

**U.S. rural adults' consumption of fruits and vegetables: Who is consuming at least five servings daily?**

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## Abstract

**Objective:** Adequate fruit and vegetable consumption reduces the risk for several major causes of morbidity and mortality. We examined differences in fruit and vegetable consumption between U.S. rural and non-rural adults and identified associated characteristics.

**Methods:** Bivariate and multivariate techniques were used to analyze 2009 Behavioral Risk Factor Surveillance Survey (BRFSS) data. Prevalence differences were mapped by U.S. state using GIS software.

**Results:** Logistic regression analysis revealed that U.S. rural adults consuming at least five daily servings of fruits and vegetables were more likely to be: female; African American, Hispanic or racially other; married or living with a partner; living in a household without children; living in a household whose annual income was at least \$35,000; and getting at least moderate physical activity. They were also more likely to have: a BMI of <30; have a personal physician; have had a routine medical exam in the past 12 months; self-define their health as good to excellent and to have deferred medical care because of cost. When comparing the standardized percent differences between rural and non-rural U.S. adults by state, 37 States had smaller proportions of rural adults consuming five or more daily servings of fruits and vegetables and 11 States a higher proportion of rural adults consuming five or more daily servings of fruits and vegetables.

**Conclusions:** Findings should be helpful to those interested in developing interventions aimed at increased consumption of recommended daily servings of fruits and vegetables.

## Introduction

Similar to U.S. Healthy People objectives (e.g., HP 2000 and HP 2010), Healthy People 2020 (HP2020) [1] also contains nutrition related objectives that include increasing the consumption of both fruits and vegetables by Americans. The HP 2020 objectives for fruit and vegetable consumption echo the 2010 Dietary Guidelines for Americans that recommend an increase in vegetable and fruit intake for all aged 2 years and older. [2] Furthermore, the newly released guidelines emphasize the importance of consuming a variety of vegetables (i.e. dark-green, red, orange vegetables) and beans and peas.[2] Increasing the consumption of fruits and vegetables is deemed an important public health issue since adequate fruit and vegetable consumption may reduce the risk for several major causes of morbidity and mortality in the U.S. including: type 2 diabetes, [3] heart disease,[4–5] stroke [6] and obesity. [3–6] In addition, research also suggests that diets rich in fruits and vegetables are associated with a lower incidence of epithelial cancers of the alimentary and respiratory tracks.[7-8]

In addition to reducing the risk of developing many chronic diseases, there is an increasing and compelling body of clinical evidence supporting the benefit of diet and physical activity in not only health maintenance and disease prevention but also for disease treatment, a process referred to as Medical Nutrition Therapy (MNT). [9] MNT is an essential component in the management of conditions such as type 2 diabetes, heart disease, hyperlipidemia, stroke and obesity. [10-12] Several widely disseminated clinical practice guidelines advise eating diets high in whole foods such as fruit, vegetables, and whole grains along with limiting animal protein and avoiding high energy low nutrient foods as an important component of disease management. There is also a growing

body of medical research demonstrating that diets rich in fruits and vegetables reduce the risk of cancer, suggesting that dietary choice can be an important cancer prevention measure. [13–15]

Another key HP2020 objective is to identify and track health inequities with the goal of eradicating disparities among segments of the population. Individuals living in rural settings are one population identified as being at risk for health disparities.[1–17] While researchers have identified fruit and vegetable intake differences by race and ethnicity, [18-20] age, [21-22] socioeconomic factors [23-24] and sex, [21, 25] there is little research about the consumption of fruits and vegetables by rural populations. Those published studies examining fruit and vegetable intake by populations living in rural areas either focused on regional or narrowly defined U.S. populations (e.g., seniors or only Hispanic and African American groups) or populations in developing countries (e.g., India) or other settings outside the U.S. (e.g., France).[26-28]

This study examined the differences in daily fruit and vegetable consumption between U.S. rural and non-rural adults and explored what characteristics were associated with rural adults consuming at least five daily servings of combined fruits and vegetables.

## **Methods**

We examined data from the 2009 Behavioral Risk Factor Surveillance Survey (BRFSS), to determine if there were disparities and/or differences between rural and non-rural adults in regard to the daily consumption of at least five daily servings of combined fruits and vegetables. The study used 2009 BRFSS data, the most recent

year of data collected and available for analysis. BRFSS is a cross-sectional, random digit telephone survey that is a collaborative project of the Centers for Disease Control and Prevention (CDC) and all U.S. states and territories. The survey measures several behavioral risk factors in the adult population aged 18 years and older. Its objective is to collect uniform, state-specific data on preventive health practices and risk behaviors linked to chronic diseases, injuries and preventable infectious diseases in the non-institutionalized adult U.S. population.

