Measurement
Household food security status	FSCDDHFS	Independent	Ordinal
Food Situation in household	FSCD_010	Independent	Ordinal
Self rated mental health	GENDDMHI	Dependent	Ordinal
Age	DHHDGAGE	-	Ordinal
Sex	DHHD_SEX	-	Nominal

c. Using the above variables (1 DV, 2 IVs, age & sex), complete descriptive data analyses. Create a graph to present one of the variables related to your research question (DV or IV). Provide interpretations of your results. (8 marks)

Analysis:

Univariate descriptive analyses were conducted for the following variables: household food security status, food situation in household, self-rated mental health, age and sex.

Results and Interpretation:

Other than the self-rated mental health variable, not many missing responses were found for all variables. Because the self-rated mental health question excluded respondents who are aged 11 and younger, it is reasonable that 8375 responses are missing considering that the 13 and under sample size is 10144. Provided that the number of missing cases are small or explainable, the valid percent will be used instead of percent in the following analysis.

Close to 92% and 83% of the respondents are “food secure” and “always had enough kinds of food wanted” respectively. For both food security-related variables, progressively smaller sample sizes are observed as food insecurity increases. The median of self-rated mental health is the “good” category while the highest number of respondents fall in the “very good” category, only approximately 5% of respondents self-rated their mental health as “poor” or “fair”. The median age of the sample is the “25 to 30 years” category. As the ages are categorized and categories are not divided in equal intervals, it is difficult to interpret if the average age is truly in this category. Lastly, the respective percentages of females and males in this sample is approximately 53% and 47%, respectively.

Statistics

		Household food security status - (D)	Food situation in household - 12 mo.	Self-rated mental health - (D)	Age - (G)	Sex
N	Valid	34894	35051	26732	35107	35107
	Missing	213	56	8375	0	0
Median		.00	1.00	3.00	7.00	2.00

Household food security status - (D)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	SECURE	32210	91.7	92.3	92.3
	WITHOUT HUNGER	1772	5.0	5.1	97.4
	W/MOD. HUNGER	714	2.0	2.0	99.4
	W/SEVERE HUNGER	198	.6	.6	100.0
	Total	34894	99.4	100.0	
Missing	NOT STATED	213	.6		
Total		35107	100.0		

Food situation in household - 12 mo.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	ALWAYS ENOUGH	29109	82.9	83.0	83.0
	ENOUGH-NOT KIND	5304	15.1	15.1	98.2
	SOMETIMES NOT	464	1.3	1.3	99.5
	OFTEN NOT	174	.5	.5	100.0
	Total	35051	99.8	100.0	
Missing	DONT KNOW	40	.1		
	REFUSAL	16	.0		
	Total	56	.2		
Total		35107	100.0		

Self-rated mental health - (D)

