Cigarette Smoking and Food Insecurity among
Low-Income Families in the United States, 2001

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Abstract: The goal of this research is to quantify the association between food insecurity and smoking among low-income families. This analysis is a retrospective study using data from the 2001 Panel Study of Income Dynamics, a longitudinal study of a representative sample of U.S. men, women, and children and the family units in which they reside. Family income is linked with U.S. poverty thresholds to identify 2,099 families living near or below 200 percent of the federal poverty level. Food insecurity (that is, having insufficient funds to purchase enough food to maintain an active and healthy lifestyle) is calculated from the eighteen core items in the food security module of the U.S. Department of Agriculture. The results indicate that smoking prevalence is higher among low-income families who are food insecure compared to low-income families who are food secure (43.6 percent versus 31.9 percent). Multivariate analysis reveals that smoking is associated with an increase in food insecurity of approximately 6 percentage points. Given our finding that families near the federal poverty level spend a large share of their income on cigarettes, perhaps it would be prudent for food assistance and tobacco control programs to work together to help low-income people quit smoking.

JEL classification: I18, I38

Key words: food security, smoking, poverty

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PURPOSE

A family is considered to be food secure if they have consistent and dependable access to enough nutritionally adequate and safe foods to engage in an active and healthy lifestyle.[1] The most recent report from the United States Department of Agriculture estimates that 11% of U.S. households were food insecure in 2005.[2] When food security is stratified by the household income-to-poverty ratio, estimates reveal that 28.3% of low-income households (incomes at or below 185% of the federal poverty level) were food insecure whereas, 36% of poor households (incomes at or below the federal poverty level) were food insecure.[2] In addition, food insecurity rates exceed 40% in lower-income households with children and approach 45% for low-income single parent households with children.[2]

Given this inverse relationship between food insecurity and income, low-income households are at increased risk of being food insecure. However, the majority of low-income households are able to maintain food security. In order to make informed decisions about policies and programs designed to reduce food insecurity, it is important to determine what other characteristics of low-income households are associated with food insecurity.

It has been shown that the prevalence of cigarette smoking in the United States is higher among adults living below the poverty level (32.9%) than among those living at or above the poverty level (22.2%).[3] An association between food insecurity and smoking has been known as far back as 1969 when a vice-president from Phillip Morris, in a presentation to their Board of Directors, stated that "The cigarette will preempt even food in times of scarcity on the smoker's priority list."[4] This suggests that food may be an opportunity cost (i.e., the goods and services smokers forgo to purchase cigarettes) of smoking among low-income families.[5,6] Thus, the aim of this study is to quantify the association between food insecurity and smoking.

Using data from the Panel Study of Income Dynamics (PSID) for 2001, we assessed the association between food insecurity and smoking, controlling for other socio-demographic and behavioral health characteristics. This assessment will aid state health departments and other organizations in formulating effective food security and tobacco-control policies, including the development of programs for low-income families, to help decrease their disproportionately high prevalence of cigarette use and smoking-related health and opportunity costs.

METHODS

The PSID is a longitudinal study of a representative sample of U.S. men, women, and children and the family units in which they reside. The PSID began collecting information on 4,800 families in 1968 and re-interviewed these families on an annual basis from 1968-1997. Since 1997, families have been re-interviewed biennially. Information is available on the economic, health, and social behavior data on 7,406 families interviewed in 2001. A detailed description of the PSID is available online at http://psidonline.isr.umich.edu.

Food insecurity was calculated from the 18 core-item food security module of the U.S. Department of Agriculture included in the 2001 survey.[7] A categorical measure of food security status that identified families as food secure, food insecure without hunger, and food insecure with hunger was recoded and families reporting food insecurity with and without hunger were coded as being food insecure.[7] The referent group consisted of those families that were food secure.

Heads of households and spouses were asked, "Do you smoke cigarettes?" and "On the average, how many cigarettes per day do you smoke?" The average number of cigarettes smoked per day was converted to packs and weekly cigarette consumption was estimated for 2001.

Analysis

Bivariate statistical tests (χ^2 and t tests) were used to compare selected demographic characteristics by food insecurity status. Multivariate logistic regression models were used to estimate the probability of a family being food insecure. Independent variables included in the models were household head characteristics (age, race, and education), marital status, number of children, whether the household head or spouse smoked cigarettes, weekly cigarette consumption, whether the household head or spouse drank alcohol on a daily basis, per-capita annual family income, whether the family resided in a metropolitan area, and region of the country.