In this survey, data are collected from a random sample of adults (one per household). A more detailed description of the sampling methodology of BRFSS is available elsewhere. [29] All BRFSS data are self-reported responses to mostly forced-choice questions. No additional data are generated to corroborate or substantiate the self-reported responses. As recommended by the Center for Disease Control, all analyses were performed on weighted data. The weighting provides a stratified representation of the US adult non-institutionalized population.

For our study, a single year of data for the year 2009 of non-institutionalized U.S. adults (n=405,556) were analyzed, and these data were weighted to represent 219,479,823 U.S. adults. From the 2009 dataset, 99,207 U.S. adults were identified as consuming at least 5 servings of fruits and vegetables daily and were then weighted to represent 52,259,789 U.S. adults of which 8,983,840 were identified as living in rural locales.

The Metropolitan Statistical Area (MSA) variable included in BRFSS was used to define place of residence as either rural or non-rural. Rural residents were defined as persons living either within an MSA that had no city center or outside an MSA. Non-rural

residents included all respondents living in a city center of an MSA, outside the city center of an MSA but inside the county containing the city center, or inside a suburban county of the MSA.

The dependent variable for this analysis was: consumption of at least 5 daily servings of fruits and vegetables. This was a calculated variable derived from survey participant responses to several questions asked by the interviewer administering the survey. In addition, a number of independent variables were included in the analysis. These were: sex, race and ethnicity, age, education, marital status, children in household, household income, body mass index (BMI), health insurance status, having a personal physician, timing of last routine medical check-up, deferment of medical care because of cost, self-defined health status, and physical activity. A number of these covariates were re-coded from their original formulation for use in this analysis. Table 1 summarizes the original survey questions and response categories with the re-coded response categories.

For all variables included in the analyses reported on here, the categories of refused or don't know or missing were re-coded as missing and not included in the data analysis. Age and number of children in the household were the only continuous variables re-coded as categorical ones. The variables education, marital status, household income, have a personal physician, timing of last routine medical check-up, and self-defined health status all had multiple categories that were collapsed into fewer categories for analysis. Race and ethnicity, BMI categories, and physical activity were all calculated variables derived from the responses to several survey questions.

Race and ethnicity was calculated from participant responses to two separate survey questions---one regarding race and the other regarding Latino/Hispanic ethnicity. Combining the responses to these two questions allowed for the derivation of the race and ethnicity variable used in these analyses. All race/ethnicity categories were computed as mutually exclusive entities. For example all respondents coded as Caucasian chose White as their racial classification, likewise black for African American, etc. If a respondent identified themselves as Hispanic, they were classified by that ethnic category regardless of any additional racial classification.

BMI was calculated from two survey questions, the first asking the respondents height in feet and inches and the second their weight in pounds. The BMI formula for imperial measurement ( $BMI = \text{weight in pounds} \times 703 / \text{height in inches}^2$ ) was then used to calculate BMI and code the resultant number into one of three categories: BMI less than 25 (neither overweight nor obese), BMI equal to or greater than 25 - less than 30 (overweight), and BMI equal to or greater than 30 (obese).

Level of physical activity was calculated by combining other variables assessing physical activity level by: 1) whether or not a person was getting recommended levels of moderate physical activity, and 2) whether or not a person was getting recommended levels of vigorous physical activity. People who reported getting recommended levels of either moderate or vigorous physical activity were coded as getting at least recommended levels of moderate physical activity. Recommended levels of moderate physical activity were defined as: moderate-intensity activities such as brisk walking for at least 30 minutes per day, at least five days a week.

Multivariate logistic regression was performed to characterize U.S. adults consuming at least five daily servings of combined fruits and vegetables. Two models were performed – one that included only rural adults, and one including only non-rural adults. Additionally, ArcView version 10.0 (ESRI, Redlands, CA) was used to map the percent differences by State between rural and non-rural adults consuming five or more daily servings of fruits and vegetables. For this calculation and mapping effort the percent of non-rural adults consuming at least five daily servings of fruits and vegetables by state was compared to the percent of their rural counterparts in the same state. Displayed on the map are both states where the percentage of rural adults consuming five or more daily servings of fruits and vegetables was either greater than or lesser than their non-rural counterparts doing the same.

For all statistical analyses, alpha was set at  $p < 0.05$ . Statistical Package for Social Scientists (SPSS, IBM, Chicago, IL) version 19.0 was used to complete all statistical analyses performed for this study. Human subject approval was sought and received from Essentia Health's IRB as well as the University of Illinois, College of Medicine at Rockford's IRB.

