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Food Insecurity in Vermont Households: An Analysis of the Association with Tobacco Use, Alcohol Consumption and Physical Inactivity

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Authors	Kaufman, Hannah R;Savoie, Kyleigh;Belanger, Emily;Bowman, Kijonna;Childs, Darren;Maltby, Hendrika
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Introduction

Food insecurity (FI) impacts 12.7% of American households as of 2015.¹ FI is defined as having limited or uncertain availability of nutritionally adequate foods.^{2,3,4} Approximately 10% of households in the state of Vermont are struggling with food insecurity.⁵ FI has been associated with a higher prevalence of chronic diseases, high healthcare costs, and low income.⁶ FI disproportionately impacts racial/ethnic minority groups.^{1,6,7} Although increased incidence of tobacco usage has been previously linked to food insecurity, a survey of the literature shows that research on the relationship between alcohol usage, sedentary lifestyle and FI is very limited.⁸ Screening and data collection for food insecurity in Vermont is sparse.

Our research seeks to identify the association between tobacco use, alcohol consumption, and sedentary lifestyle and FI among Vermonters. To best develop targeted interventions to reduce the risk of chronic diseases among FI populations, it is imperative that the incidence of these chronic disease risk behaviors are assessed.

Methods

This cross-sectional study utilizes data from the 2018 Vermont Behavioral Risk Factor Surveillance System (BRFSS). Surveys were completed by 6,544 non-institutionalized adults aged 18 and older.⁹

A question was added to BRFSS in 2018 to assess FI. “In the past year have you ever worried that you or someone else in your household would NOT have enough food to eat?” Responses in the affirmative were coded as (1), while all other responses were coded “no,” (0).

The predictor variables included tobacco use, alcohol consumption, and sedentary lifestyle. At-risk tobacco use responses were recategorized into a dichotomous variable for smoking status; those who reported smoking “every day” and “some days” were coded 1, and

“not at all” as 0. Sedentary lifestyles were established by a “no” response to the question, “During the past month, have you participated in physical activities or exercise?”, and coded as 1, and “yes” responses were coded 0 = active lifestyle. Alcohol use was assessed by the reported average number of drinks-per-day the respondent recalled having during the previous month.

Covariates were identified by the Healthy People 2020 risk factors associated with food insecurity, and included income per-year, (<\$50,000, \$50,000 +), sex (male, female), age (18-64,65+), race (white, racial/ethnic minority (non-white) and activity limitation status (no limitations,limitations.)¹⁰ These variables were transformed into dichotomous categories to increase statistical power.

SPSS v.26 was used in conducting the analyses. The binomial logistic regressions were designed utilizing the model of best selection. All independent variables were statistically significant at $p < 0.05$ and were included in the model building process. Following the χ^2 tests of association, the six variables were assessed in a univariable logistic regression with the outcome at a level of $p < 0.25$ significant. Unadjusted analysis between the predictors and outcomes was conducted, in addition to univariable comparisons of the nine covariates. All were statistically significant and included in adjusted analyses. The multiple binomial logistic regression models were constructed to test the significance of the predictor variables, adjusting for covariates, with the outcome to form the adjusted logistic regression.

Results

Of the 6,543 respondents to the 2018 BRFSS, a total of 5,165 respondents were excluded from analysis due to one or more of the independent or dependent measures being missing, with the most frequent being alcohol consumption (2,740 missing), tobacco use (3,596 missing), and income (1,171 missing). The resulting sample of 1,378 was used for all subsequent analysis.

In the adjusted binomial logistic regression, considering all covariates on the association, food insecure adults in Vermont were more likely to be between 18-64, female, a person of color, make less than \$50,000 annually, and have activity limitations, compared to food secure adults.

In the unadjusted binomial logistic regression, the predictors of interest were assessed in relation to the outcome, (Table 1), tobacco users were 3.32 times more likely to be food insecure than non-tobacco users (CI 2.00-5.54). Those who do not exercise were 98% more likely to be food insecure than adults who did (CI 1.13-3.45). For every-one alcohol beverage consumed, adults were 5% more likely to be food insecure (0.99-1.12).

In the fully adjusted binomial logistic regression, considering the confounding relationship of covariates (Table 1), the odds of food insecurity increase by 9% per every one alcoholic beverage consumed (CI 1.06-1.71). There were no statistically significant associations between food insecurity and tobacco use or sedentary lifestyles. According to the adjusted logistic regression: individuals who make below \$50,000 have 14.90 times the odds of being food insecure than those who make above \$50,000 when controlling for the covariates. Females are at 2 times the risk of being food insecure compared to males, controlling for the covariates. Individuals who are 18-64 have a 4.24 times greater risk of being food insecure than those 65 years and older when controlling for the covariates. Individuals with activity limitations are 4 times more likely to be food insecure than those without limitations when controlling for covariates.