Family income was linked with U.S. poverty thresholds[8] to identify 2,099 families living at or below 200% of the federal poverty level. This analysis is limited to households with family incomes close to the poverty level for two reasons. First, food insecurity is primarily an issue among the poor and near poor.[2,9] Second, given that food insecurity disproportionately affects families at or near the federal poverty level, it is highly likely that there are unobserved factors associated with household poverty are also associated with the probability of being food insecure. Ignoring this endogeneity would lead to biased results. The standard statistical approach to reduce problems associated with endogeneity would be to use an instrumental variables technique. This entails identifying a variable to measure for poverty; that is a variable that is both correlated with poverty and is not itself endogenous. However, such a variable is difficult to identify, a priori. Thus, to reduce the problem of endogeneity, we limited our analysis to low-income families within 200% of the federal poverty level. Descriptive and multivariate estimates were obtained using SAS (version 9.1).[10] The level of statistical significance was set at 5%.

RESULTS

Some 2099 families living at or below 200% of the federal poverty level were included in our analysis. Socio-demographic and behavioral health characteristics of the respondents are shown in Table 1. The mean age of household heads was approximately 44 years. Overall, 48.4% of household heads were black, 37.5% were white, and 34.1% were married or cohabitating. Approximately 48% of responding household heads had less than a high school education, approximately 47% were high school graduates, and 6% attended college. Household income averaged $16,369 and mean per capita income was $6,628. The majority of households (68.5%) were residents of metropolitan areas and 50.5% lived in the southern United States. Some 21.5% of households were food insecure, 52.1% had at least one adult family member who drank alcohol on a daily basis and 34.4% had at least one adult family member who smoked in 2001.

Low-income families who were food insecure were more likely to have a head of household or spouse who smoked cigarettes than low-income families who were food secure (43.6% versus 31.9%; p<0.01). Cigarette consumption, measured in terms of packs smoked per week, was higher in food insecure households than in households that were food secure (10.6 vs. 9.4; p=0.07). Food-insecure households had an older household head (aged 45.6 years versus 40.7 years; p<0.05) who was more likely to be black (56.4% versus 46.2%; p<0.01) more likely to have less than a high school education (59.7% versus 44.5%; p<0.01), were less likely to drink alcohol on a daily basis (51.8% versus 52.2%; p=0.88), and had a lower mean per-capita annual household income ($5,488 versus $6,944; p<0.01) than households that were food secure.

Table 2 shows the odds of being food insecure in 2001, controlling for socioeconomic and demographic characteristics. The coefficient on the key variable of interest "current

cigarette smoker" is positive and statistically significant indicating that a household containing a head and/or spouse who smoked cigarettes was associated with approximately a six percentage point increase in the probability of being food insecure.

The coefficient on the age variable reveals a positive association between food insecurity and the age of a household head (Table 2). The independent variable age was also squared to capture any potential non-linear effects of age on food insecurity. The results shown in Table 2 also reveal that the coefficient on the age-squared term is negative. Collectively, the signs on the coefficients of the age and age-squared variables imply that the association between age and food insecurity increased at a decreasing rate ($p < 0.01$ and $p < 0.01$, respectively). The coefficient on married head of household is negative, suggesting that households containing both a head and spouse were less likely than single headed households to be food insecure; however, the difference is not statistically significant ($p = 0.08$). The coefficient on black race is positive and statistically significant ($p < 0.05$). Increases in per-capita family income were associated with a reduction in food insecurity ($p < 0.01$). Relative to households whose heads had a high school education, those whose household heads had less than a high school education were more likely to be food insecure ($p < 0.01$) whereas those households with a college-educated head were less likely to be food insecure ($p < 0.01$). Having more children was associated with a statistically significant reduction in food insecurity ($p = 0.03$). Alcohol consumption by the head or the spouse of the head was not significantly associated with food insecurity ($p = 0.15$).

Household heads who reside in metropolitan areas were more likely to be food insecure than household heads who reside in rural areas although the difference was not statistically significant ($p = 0.96$). Household heads residing in the western states were more likely to be food insecure than household heads residing in southern states ($p = 0.02$). Also, household heads

residing in the northeastern states and north central states were more likely to be food secure than household heads residing in southern states; however, the differences were not statistically significant (p=0.23 and p=0.16, respectively).