## **Results**

Bivariate analysis revealed that in comparison to U.S. non-rural adults U.S. rural adults were less likely to consume five or more servings of fruits and vegetables. Table 2 also displays additional comparative data for U.S. non-rural and rural adults regardless of daily consumption of fruits and vegetables. Most notably higher proportions of rural adults when compared to non-rural ones were: Caucasian, older ( $\geq$



65 years of age), heavier (BMI  $\geq$  30), less educated (college graduation), poorer (household income <\$35,000), married or living with a partner, and without health insurance. Further, a higher proportion of rural vs. non-rural adults: did not have children living at home, had not had a routine medical check-up in the past 12 months, and self-defined their health as fair to poor rather than good to excellent.

Table 3 displays the results of a comparative bivariate analysis of non-rural and rural U.S. adults consuming at least five servings of fruits and vegetables daily. This analysis revealed similar patterns of consumption for both non-rural and rural adults. For instance, a greater proportion of women from both populations consumed at least five servings of fruits and vegetables daily. Similarly, a greater proportion of both rural and non-rural adults who had at least moderate levels of physical activity, who were married or living with a partner, who had no children living at home, and who defined their health as good to excellent consumed at least five servings of fruits and vegetables daily. Of interest were the difference in the racial/ethnicity composition among adults consuming at least five daily servings of fruits and vegetables. Specifically, there was a 42.4% difference between the percentage of non-Caucasian rural adults (18.8%) and non-Caucasian non-rural adults (32.7%) consuming at least five daily servings of fruits and vegetables.

Table 4 displays the results of the two multivariate models. Consumption of at least 5 daily servings of fruits and vegetables was the dependent variable for both models. The first model included only rural adults and the second only non-rural ones. The logistic regression analysis revealed that rural adults whose daily consumption of fruits and vegetables included at least five servings were more likely to be: female

(OR=1.666; 95% CI 1.663, 1.669) rather than male; African American (OR=1.127; 95% CI 1.123, 1.131), Hispanic (OR=1.474; 95% CI 1.469, 1.479) or racially other (OR=1.251; 95% CI 1.246, 1.255) rather than Caucasian; married or living with a partner (OR=1.071; 95% CI 1.069, 1.073) rather than single; living in a household without children (OR=1.052; 95% CI 1.050, 1.054); living in a household whose annual income is at least \$35,000 (OR=1.111; 95% CI 1.108, 1.113) compared to an income than less than \$35,000; and getting at least moderate physical activity (OR=1.881; 95% CI 1.878, 1.885) rather than being inactive. Rural adults consuming five or more servings of vegetables daily were also more likely to have: a BMI of <25 (OR=1.126; 95% CI 1.124, 1.129) or a BMI of 25 to <30 (OR=1.066; 95% CI 1.064, 1.068) rather than  $\geq 30$ ; have a personal physician (OR=1.045; 95% CI 1.042, 1.047); have had a routine medical exam in the past 12 months (OR=1.224; 95% CI 1.222, 1.226); and self-define their health as good to excellent (OR=1.148; 95% CI 1.145, 1.151) rather than fair to poor. Rural adults consuming at least 5 daily servings of fruits and vegetables were also more likely to have deferred medical care because of cost.

Rural adults consuming at least 5 daily servings of fruits and vegetables were approximately 33% less likely to be younger (18-34 years or 35-64 years) than older (65 or older). They also were 35.3% to 47.3% less likely of being educated beyond high school (have less than a high school education or being a high school graduate) than being a college graduate. With only slight variations in degree or magnitude of the odds ratios these patterns were the same for non-rural adults.

Table 5 displays the percentage of rural and non-rural adults consuming 5 or more daily servings of fruits and vegetables by State. Also displayed in Table 5 are the

standardized percent differences between the proportion of rural and non-rural adults consuming 5 or more daily servings of fruits and vegetables. The proportions for rural adults ranged from a low of 13.88% in Oklahoma to a high of 28.74 % in Vermont. For non-rural adults the proportions ranged from a low of 14.44% in Oklahoma to a high of 28.27% in Maine.

The percent differences are presented in Figure 1 according to states with either smaller or larger proportions of the rural adult population consuming 5 or more daily servings of fruits and vegetables in comparison to their non-rural counterparts. When comparing the standardized percent differences between the two populations (rural and non-rural) 37 States had smaller proportions of rural adults consuming 5 or more daily servings of fruits and vegetables and 11 States a higher proportion of rural adults consuming 5 or more daily servings of fruits and vegetables. In two States (New Jersey and Rhode Island) no data on the fruit and vegetable consumption of rural adults was available.

Of the 11 states where a higher proportion of rural adults consumed at least 5 daily servings of fruits and vegetables when compared to the non-rural adult population, only one State, Hawaii, was ranked in the top 10 states for fruit and vegetable production. An additional state, Arizona, ranked in the top 20 of fruit and vegetable producing States.