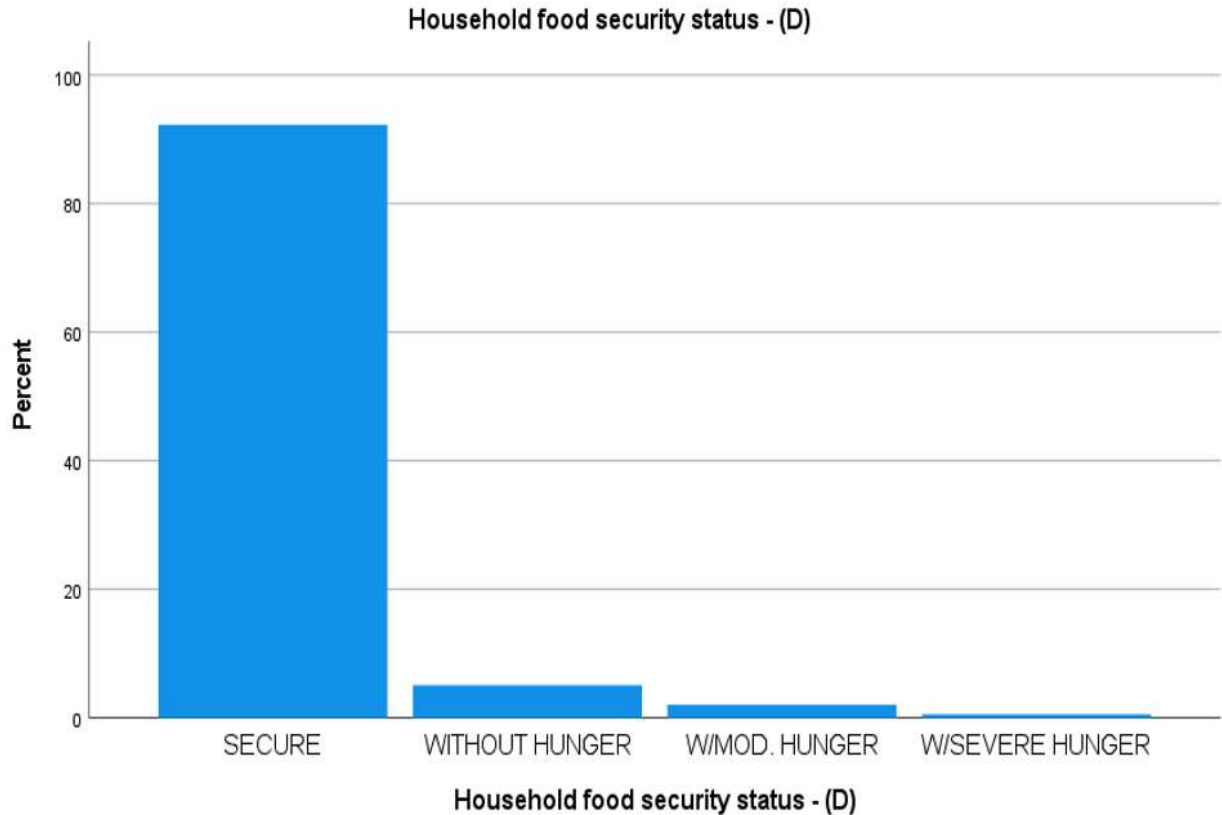
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	POOR	241	.7	.9	.9
	FAIR	1091	3.1	4.1	5.0
	GOOD	5598	15.9	20.9	25.9
	VERY GOOD	9764	27.8	36.5	62.4
	EXCELLENT	10038	28.6	37.6	100.0
	Total	26732	76.1	100.0	
Missing	NOT APPLICABLE	8335	23.7		
	NOT STATED	40	.1		
	Total	8375	23.9		
Total		35107	100.0		

Age - (G)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	UNDER 1 YEAR	289	.8	.8	.8
	1 TO 3 YEARS	2302	6.6	6.6	7.4
	4 TO 8 YEARS	3359	9.6	9.6	16.9
	9 TO 13 YEARS	4194	11.9	11.9	28.9
	14 TO 18 YEARS	4766	13.6	13.6	42.5
	19 TO 24 YEARS	2059	5.9	5.9	48.3
	25 TO 30 YEARS	1925	5.5	5.5	53.8
	31 TO 35 YEARS	1101	3.1	3.1	57.0
	36 TO 40 YEARS	1291	3.7	3.7	60.6
	41 TO 45 YEARS	1524	4.3	4.3	65.0
	46 TO 50 YEARS	1773	5.1	5.1	70.0
	51 TO 55 YEARS	1831	5.2	5.2	75.2
	56 TO 60 YEARS	1685	4.8	4.8	80.0
	61 TO 65 YEARS	1360	3.9	3.9	83.9
	66 TO 70 YEARS	1266	3.6	3.6	87.5
	71 YEARS AND OLD	4382	12.5	12.5	100.0
	Total	35107	100.0	100.0	

Sex

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	MALE	16532	47.1	47.1	47.1
	FEMALE	18575	52.9	52.9	100.0
	Total	35107	100.0	100.0	



d. Using the above variables (1 DV, 2 IVs, age & sex), create a baseline demographics table. Refer to the table (“Table 1”) below for an example. (4 marks)

Table 1. Univariate demographic characteristics

Characteristic	Level of Measurement	Frequency	Percentage
Age*	Ordinal		
≤18 years old		14910	42.5
≥19 - 30 years old		3984	11.4
≥31 - 40 years old		2392	6.8
≥41 - 50 years old		3297	9.4
≥51 - 60 years old		3516	10.0
≥61 - 70 years old		2626	7.5

≥71 years old		4382	12.5
Sex	Nominal		
Male		16532	47.1
Female		18575	52.9
Household food security status	Ordinal		
Secure		32210	92.3
Food insecure without hunger		1772	5.1
Food insecure with moderate hunger		714	2.0
Food insecure with severe hunger		198	0.6
Food Situation in household	Ordinal		
Always had enough kinds of food wanted		29109	83.0
Enough, but not always kinds wanted		5304	15.1
Sometimes did not have enough		464	1.3
Often did not have enough		174	0.5
Self-rated mental health	Ordinal		
Poor		241	0.9
Fair		1091	4.1
Good		5598	20.9
Very Good		9764	36.5
Excellent		10038	37.6

*In the CCHS 2.2, there are 16 levels in the age variable, which we have collapsed into seven levels for data simplification.

e. Using any variables that are relevant to your study, complete 1 Chi-square analysis. Provide interpretations of your results. (4 marks)

Analysis:

The Chi-square test was done with “household food security status” as the independent variable and “self rated mental health” as the dependent variable. Prior to running a bivariate test, we conducted a univariate analysis for the variable on its own. Both crosstabs and Chi-square test results are displayed below.