Table 3 shows the odds of being food insecure, conditional on a household head and/or spouse being a smoker. The coefficient on the key variable of interest, weekly cigarette consumption, is positive and statistically significant indicating that consuming an additional pack of cigarettes per week was associated with an increase in food insecurity of approximately one percentage point (p<0.01).

DISCUSSION

The findings in this study are the first to quantify an association between food insecurity and smoking in the United States. The results indicate that cigarette consumption is associated with increased food insecurity. On average, low-income families with an adult smoker purchased approximately 10 packs of cigarettes per week. Assuming an average price of $3.37 per pack,[11] these households spent approximately $33.70 per week on cigarettes. The extent to which smokers in low-income families substitute cigarettes for food adversely affects household food security.

Providing access to tobacco-cessation programs that are proven to be successful in helping poor people quit will, in addition to reducing tobacco-related disease and death, free up family funds that might be used to reduce food insecurity. As of December 31, 2002, a total of 36 Medicaid programs covered some tobacco-dependence counseling or medication for all Medicaid recipients, and only two states offered coverage for all pharmacotherapy and counseling treatments recommended by the Public Health Service Clinical Practice Guideline. [12]

Smoking prevalence is 11.7 percentage points higher among low-income families who are food insecure than low-income families who are food secure. To reduce disparities in smoking prevalence among low-income populations health departments, medical professionals serving low-income families, and state health plans such as Medicaid are encouraged to 1) increase their capacity to document tobacco-use status in medical charts; 2) develop tobacco-control strategies that are culturally competent; 3) draw on community assets, such as churches and youth groups, to target the needs and address the concerns facing low-income populations; 4) provide free or low-cost access to smoking-cessation advice, counseling, and medication; and 5) monitor quit attempts.[1,11] Tobacco-control initiatives based on these practices can reduce disparities among poor populations regarding smoking prevalence, access to prevention and cessation services, and the burden of tobacco-related disease. In addition, the provision of such services that help low-income smokers quit will free up funds that might be used to reduce food insecurity.

Our analysis was limited to low-income families, specifically household heads and spouses reporting income at or below 200% of the federal poverty level. The term low-income is often used as a synonym for poverty or poor, however it is not the same thing and there is little consensus surrounding the definition of near poor.[2,9] Thus, to test the sensitivity of our results to the definition of low-income we re-estimated our model using household income-to- poverty ratios set at or below 150% of the federal poverty level and at or below the federal poverty level (i.e. poor). As before, we find an association between food insecurity and household head and or spouse cigarette use (Appendix A, Tables A.1 and A.2).

It is of interest to note that we found no statistically significant association between food insecurity and alcohol use, the other behavioral choice variable included in the analysis. To test

the sensitivity of our results to the definition of alcohol use, we re-estimated our model using various definitions including drinking two or more drinks per day and drinking three or more drinks per day, and obtained results consistent with those shown in Table 2 and found in previous work.[13]

We found a negative and statistically significant association between food insecurity and the mean number of children residing in a household. This supports previous findings, that children living in low-income households are not the same as hungry children.[13] Among 153 households reporting food insecurity with hunger, 89 had one or more child residents and 19% of these households (17 of 89) reported child hunger. It has been suggested by others that in food insecure households reporting hunger the parents go without food so the children do not have too.[13] Also, there might be an incentive for households with children to underreport hunger because of embarrassment or fear that child services might intervene and remove children from the household. Alternatively, perhaps this finding reflects that low-income families with children are eligible for other types of assistance that reduces food insecurity.

The findings in this report are subject to at least four limitations. First, smoking information was limited to household heads and their spouses. Data on smoking among children in a household were not available. Thus, these estimates might understate actual household cigarette consumption. Second, smoking expenditures were calculated using market-share weighted price data. If low-income persons are more likely to smoke lower-priced cigarette brands which have lower market shares, then the smoking-expenditure estimates might overstate actual household expenditures. Third, poor persons who smoke to relieve the stress associated with poverty might increase their risk of being food insecure. This analysis did not attempt to characterize the causality between smoking and food insecurity. Finally, no single measure might

be sufficient for measuring food security. Thus, a direction for future work is to test the sensitivity of the results to the definition of food insecurity.