## **Discussion**

Chronic disease accounts for about 75% of the health care costs in the United States and several studies document the benefits of a healthy diet for weight control,

and the prevention of illnesses such as diabetes, cardiovascular disease and certain types of cancer. [3-6, 30] Consuming at least five daily servings of fruits and vegetables are considered an essential part of an overall healthy balanced diet. Our study found that regardless of residency (rural or non-rural) less than 1 in 4 U.S. adults consume five or more servings of fruits and vegetables, a result similar to previous findings [31] and a proportion that falls dramatically short of the recommended targets set by HP 2010. Our results also revealed that compared to non-rural adults, a smaller proportion of rural adults reported consuming recommended amounts of combined fruits and vegetables. The findings reported here underscore the continued need for developing targeted interventions that effectively encourage healthier dietary choices.

While it may be ironic that rural adults, who live where fruits and vegetables grow, were less likely to consume the recommended number of daily servings it is not necessarily unexpected. Although rural communities produce fruits and vegetables, they typically have fewer stores that offer a wide selection of healthy lower-cost food selections than non-rural communities. [32] The importance of community environment as a contributor for individuals adopting a healthy lifestyle, including diet, is increasingly being recognized. [33] Since approximately 20% of the US population lives in rural settings [34] improving access to healthy food for rural residents could yield significant health benefits. In addition to environmental access issues, rural residents are typically poorer than their non-rural counterparts and affordability is likely an important contributing factor to fewer rural residents consuming recommended amounts of fruits and vegetables. Our results indicate that a higher proportion of rural residents earning less than \$35,000 did not consume five servings of fruits and vegetables when

compared to their non-rural counterparts. Food costs correlate to store type and food tends to be less expensive in larger supermarkets than smaller markets or convenience stores. These higher priced food outlets may be the only local and convenient food source for some rural communities. In addition to a convenience factor, transportation costs may be a barrier to purchasing less expensive healthier food that might be available in a nearby community.

Our findings also reveal several differences in the consumption of fruits and vegetables by characteristics such as gender, age, education, race/ethnicity, physical activity and reported health status. Similar to other studies, [18-25] this study found that women and those with more education were more likely to consume the recommended number of daily servings of fruits and vegetables. Likewise rural adults over age 65 were more likely to eat at least five servings of fruits and vegetables daily. Data regarding race and ethnicity from previous studies are mixed. In some studies, Caucasians consumed more fruits and vegetables than African Americans while other studies using national data demonstrated the converse. [35-38] Our study found that Caucasians were less likely to consume five servings of fruits and vegetables and that the difference was greater for Caucasians living in rural settings, even though they tended to be better educated and have higher income levels than rural non-Caucasians. The reasons for this difference are not clear and further study to confirm this finding and to understand the reasons why may be helpful in tailoring interventions to improve dietary choices among rural residents. Those engaging in regular physical activity and with a lower BMI were also more likely to consume five servings of fruits and vegetables. While physical activity and weight does not directly affect diet choices, our

findings add to the body of knowledge that unhealthy lifestyles choices tend to coexist or cluster among individuals. [35]

Finally, of interest is the distribution of fruit and vegetable consumption by rural and non-rural adults by state. This distribution indicated that in only 11 states did a higher proportion of rural adults consume five or more daily servings of fruits and vegetables than non-rural adults. The reason for this distribution is unclear especially since of those 11 states only one, Hawaii, ranked as a top ten U.S. State for fruit and vegetable production. This finding does suggest the need for further investigation--- specifically, are there differences between the rural populations in the states where adults are consuming five or more daily servings of fruits and vegetables and those states where such is not occurring? This might provide insight into the role that community environment plays in diets and for what strategies for improving diets might be best suited to a rural settings

Several potential limitations to this study should be noted. First, the survey is based on telephone derived data and may be skewed because those who could not be reached by phone could not participate in the survey. For example, persons of lower socioeconomic status may have been excluded because of poorer phone access. However, the fact that the vast majority of US residents live in households with telephones minimizes this bias. Furthermore, U.S. cell phone numbers are now included in the pool of phones contacted for the survey. In addition, study strength is the use of a large multi-state database that includes a robust sample of rural residents weighted to reflect the demographics of rural vs. non-rural US populations.

A second limitation is that the survey used close-ended questions, which limit a responder's options to fully explain response choices. However, while a different question format may have yielded different results, the survey questions were worded so that the answer choices covered a wide range of response possibilities. A third and related limitation is that the answers are self-reported, which introduces the possibility of recall bias on the part of the survey participants.

Fourthly, the question asking respondents about the number of servings of vegetables is somewhat ambiguous and may have led to an under-reporting of the number of servings of vegetables consumed. For instance no refined measure consumption was included hence eating vegetables at both lunch and dinner may in actuality constitute more than 2 servings depending upon the amount of vegetables consumed. Furthermore, the questions did not include vegetable prepared in meals such as stews or soups.