Self-rated mental health - (D) * Household food security status - (D)

			Crosstab				
			Household food security status - (D)				
			SECURE	WITHOUT HUNGER	W/MOD. HUNGER	W/SEVERE HUNGER	Total
Self-rated mental health - (D)	POOR	Count	146	37	30	19	232
		% within Household food security status - (D)	0.6%	3.2%	5.5%	11.2%	0.9%
	FAIR	Count	853	115	79	34	1081
		% within Household food security status - (D)	3.5%	10.0%	14.5%	20.1%	4.1%
	GOOD	Count	4987	354	178	46	5567
		% within Household food security status - (D)	20.2%	30.8%	32.8%	28.4%	21.0%
	VERY GOOD	Count	9118	365	157	48	9688
		% within Household food security status - (D)	36.9%	31.7%	28.9%	28.4%	36.5%
	EXCELLENT	Count	9578	280	99	20	9977
		% within Household food security status - (D)	38.8%	24.3%	18.2%	11.8%	37.6%
	Total	Count	24682	1151	543	169	26545
		% within Household food security status - (D)	100.0%	100.0%	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1079.907 ^a	12	<.001
Likelihood Ratio	714.400	12	<.001
Linear-by-Linear Association	758.894	1	<.001
N of Valid Cases	26545		

a. 2 cells (10.0%) have expected count less than 5. The minimum expected count is 1.48.

Results:

Results show a Pearson Chi-square value of 1079.9, $p = < 0.001$, $n = 26545$ for self-rated mental health and household food security status.

Interpretation:

According to the p-value of < 0.001 in the Chi-square test, we can conclude that the result is statistically significant. Therefore we reject the null hypothesis and accept the alternative hypothesis, as the data indicates that “household food security status” and “self-rated mental health” are associated.

The crosstabs table for “self-rated mental health” and “household food security status”, tells us that 38.8% of respondents with a “secure” household security status have excellent self-rated mental health compared to 20.1% of respondents with a “severe hunger” household food security status reporting fair self-rated mental health. These findings are not surprising since they are inline with findings from studies who found that food insecurity generally is linked to poorer mental health outcomes (Bruening et al., 2017; Maynard et al., 2018).

f. Using any variables that are relevant to your study, complete a Pearson’s correlation analysis. Provide interpretation of the results. Ensure to include the r and p values. (4 marks)

Analysis:

Usually, Pearson correlation tests are only conducted on ratio level data as this data is more precise. A limitation of the CCHS dataset is that it does not provide any data of ratio level for variables that measure food security and mental health status. For this reason, we ran a Pearson correlation on ordinal level variables as though they were ratio while being mindful of the limitations of ordinal level data during interpretation. We conducted a Pearson correlation test using the variables “household food security status”, and “self-rated mental health”. We originally conducted a univariate analysis for each of these variables prior to conducting bivariate analysis.

Correlations

		Household food security status - (D)	Self-rated mental health - (D)
Household food security status - (D)	Pearson Correlation	1	-.169**
	Sig. (2-tailed)		<.001
	N	34894	26545
Self-rated mental health - (D)	Pearson Correlation	-.169**	1
	Sig. (2-tailed)	<.001	
	N	26545	26732

** . Correlation is significant at the 0.01 level (2-tailed).

Results:

Results show a Pearson correlation of $r = -0.169$, $p < 0.001$, $n = 26545$. Therefore, we conclude that these two variables have a statistically significant weak and negative correlation.

Interpretation:

Results show that as household food security decreases, self-rated mental health decreases. These results demonstrate how household food security status does play a role in predicting self-perceived mental health. Mental health is however very complex, and there are many other variables that can act as predictors of mental health. It is therefore not surprising that the correlation between these two variables is considered weak.

g. Using your most relevant variables complete a bivariate linear regression analysis. Provide interpretations of your results. (6 marks)

Analysis:

Normally, the bivariate linear regression is used to analyze two ratio-level variables. However a limitation of the CCHS is that it does not provide any data of ratio level that measure food security status and mental health status. Therefore, we have selected ordinal level data to run a bivariate linear regression analysis as though this data were ratio level data.