SO WHAT

We find that, for low-income families, having a household head and/or spouse who smokes is associated with a six percentage point increase in the probability of the family experiencing food insecurity. Currently, U.S. food assistance programs focus on alleviating food insecurity among low-income families while tobacco control programs have been encouraged to target low-income individuals because they smoke at disproportionately higher rates than higher-income individuals. Given our finding that families near the federal poverty level spend a large share of their income on cigarettes, perhaps it would be prudent for food assistance and tobacco control programs to work together to help low-income people quit smoking. The pooling of resources might enhance the effectiveness of tobacco cessation services and, if successful, help low-income people free up family funds that might be used to reduce food insecurity.

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Table 1. Food insecurity[*] among low-income[†] families, by selected socioeconomic characteristics – Panel Study of Income Dynamics, 2001.

		Food Insecurity		
	Total (N=2099)	Yes (n=452)	No (n=1647)	
Characteristic[‡]	%	%	%	p-value
Mean age of Household Head (yrs)	44.2	45.1	40.7	p<0.01
Race of Household Head				
Black	48.4	56.4	46.2	p=0.01
White	37.5	26.8	40.4	p<0.01
Other	14.1	16.8	13.4	p=0.01
Marital Status (married)	34.1	32.3	34.6	p=0.37
Educational attainment				
Less than high school	47.8	59.7	44.5	p<0.01
High school	46.6	38.1	49.0	p<0.01
College	5.6	2.2	6.5	p<0.01
Mean no. of children	1.3	1.5	1.3	p<0.01
Average Annual Family Income ($)	16,369	14,762	16,810	p<0.01
Annual per-capita family income ($)	6,628	5,488	6,940	p<0.01
Current cigarette smoker[§]	34.4	43.6	31.9	p<0.01
Cigarettes smoked (packs p/week)[|]	9.7	9.4	10.6	p=0.07
Current alcohol drinker[§]	52.1	51.8	52.2	p=0.88
Reside in a metropolitan area	68.5	71.0	67.8	p=0.01
Region[|]				
North East	10.2	9.7	10.4	p=0.94
North Central	22.7	23.2	22.6	p=0.72
South	50.5	48.7	50.9	p=0.10
West	16.6	18.4	16.1	p=0.82

[*] Having insufficient funds to purchase enough food to maintain an active and healthy lifestyle.

[†] Households reporting income at or below 200% of the federal poverty level.

[‡] The referent group for married head of households is non-married headed households. For the categorical variables race, educational attainment, and region, the referent group is the sum of the other categories. For example, for black the referent group is non-black (i.e., white plus other).

[§] Denotes head of household or spouse.

[|] Northeast: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. North Central: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. South: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia. West: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

Table 2. Predictors of food insecurity[*] among low-income[†] families – Panel Study of Income Dynamics, 2001.

	Adjusted Odds Ratios	Marginal Effects[#]
	(95% confidence intervals)	(p-values)
Characteristic[‡]		
Mean age of Household Head (yrs)	1.09 (1.05, 1.13)	0.01 (p<0.01)
Age squared	0.36 (0.24, 0.53)	−0.02 (p<0.01)
Marital Status (married or cohabitates)	0.78 (0.62, 1.03)	−0.03 (p=0.08)
Race of Household Head		
Black	1.30 (1.01, 1.68)	0.04 (p<0.05)
Annual per-capita family income ($)[§d]	0.92 (0.87, 0.94)	−0.02 (p<0.01)
Educational attainment		
<High school	1.78 (1.42, 2.25)	0.09 (p<0.01)
College	0.53 (0.27, 1.05)	−0.08 (p<0.07)
Mean no. of children	0.91 (0.83, 0.99)	−0.02 (p=0.03)
Current alcohol drinker[|]	0.85 (0.68, 1.07)	−0.02 (p=0.15)
Current cigarette smoker[|]	1.44 (1.14, 1.82)	0.06 (p<0.01)
Reside in a metropolitan	1.01 (0.78, 1.29)	0.01 (p=0.96)
Region[¶]		
North East	1.28 (0.86, 1.90)	0.04 (p=0.23)
North Central	1.23 (0.92, 1.64)	0.03 (p=0.16)
West	1.47 (1.05, 2.05)	0.06 (p=0.02)