A fifth potential bias resulted from the languages of the survey – English and Spanish. Individuals who did not speak English or Spanish were excluded from this survey. Not all U.S. residents speak the two languages of this survey as a result those adults from other cultures who do not speak either English or Spanish and who have vegetable rich (e.g., Chinese) or fruit and vegetable rich (e.g., Mediterranean) diets may have been excluded and as a result the aggregated data on the consumption of fruits and vegetables may not be representative of actual consumption by all adults who are residing in the United States.

## **Conclusion**

In conclusion, most Americans do not eat the recommended amounts of fruits and vegetables. However, rural residents appear at greater risk for not making healthy dietary choices. In addition to rural populations---men, younger individuals and those with less education and those living in poorer income households---are at even greater risk. Successfully improving the dietary patterns of Americans will need to incorporate the environmental context in which people live and the results of this study. These findings should be helpful for public health practitioners interested in developing interventions aimed at improving the diets and health of Americans.



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rural adults' fruit and vegetable consumption

<b>Table 1. Original Survey Question and Response Categories with Re-Coded Response Categories 2009 BRFSS Data</b>				
<b>Analysis Variable</b>	<b>Survey Question</b>	<b>Original Response Categories</b>		<b>Re-coded Response Categories</b>
<b>Fruit and Vegetable Consumption</b>	Not counting juice, how often do you eat fruit?	Calculated variable for consumed five or more servings of fruits or vegetables per day derived from the servings per day variables.	Respondents that reported they never consumed fruits and vegetables or consumed less than 5 servings per day	less than 5 servings per day
	How often do you eat green salad?		Respondents that reported they consumed 5 or more servings of fruits and vegetables per day	5 or more servings of fruits and vegetables per day
	Not counting carrots, potatoes, or salad, how many servings of vegetables do you usually eat? (Example: A serving of vegetables at both lunch and dinner would be two servings.)		Respondents who reported they didn't know the servings consumed per day, those who refused to answer, and those with missing responses	Missing
<b>Sex</b>	Indicate sex of respondent.	Male		Male
		Female		Female
<b>Race and Ethnicity</b>	Which one of these groups would you say best represents your race?	Race responses were combined with Hispanic variable to create the second column categories		
		White	White, non-Hispanic	Caucasian
		Black or African American	Black non-Hispanic	African American
		Asian	Asian non-Hispanic	Other/multiracial
		Native Hawaiian or Other Pacific Islander	Native Hawaiian or Other Pacific Islander non-Hispanic	
		American Indian, Alaska Native	American Indian, Alaska Native non-Hispanic	
		Other	Other non-Hispanic	
		Multiracial but preferred race not asked	Multiracial non-Hispanic	
		Don't know/Not sure, Refused	Don't know/Not sure, Refused	Missing
	Are you Hispanic or Latino?	Yes	Hispanic	Hispanic
No		Non-Hispanic		
Don't know/Not Sure, Refused		Don't know/Not Sure, Refused	Missing	

rural adults' fruit and vegetable consumption

Table 1. Original Survey Question and Response Categories with Re-Coded Response Categories 2009 BRFSS Data				
Analysis Variable	Survey Question	Original Response Categories		Re-coded Response Categories
<b>Age Range</b>	What is your age?	__ age in years		18-34 Years
				35-64 Years
				>=65 Years
<b>Education</b>	What is the highest grade or year of school you completed?	Never attended school or only kindergarten		<High School
		Grades 1 through 8 (Elementary)		
		Grades 9 through 11 (Some high school)		
		Grade 12 or GED (High school graduate)		Completed High School
		College 1 year to 3 years (Some college or technical school)		
		College 4 years or more (College graduate)		College Graduate
Refused, Not asked or Missing		Missing		
<b>Marital Status</b>	Are you: (marital status)	Married		Married or Living with Partner
		A member of an unmarried couple		
		Divorced		Unmarried and Not Living With a Partner
		Widowed		
		Separated		
		Never married		Missing
Refused, Not asked or Missing				
<b>Children in Household</b>	How many children less than 18 years of age live in your household?	Number of children: __ = Number of children		At Least One Child
		None		No Children
		Refused or Missing		Missing
<b>Household Income</b>	Is your annual household income from all sources:	Less than \$10,000		< \$35,000
		Less than \$15,000 (\$10,000 to less than \$15,000)		
		Less than \$20,000 (\$15,000 to less than \$20,000)		
		Less than \$25,000 (\$20,000 to less than \$25,000)		
		Less than \$35,000 (\$25,000 to less than \$35,000)		
		Less than \$50,000 (\$35,000 to less than \$50,000)		> \$35,000
		Less than \$75,000 (\$50,000 to less than \$75,000)		
		\$75,000 or more		
		Don't know/Not sure, Refused and Not asked or Missing		Missing
<b>BMI Categories</b>	About how much do you weigh without shoes?	BMI calculated using weight and height variables		
		__ = weight in pounds	BMI calculated using imperial scale:  (weight X 703)/ height in inches <sup>2</sup>	BMI <25