We conducted bivariate linear regression analysis assigning “self-perceived mental health” as a dependent variable and “food bought just didn’t last - 12 mo.” as an independent variable.

Correlations

		Self-perceived mental health	Food bought just didnt last - 12 mo.
Pearson Correlation	Self-perceived mental health	1.000	-.162
	Food bought just didnt last - 12 mo.	-.162	1.000
Sig. (1-tailed)	Self-perceived mental health	.	<.001
	Food bought just didnt last - 12 mo.	.000	.
N	Self-perceived mental health	26660	26660
	Food bought just didnt last - 12 mo.	26660	26660

Results:

The results show a Pearson correlation of $r = -0.162$, $p\text{-value} < 0.001$ and $n = 26660$. Therefore, we conclude that these two variables have a statistically significant, weak negative correlation.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.162 ^a	.026	.026	.896

a. Predictors: (Constant), Food bought just didnt last - 12 mo.

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	578.107	1	578.107	720.387	<.001 ^b
	Residual	21392.893	26658	.802		
	Total	21971.000	26659			

a. Dependent Variable: Self-perceived mental health

b. Predictors: (Constant), Food bought just didnt last - 12 mo.

The model summary and ANOVA tables show the $R^2 = 0.026 = 2.6\%$, $p < 0.001$. This means that the linear regression model including “food bought just didn’t last - 12 mo.” as the independent variable only explains 2.6% of the variability in the dependent variable, which is “self-perceived mental health.”

Interpretation:

Results show that as the “food bought just didn’t last - 12 mo.” value decreased (from 3 - “Never True” towards 1 - “Often True”), the “self-perceived mental health” value increased (from 1 - “Excellent” towards 5 - “Poor”). This makes sense because if someone never experienced “food bought just didn’t last,” we would predict that their “self-perceived mental health” would lean towards the excellent side. A weak negative correlation between these variables indicates that “food bought just didn’t last - 12 mo.” does play a role in predicting “self-perceived mental health,” but not to a great extent. Mental health is a very complex issue, and there are many other variables that can act as predictors of mental health, such as daily stress, life satisfaction, sense of community belonging, or financial status. As a result, exploring several more relevant independent variables may help us better predict and explain “self-perceived mental health.” It is also worthwhile to note that although the bivariate correlations cannot prove causal relationships, it can provide evidence to support such causal arguments.

h. Using your most relevant variables complete a multiple (linear) regression analysis. Provide interpretations of your results. (8 marks)

Analysis:

As previously mentioned, a limitation of the CCHS is that it does not provide data on ratio level measurements for variables that measure food security status and mental health. We have selected the dependent variable “self-rated mental health”, and the independent variables “food situation in household - 12 mo.”, “household food security status” to run a multivariate regression analysis.

Model 1 - (1DV:2IVs)

		Correlations		
		Self-rated mental health - (D)	Food situation in household - 12 mo.	Household food security status - (D)
Pearson Correlation	Self-rated mental health - (D)	1.000	-.159	-.169
	Food situation in household - 12 mo.	-.159	1.000	.576
	Household food security status - (D)	-.169	.576	1.000
Sig. (1-tailed)	Self-rated mental health - (D)	.	<.001	<.001
	Food situation in household - 12 mo.	.000	.	.000
	Household food security status - (D)	.000	.000	.
N	Self-rated mental health - (D)	26545	26545	26545
	Food situation in household - 12 mo.	26545	26545	26545
	Household food security status - (D)	26545	26545	26545

Results:

The Pearson correlation for “self-rated mental health” and “food situation in household - 12 mo” is statistically significant, but has a weak negative correlation ($r = -0.159$, $p < 0.001$, $n = 26545$). Furthermore, the Pearson correlation of “self-rated mental health” and “household food security status” is statistically significant, with a weak negative correlation ($r = -0.169$, $p < 0.001$, $n = 26545$); however, the Pearson correlation of “food situation in household - 12 mo” and “household food security” shows a statistically significant, moderate positive correlation ($r = 0.576$, $p < 0.001$, $n = 26545$).

Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	Change Statistics			
						F Change	df1	df2	Sig. F Change
1	.185 ^a	.034	.034	.892	.034	471.965	2	26542	<.001

a. Predictors: (Constant), Household food security status - (D), Food situation in household - 12 mo.

b. Dependent Variable: Self-rated mental health - (D)

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	750.903	2	375.451	471.965	<.001 ^b
	Residual	21114.357	26542	.796		
	Total	21865.260	26544			

a. Dependent Variable: Self-rated mental health - (D)

b. Predictors: (Constant), Household food security status - (D), Food situation in household - 12 mo.