[*] Having insufficient funds to purchase enough food to maintain an active and healthy lifestyle.
[†] Households reporting income at or below 200% of the federal poverty level.
[‡] The referent group is male head of households, non-black, high-school educated, who do not drink alcohol, do not smoke cigarettes, and reside in rural areas in the southern states, in 2001.
[§] The income variable was measured in thousands of dollars.
[|] Denotes head of household or spouse.
[¶] Northeast: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. North Central: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. South: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia. West: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.
[#] Because of the nonlinear nature of the logistic regression model, a coefficient is not equal to the derivative of an expected value with respect to a variable. Therefore, in addition to the odds ratios, the marginal effects were estimated at the sample means and are reported as percentage point changes for each variable. The marginal effects were reported, in part, because the presenter at an econometric workshop, sponsored by the Centers for Disease Control and Prevention, questioned the publics understanding of odds ratio units.[14] Individuals may not think in terms of odds ratio units, but they think in terms of change (e.g., increasing weekly consumption of cigarettes by one pack increases the probability of food insecurity by approximately one percentage point).[14] Therefore, the marginal effects were reported because they are more intuitive when it comes to interpreting the effects of explanatory variables.

Table 3. Predictors of food insecurity[*] among low-income[†] families with household head and or spouse who smokes cigarettes – Panel Study of Income Dynamics, 2001.

	Adjusted Odds Ratios	Marginal Effects[#]
	(95% confidence intervals)	(p-values)
Characteristic[‡]		
Mean age of Household Head (yrs)	1.09 (1.05, 1.13)	0.03 (p<0.01)
Age squared	0.36 (0.24, 0.53)	−0.02 (p<0.01)
Marital Status (married or cohabitates)	0.78 (0.62, 1.03)	−0.07 (p=0.08)
Race of Household Head		
Black	1.30 (1.01, 1.68)	0.11 (p<0.05)
Annual per-capita family income ($)[§]	0.92 (0.87, 0.94)	−0.02 (p<0.01)
Educational attainment		
<High school	1.78 (1.42, 2.25)	0.07 (p<0.01)
College	0.53 (0.27, 1.05)	−0.09 (p=0.02)
Mean no. of children	0.91 (0.83, 0.99)	−0.02 (p=0.03)
Current alcohol drinker[|]	0.85 (0.68, 1.07)	−0.01 (p=0.16)
Cigarettes smoked (packs per week)[|]	1.44 (1.14, 1.82)	0.01 (p<0.01)
Reside in a metropolitan area	1.01 (0.78, 1.29)	0.01 (p=0.96)
Region[¶]		
North East	1.28 (0.86, 1.90)	0.12 (p=0.25)
North Central	1.23 (0.92, 1.64)	0.08 (p=0.17)
West	1.47 (1.05, 2.05)	0.15 (p=0.04)

[*] Having insufficient funds to purchase enough food to maintain an active and healthy lifestyle.
[†] Households reporting income at or below 200% of the federal poverty level.
[‡] The referent group is male head of households, non-black, high-school educated, who do not drink alcohol, and reside in rural areas in the southern states, in 2001.
[§] The income variable was measured in thousands of dollars.
[|] Denotes head of household or spouse.
[¶] Northeast: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. North Central: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. South: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia. West: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.
[#] Because of the nonlinear nature of the logistic regression model, a coefficient is not equal to the derivative of an expected value with respect to a variable. Therefore, in addition to the odds ratios, the marginal effects were estimated at the sample means and are reported as percentage point changes for each variable. The marginal effects were reported, in part, because the presenter at an econometric workshop, sponsored by the Centers for Disease Control and Prevention, questioned the publics understanding of odds ratio units.[14] Individuals may not think in terms of odds ratio units, but they think in terms of change (e.g., increasing weekly consumption of cigarettes by one pack increases the probability of food insecurity by approximately one percentage point).[14] Therefore, the marginal effects were reported because they are more intuitive when it comes to interpreting the effects of explanatory variables.

Appendix A

Table A.1. Panel A. Predictors of food insecurity[*] among low-income[†] families – Panel Study of Income Dynamics, 2001.