rural adults' fruit and vegetable consumption

Table 1. Original Survey Question and Response Categories with Re-Coded Response Categories 2009 BRFSS Data					
Analysis Variable	Survey Question	Original Response Categories		Re-coded Response Categories	
	About how tall are you without shoes?	_ / _ _ = height in feet / inches		BMI 25-<30	
				BMI >=30	
		Don't know/Not sure, Refused, Not asked or Missing	Don't know/Not sure, Refused, Not asked or Missing	Missing	
<b>Physical Activity</b>	Now, thinking about the moderate activities you do in a usual week, do you do moderate activities for at least 10 minutes at a time, such as brisk walking, bicycling, vacuuming, gardening, or anything else that causes some increase in breathing or heart rate?	Calculated variable for adults that have reported participating in either moderate physical activity defined as 30 or more minutes per day for 5 or more days per week, or vigorous activity for 20 or more minutes per day on 3 or more days.	Respondents who reported doing enough moderate or vigorous physical activity to meet the recommendations	Getting at least moderate physical activity	
	How many days per week do you do these moderate activities for at least 10 minutes at a time?				
	On days when you do moderate activities for at least 10 minutes at a time, how much total time per day do you spend doing these activities?			Respondents who reported doing insufficient moderate or vigorous physical activity to meet recommendations, or respondents that reported doing no moderate or vigorous physical activity	Inactive
	Now, thinking about the vigorous activities you do in a usual week, do you do vigorous activities for at least 10 minutes at a time, such as running, aerobics, heavy yard work, or anything else that causes large increases in breathing or heart rate?			Respondents who reported they didn't know whether they did moderate or vigorous physical activity or didn't know how many days or didn't know how much time they did the activity, those who refused to	Missing

rural adults' fruit and vegetable consumption

<b>Table 1. Original Survey Question and Response Categories with Re-Coded Response Categories 2009 BRFSS Data</b>				
<b>Analysis Variable</b>	<b>Survey Question</b>	<b>Original Response Categories</b>		<b>Re-coded Response Categories</b>
	How many days per week do you do these vigorous activities for at least 10 minutes at a time? On days when you do vigorous activities for at least 10 minutes at a time, how much total time per day do you spend doing these activities?		answer, and those with missing responses	
<b>Have Health Insurance</b>	Do you have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicare?	Yes		Yes
		No		No
		Don't know/Not Sure, Refused		Missing
<b>Have a Personal Physician</b>	Do you have one person you think of as your personal doctor or health care provider? (If "No" ask "Is there more than one or is there no person who you think of as your personal doctor or health care provider?")	Yes, only one		Yes
		More than one		
		No		No
		Don't know/Not Sure, Refused, Not asked or Missing		Missing
<b>Timing of Last Routine Medical Check-up</b>	About how long has it been since you last visited a doctor for a routine checkup? A routine checkup is a general physical exam, not an exam for a specific injury, illness, or condition.	Within past year (anytime less than 12 months ago)		Within the Past 12 Months
		Within past 2 years (1 year but less than 2 years ago)		More than 12 Months Ago
		Within past 5 years (2 years but less than 5 years ago)		
		5 or more years ago		
		Never		
		Don't know/Not sure or Refused		Missing
<b>Deferment of Medical Care Because of Cost</b>	Was there a time in the past 12 months when you needed to see a doctor but could not because of cost?	Yes		Yes
		No		No
		Don't know/Not sure, Refused		Missing
<b>Self-Defined Health Status</b>	Would you say that in general your health is:	Excellent		Good to Excellent
		Very good		
		Good		
		Fair		Fair to Poor
		Poor		

rural adults' fruit and vegetable consumption

<b>Table 1. Original Survey Question and Response Categories with Re-Coded Response Categories 2009 BRFSS Data</b>			
<b>Analysis Variable</b>	<b>Survey Question</b>	<b>Original Response Categories</b>	<b>Re-coded Response Categories</b>
		Don't know/Not Sure, Refused, Not asked or Missing	Missing
<b>Residency by Geographic Locale</b>	Metropolitan Status Code	In the center city of an MSA	Non-rural
		Outside the center city of an MSA but inside the county containing the center city	
		Inside a suburban county of the MSA	
		In an MSA that has no center city	Rural
		Not in an MSA	