The model summary and ANOVA tables illustrate that the $R^2 = 0.034 = 3.4\%$, $p < 0.001$. Based on this information, the multiple linear regression model explains that 3.4% of the variability in the dependent variable (i.e., self-rated mental health) can be explained by the independent variables (i.e., food situation in household - 12mo, and household food security).

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.300	.017		192.923	.000
	Food situation in household - 12 mo.	-.180	.014	-.093	-12.574	<.001
	Household food security status - (D)	-.253	.016	-.116	-15.668	<.001

a. Dependent Variable: Self-rated mental health - (D)

The coefficients table illustrates an important analysis, the standardized coefficient beta, which refers to each independent variable as a singular contributor of the total impact on the dependent variable (i.e., self-rated mental health). In this model, the independent variables are “food situation in household - 12 mo” and “household food security status.” Both independent variables do predict “self-rated mental health” in a weak negative way, with the standardized coefficient betas for “food situation in household - 12 mo” = -0.093 ($p < 0.001$), and “household food security” = -0.116 ($p < 0.001$). By extending the multiple linear regression equation, it will explain the relative importance of each independent variable at predicting “self-rated mental health.” Both partial regression coefficients (unstandardized B) are negative. Therefore, the

predicted self-rated mental health decreases by 0.180 when the food situation in the household - 12 mo increases by 1. Furthermore, the predicted self-rated mental health decreases by 0.253 when the household food security status increases by 1. The constant (3.300) value represents the point where the regression line crosses the Y-axis when all other variables are zeroed out. In conclusion, a decrease in self-rated mental health results in poorer mental health conditions. Thus, as the independent variables (i.e., food situation in the household - 12 mo and household food security status) increase, self-rated mental health decreases by 0.180 and 0.253, respectively. Moreover, when all variables approach zero (they start to improve in food situations, and become more food secure), self-rated mental health can be viewed as being very good.

Interpretation:

The results show that as “food situation in household - 12 mo” increases (from 1 - “Always had enough kinds of food wanted” towards 4 - “Often didn’t have enough”), “self-rated mental health” decreases (from 4 - “Excellent” towards 0 - “Poor”). This can be illustrated as self-rated mental health improves when the food situation in the household improves. Furthermore, results show that when “household food security status” increases (from 0 - “Food Secure” towards 3 - “Food insecure with severe hunger”), “self-rated mental health” shifts towards a poor state (score of 0). Both independent variables (i.e., ‘food situation in household - 12 mo’ & ‘household food security status’) demonstrate a weak, negative correlation in relation to self-rated mental health (dependent variable), independent of one another. A weak negative correlation between each independent variable with the dependent variable demonstrates that each variable plays a role in predicting “self-rated mental health”, to some degree. However, the results show that as “food situation in household - 12 mo” increases (from 1 - “Always had enough kinds of food wanted” towards 4 - “Often didn’t have enough”), “household food security status” also increases (from 0 - “Food Secure” towards 3 - “Food insecure with severe hunger”). These two variables demonstrate a moderate/good positive correlation with one another. This can be explained as, when the food situation in the household gets worse, the food security status of the household declines. Mental health cannot simply be defined/predicted by one variable, its complex and incorporates multiple variables (i.e., financial status, sense of belonging, etc.). Further analyses of other variables, or including more variables, may have stronger predictive outcomes. However, incorporating too many variables may make it difficult to understand/follow. After conducting a multivariate regression analysis, what we observe is that each independent variable is capable of predicting “self-rated mental health” in a weak negative way. Meaning, that as the food situation in the household worsens, self-rated mental health gets worse. Moreover, as the food security status within the household declines, self-rated mental health also declines; however, both of these independent variables predict the self-rated mental health outcome weakly. Illustrating that on a more positive note, as the food situation and food security status within households improve, people viewed their mental health as being very good.

References

- Bruening, M., Dinour, L. M., & Chavez, J. B. R. (2017). Food insecurity and emotional health in the USA: a systematic narrative review of longitudinal research. *Public Health Nutrition*, 20(17), 3200-3208. <https://doi.org/10.1017/s1368980017002221>
- Maynard, M., Andrade, L., Packull-McCormick, S., Perlman, C. M., Leos-Toro, C., & Kirkpatrick, S. I. (2018). Food Insecurity and Mental Health among Females in High-Income Countries. *Int J Environ Res Public Health*, 15(7). <https://doi.org/10.3390/ijerph15071424>