	Adjusted Odds Ratios	Marginal Effects[#]
	(95% confidence intervals)	(p-values)
Characteristic[‡]		
Mean age of Household Head (yrs)	1.09 (1.04, 1.14)	0.01 (p<0.01)
Age squared	0.36 (0.23, 0.56)	−0.02 (p<0.01)
Marital Status (married or cohabitates)	0.90 (0.67, 1.21)	−0.02 (p=0.47)
Race of Household Head		
Black	1.45 (1.08, 1.95)	0.07 (p=0.01)
Annual per-capita family income ($)[§]	0.93 (0.88, 0.98)	−0.01 (p<0.01)
Educational attainment		
<High school	1.87 (1.45, 2.44)	0.11 (p<0.01)
College	0.44 (0.18, 1.05)	−0.12 (p=0.01)
Mean no. of children	0.96 (0.87, 1.06)	−0.01 (p=0.40)
Current alcohol drinker[|]	0.81 (0.63, 1.06)	−0.04 (p=0.11)
Current cigarette smoker[|]	1.41 (1.08, 1.83)	0.06 (p=0.01)
Reside in a metropolitan	0.92 (0.69, 1.22)	0.02 (p=0.54)
Region[¶]		
North East	1.32 (0.84, 2.08)	0.05 (p=0.26)
North Central	1.39 (1.01, 1.92)	0.06 (p=0.06)
West	1.49 (1.01, 2.19)	0.06 (p=0.06)

Table A.1. Panel B. Predictors of food insecurity[*] among low-income[†] families with household head and or spouse who smokes cigarettes – Panel Study of Income Dynamics, 2001.

	Adjusted Odds Ratios	Marginal Effects[#]
	(95% confidence intervals)	(p-values)
Characteristic		
Mean age of Household Head (yrs)	1.15 (1.05, 1.29)	0.03 (p<0.01)
Age squared	0.15 (0.04, 0.53)	−0.01 (p<0.01)
Marital Status (married or cohabitates)	0.73 (0.44, 1.21)	−0.06 (p=0.21)
Race of Household Head		
Black	1.82 (1.09, 3.08)	0.13 (p<0.05)
Annual per-capita family income ($)[§]	0.95 (0.87, 1.03)	−0.01 (p=0.22)
Educational attainment		
<High school	1.41 (0.92, 2.18)	0.07 (p=0.11)
College	0.70 (0.18, 2.70)	−0.07 (p=0.58)
Mean no. of children	0.88 (0.80, 1.13)	−0.01 (p=0.53)
Current alcohol drinker[|]	0.99 (0.66, 1.54)	−0.01 (p=0.97)
Cigarettes smoked (packs per week)[|]	1.06 (1.02, 1.10)	0.01 (p<0.01)
Reside in a metropolitan area	0.89 (0.54, 1.45)	0.03 (p=0.63)
Region[¶]		
North East	1.76 (0.87, 3.55)	0.13 (p=0.14)
North Central	1.57 (0.94, 2.65)	0.10 (p=0.10)
West	1.85 (0.96, 3.57)	0.14 (p=0.08)

[*] Having insufficient funds to purchase enough food to maintain an active and healthy lifestyle.

[†] Households reporting income at or below 150% of the federal poverty level.

[‡] The referent group is male head of households, non-black, high-school educated, who do not drink alcohol, do not smoke cigarettes, and reside in rural areas in the southern states, in 2001.

[§] The income variable was measured in thousands of dollars.

[|] Denotes head of household or spouse.

[¶] Northeast: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. North Central: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. South: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia. West: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

[#] Because of the nonlinear nature of the logistic regression model, a coefficient is not equal to the derivative of an expected value with respect to a variable. Therefore, in addition to the odds ratios, the marginal effects were estimated at the sample means and are reported as percentage point changes for each variable. The marginal effects were reported, in part, because the presenter at an econometric workshop, sponsored by the Centers for Disease Control and Prevention, questioned the publics understanding of odds ratio units.[14] Individuals may not think in terms of odds ratio units, but they think in terms of change (e.g., increasing weekly consumption of cigarettes by one pack increases the probability of food insecurity by approximately one percentage point).[14] Therefore, the marginal effects were reported because they are more intuitive when it comes to interpreting the effects of explanatory variables.

Table A.2. Panel A. Predictors of food insecurity among low-income[*] families – Panel Study of Income Dynamics, 2001.