rural adults' fruit and vegetable consumption

<b>Variables and Factors</b>		<b>% Rural*</b> (weighted n=42,365,517)	<b>% Non-rural*</b> (weighted n=177,114,306)
<b>Fruit and Vegetable Consumption</b>	<5 Servings Daily	78.8	75.6
	At Least 5 Servings Daily	21.2	24.4
<b>Sex</b>	Male	48.2	48.8
	Female	51.8	51.2
<b>Race And Ethnicity</b>	Caucasian	81.3	65.6
	African American	6.2	10.9
	Hispanic	6.6	15.2
	Other	5.8	8.2
<b>Age Ranges</b>	18-34 Years	28.4	30.4
	35-64 Years	51.8	53.0
	>=65 Years	19.8	16.6
<b>Education</b>	<High School	11.8	10.4
	Completed High School	63.5	52.7
	College Graduate	24.6	36.9
<b>Marital Status</b>	Married Or Living With Partner	66.4	63.9
	Unmarried/Not Living With A Partner	33.6	36.1
<b>Children In Household</b>	No Children In Household	60.0	56.0
	At Least 1 Child In Household	40.0	44.0
<b>Household Income</b>	<\$35,000	43.6	35.1
	>=\$35,000	56.4	64.9
<b>BMI Categories</b>	BMI<25	32.8	37.2
	BMI 25-<30	36.6	36.2
	BMI >=30	30.6	26.6
<b>Physical Activity</b>	Getting At Least Moderate Physical Activity	48.9	49.7
	Inactive	51.1	50.3
<b>Have Health Insurance</b>	Yes	83.0	85.0
	No	17.0	15.0
<b>Have A Personal Physician</b>	Yes	81.9	80.5
	No	18.1	19.5
<b>Timing Of Last Routine Medical Checkup</b>	Within Last 12 Months	65.8	68.2
	Longer Than 12 Months Ago	34.2	31.8
<b>Deferment Of Medical Care Because Of Cost</b>	Deferred Medical Care Because Of Cost	15.5	14.7
	Did Not Defer Medical Care Because Of Cost	84.5	85.3
<b>Self Defined Health Status</b>	Good To Excellent	81.7	84.7
	Fair To Poor	18.3	15.3

\*Cell percentages by row significantly different by z-test measure p< .05

rural adults' fruit and vegetable consumption

**Table 3. Bivariate Predictor Variables for of U.S. Rural Adults Consuming at Least 5 Fruits and Vegetables Daily by Geographic Locale (Non-rural or Rural) 2009 BRFSS (weighted n=52,259,789)**

Variables and Factors		% Rural* (weighted n=8,983,840)	% Non-rural * (weighted n=43,275,949)
<b>Sex</b>	Male	38.8	39.9
	Female	61.2	60.1
<b>Race And Ethnicity</b>	Caucasian	81.3	67.3
	African American	5.3	10.3
	Hispanic	6.9	13.3
	Other	6.6	9.1
<b>Age Ranges</b>	18-34 Years	26.9	28.3
	35-64 Years	49.4	52.7
	>=65 Years	23.7	19.0
<b>Education</b>	<High School	8.6	8.3
	Completed High School	58.2	47.0
	College Graduate	33.3	44.7
<b>Marital Status</b>	Married Or Living With Partner	68.8	65.6
	Unmarried/ Not Living With A Partner	31.2	34.4
<b>Children In Household</b>	No Children In Household	61.2	57.3
	At Least 1 Child In Household	38.8	42.7
<b>Household Income</b>	<\$35,000	38.6	31.4
	>=\$35,000	61.4	68.6
<b>BMI Categories</b>	BMI<25	36.8	42.0
	BMI 25-<30	35.9	35.0
	BMI >=30	27.3	23.0
<b>Physical Activity</b>	Getting At Least Moderate Physical Activity	60.9	61.0
	Inactive	39.1	39.0
<b>Have Health Insurance</b>	Yes	85.8	87.5
	No	14.2	12.5
<b>Have A Personal Physician</b>	Yes	85.0	83.8
	No	15.0	16.2
<b>Timing Of Last Routine Medical Checkup</b>	Within Last 12 Months	70.7	73.2
	Longer Than 12 Months Ago	29.3	26.8
<b>Deferment Of Medical Care Because Of Cost</b>	Deferred Medical Care Because Of Cost	14.3	13.4
	Did Not Defer Medical Care Because Of Cost	85.7	86.6
<b>Self Defined Health Status</b>	Good To Excellent	84.9	87.0
	Fair To Poor	15.1	13.0