The fit of the multiple logistic regression was determined by model diagnostics, assessing for outliers, correlations, and residual values. Model fit was assessed using analysis of residuals and found to be sufficient. The final model had an r-squared value of 0.264, indicating that 26.4

percent of the variability in food security status can be explained by alcohol consumption, age, income, sex, and activity limitations.

Discussion

According to Vermont's 2018 BRFSS data, 4.57% of the adult population in Vermont struggled with FI. Females, people of color, those making less than \$50,000, and individuals with physical limitations were disproportionately impacted by FI. The fully adjusted model found statistically significant associations between alcohol consumption, age, sex, income, and activity limitations. There were no statistically significant associations between sedentary lifestyle or tobacco usage and FI.

Our findings contradict a scoping review of articles from the US and Canada that reported a statistically significant correlation between FI and smoking.⁹ The Vermont Tobacco Cessation program funding is nearly triple the national average and the CDC notes that in 2018, 52.1% of the daily adult smokers in Vermont quit for at least one day.¹¹ The CDC findings coupled with our small participant pool suggest additional research on the impact of tobacco cessation programs on individuals struggling with FI is needed.

Vermont's 2018 BRFSS only captured 288 individuals who identified as struggling with FI. The use of telephones for data collection created responder bias by restricting participants to those that have a telephone. A recent study found that collecting data via a proxy indicator, using mobile data or lack thereof, could compliment in-person surveys and improve the targeting of ground-based information gathering in areas of high risk for FI.¹² It is our recommendation that further research into more efficient and effective methods of capturing FI be conducted. Based on our findings, when planning outreach and interventions to address FI within communities,

coordinators and stakeholders should incorporate methods to concurrently address chronic disease risk behaviors.

Citations

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**The University of Vermont Institutional Review Board has reviewed this project and determined that it qualifies as exempt from additional review.*

Supplemental Table 1: Multiple Logistic Regressions

Food Insecure	Unadjusted Model		Final Model	
	Odds Ratio	Confidence Interval	Odds Ratio	Confidence Interval
Tobacco Use				
At-Risk Tobacco Use	3.324**	2.00-5.54	1.09	0.61-1.96
Alcohol	1.05*	0.99-1.12	1.09*	1.06-1.71
Exercise				
No	1.98*	1.13-3.45	0.94	0.50-1.79
Income				
Below \$50,000	16.36**	6.51-41.05	14.90**	5.83-38.10
Race				
Person of Color	1.85	0.77-4.43	--	--
Sex				
Female	1.917*	1.14-3.24	1.98*	1.13-3.49
Age				
18-64	4.38**	1.99-8.31	4.24**	2.11-9.11
Activity Limitations				
Yes	8.99**	4.76-16.99	4.03**	2.02-4.03

*significant p<0.05

**significant p<0.001

Supplemental Table 2. Population Characteristics by Group

Characteristic	Group 0: Food Secure n=1,315		Group 1: Food Insecure n=63		Population	
Alcohol mean (sd)	2.09(1.54)		2.86 (3.99)		2.13 (1.72)	
	n	(%)	n	(%)	n	(%)
Tobacco Use						
Not At-Risk	1095	83.27	40	63.49	1,135	82.37
At-Risk Use	220	16.73	23	36.51	243	17.63
Exercise						
Yes	1,079	82.05	44	69.84	1,123	81.49
No	236	17.95	19	30.16	255	18.51
Income						
Below \$50,000	546	41.52	58	92.06	774	56.17
\$50,000+	769	58.48	5	7.94	604	43.83
Race						
White	1,244	94.60	57	90.48	1,301	94.41
Other	71	5.40	6	9.52	77	5.59
Sex						
Male	689	52.40	23	36.51	712	51.67
Female	626	47.60	40	63.49	666	48.33
Age						
18-64	784	59.62	54	85.71	838	60.81
65+	531	40.38	9	14.29	540	39.19
Location						
Urban	590	44.87	25	39.68	615	44.63
Rural	725	55.13	38	60.32	763	55.37
Activity Limitations						
No	1,267	96.35	47	74.60	1,267	96.35
Yes	48	3.65	16	25.40	48	3.65