	Adjusted Odds Ratios	Marginal Effects[#]
	(95% confidence intervals)	(p-values)
Characteristic[‡]		
Mean age of Household Head (yrs)	1.11 (1.06, 1.18)	0.02 (p<0.01)
Age squared	0.31 (0.18, 0.53)	–0.02 (p<0.01)
Marital Status (married or cohabitates)	0.78 (0.51, 1.19)	–0.05 (p=0.23)
Race of Household Head		
Black	1.36 (0.92, 2.03)	0.05 (p=0.12)
Annual per-capita family income ($)[§]	0.91 (0.83, 1.01)	–0.02 (p=0.06)
Educational attainment		
<High school	2.00 (1.42, 2.82)	0.13 (p<0.01)
College	0.22 (0.05, 0.97)	–0.20 (p<0.01)
Mean no. of children	0.99 (0.88, 1.12)	–0.01 (p=0.89)
Current alcohol drinker[|]	0.75 (0.53, 1.05)	–0.06 (p=0.09)
Current cigarette smoker[|]	1.41 (0.99, 1.99)	0.07 (p=0.06)
Reside in a metropolitan	0.71 (0.48, 1.03)	–0.07 (p=0.07)
Region[¶]		
North East	1.34 (0.70, 2.52)	0.06 (p=0.41)
North Central	1.36 (0.89, 2.06)	0.06 (p=0.17)
West	2.15 (1.27, 3.65)	0.16 (p<0.01)

Table A.2. Panel B. Predictors of food insecurity[*] among low-income[†] families with household head and or spouse who smokes cigarettes – Panel Study of Income Dynamics, 2001.

	Adjusted Odds Ratios	Marginal Effects[#]
	(95% confidence intervals)	(p-values)
Characteristic		
Mean age of Household Head (yrs)	1.14 (0.99, 1.32)	0.03 (p=0.05)
Age squared	0.15 (0.03, 0.91)	−0.01 (p=0.03)
Marital Status (married or cohabitates)	0.76 (0.35, 1.66)	−0.06 (p=0.48)
Race of Household Head		
Black	1.76 (0.84, 3.69)	0.12 (p=0.12)
Annual per-capita family income ($)[§]	0.84 (0.69, 1.01)	−0.04 (p<0.06)
Educational attainment[†]		
<High school	1.38 (0.77, 2.45)	0.07 (p=0.27)
Mean no. of children	0.92 (0.76, 1.03)	−0.02 (p=0.46)
Current alcohol drinker[ǀ]	0.83 (0.47, 1.47)	−0.04 (p=0.52)
Cigarettes smoked (packs per week)[ǀ]	1.06 (1.02, 1.08)	0.01 (p<0.05)
Reside in a metropolitan area	0.64 (0.32, 1.31)	0.10 (p=0.24)
Region[¶]		
North East	1.72 (0.70, 4.32)	0.13 (p=0.26)
North Central	1.52 (0.76, 3.04)	0.10 (p=0.25)
West	2.00 (0.80, 4.99)	0.17 (p=0.15)

[*] Having insufficient funds to purchase enough food to maintain an active and healthy lifestyle. There were 6 impoverished individuals with a college education. This small number would not let the model converge so these 6 individuals were dropped from the analysis.

[†] Households reporting income at or below the federal poverty level.

[‡] The referent group is male head of households, non-black, high-school educated, who do not drink alcohol, do not smoke cigarettes, and reside in rural areas in the southern states, in 2001.

[§] The income variable was measured in thousands of dollars.

[ǀ] Denotes head of household or spouse.

[¶] Northeast: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. North Central: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. South: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia. West: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

[#] Because of the nonlinear nature of the logistic regression model, a coefficient is not equal to the derivative of an expected value with respect to a variable. Therefore, in addition to the odds ratios, the marginal effects were estimated at the sample means and are reported as percentage point changes for each variable. The marginal effects were reported, in part, because the presenter at an econometric workshop, sponsored by the Centers for Disease Control and Prevention, questioned the publics understanding of odds ratio units.[14] Individuals may not think in terms of odds ratio units, but they think in terms of change (e.g., increasing weekly consumption of cigarettes by one pack increases the probability of food insecurity by approximately one percentage point).[14] Therefore, the marginal effects were reported because they are more intuitive when it comes to interpreting the effects of explanatory variables.