\*Cell percentages by row significantly different by z-test measure p< .05

rural adults' fruit and vegetable consumption

**Table 4. Characteristics of U.S. Rural Adults Consuming at Least 5 Fruits and Vegetables Daily 2009 BRFSS**

Predictor Variables and Factors		Rural Adults Adjusted Odds Ratio (95% CI)	Non-rural Adults Adjusted Odds Ratio (95% CI)
<b>Sex</b>	Male	--***	--***
	Female	1.666 (1.663, 1.669)	1.632 (1.631, 1.633)
<b>Race And Ethnicity</b>	Caucasian	--***	--***
	African American	1.127 (1.123, 1.131)	1.056 (1.054, 1.057)
	Hispanic	1.474 (1.469, 1.479)	1.086 (1.085, 1.087)
	Other	1.251 (1.246, 1.255)	1.276 (1.275, 1.278)
<b>Age Ranges</b>	18-34 Years	.673 (.671, .675)	.740 (.739, .741)
	35-64 Years	.675 (.673, .676)	.769 (.768, .770)
	>=65 Years	--***	--***
<b>Education</b>	<High School	.527 (.525, .529)	.722 (.721, .723)
	Completed High School	.647 (.646, .648)	.707 (.707, .708)
	College Graduate	--***	--***
<b>Marital Status</b>	Married Or Living With Partner	1.071 (1.069, 1.073)	1.039(1.038, 1.040)
	Unmarried /Not Living With A Partner	--***	--***
<b>Children In Household</b>	No Children In Household	1.052 (1.050, 1.054)	1.038 (1.037, 1.039)
	At Least 1 Child In Household	--***	--***
<b>Household Income</b>	<\$35,000	--***	--***
	>=\$35,000	1.111 (1.108, 1.113)	1.044 (1.042, 1.045)
<b>BMI Categories</b>	BMI<25	1.126 (1.124, 1.129)	1.201 (1.200, 1.202)
	BMI 25-<30	1.066 (1.064, 1.068)	1.096 (1.095, 1.098)
	BMI >=30	--***	--***
<b>Physical Activity</b>	Getting At Least Moderate Physical Activity	1.881 (1.878, 1.885)	1.884 (1.883, 1.886)
	Inactive	--***	--***
<b>Have Health Insurance</b>	Yes	.962 (.959, .964)	.950 (.949, .951)
	No	--***	--***
<b>Have A Personal Physician</b>	Yes	1.045 (1.042, 1.047)	1.022 (1.020, 1.023)
	No	--***	--***
<b>Timing Of Last Routine Medical Checkup</b>	Within Last 12 Months	1.224 (1.222, 1.226)	1.254 (1.253, 1.255)
	Longer Than 12 Months Ago	--***	--***
<b>Deferment Of Medical Care Because Of Cost</b>	Deferred Medical Care Because Of Cost	--***	--***
	Did Not Defer Medical Care Because Of Cost	.897 (.895, .899)	.951 (.949, .952)
<b>Self Defined Health Status</b>	Good To Excellent	1.148 (1.145, 1.151)	1.030 (1.029, 1.032)
	Fair To Poor	--***	--***

--\*\*\* reference group

rural adults' fruit and vegetable consumption

<b>Table 5. Percentage of Rural and Non-Rural Adults Consuming 5 or More Daily Servings of Fruits and Vegetables</b>				
<b>2009 BRFSS Data and 2007 USDA Census Data</b>				
<b>State</b>	<b>% Rural Adults</b>	<b>%Non-Rural Adults</b>	<b>% Difference Between Rural and Non-Rural Adults</b>	<b>National Ranking for Fruit and Vegetable Production*</b>
Alabama	17.01	20.63	-21.27	17
Alaska	19.79	23.76	-20.04	48
Arizona	25.39	23.13	8.90	12
Arkansas	19.01	19.74	-3.87	35
California	22.90	24.28	-6.01	1
Colorado	21.84	22.58	-3.37	26
Connecticut	25.76	27.57	-7.00	37
Delaware	23.45	22.75	2.96	46
Florida	21.64	23.32	-7.77	11
Georgia	21.94	23.58	-7.50	19
Hawaii	25.79	21.40	17.05	7
Idaho	21.55	25.03	-16.19	34
Illinois	22.63	21.65	4.34	24
Indiana	17.17	20.34	-18.42	25
Iowa	17.82	17.96	-0.78	29
Kansas	17.24	18.48	-7.20	41
Kentucky	17.30	21.96	-26.91	14
Louisiana	14.48	17.25	-19.16	38
Maine	25.93	28.27	-9.04	33
Maryland	21.24	26.99	-27.05	32
Massachusetts	19.66	24.27	-23.47	27
Michigan	21.39	22.05	-3.06	5
Minnesota	19.53	22.70	-16.25	22
Mississippi	14.26	19.02	-33.36	28
Missouri	18.14	18.80	-3.64	23
Montana	24.35	25.88	-6.28	40
Nebraska	21.23	19.45	8.35	43
Nevada	23.19	22.48	3.03	49
New Hampshire	28.45	24.71	13.17	42
New Jersey	N/A	24.83	N/A	20
New Mexico	21.34	22.59	-5.86	15
New York	24.50	25.65	-4.69	4
North Carolina	17.34	21.04	-21.37	6
North Dakota	21.75	21.68	0.30	47
Ohio	18.26	20.94	-14.67	9
Oklahoma	13.88	14.44	-4.07	31
Oregon	23.62	25.41	-7.59	8
Pennsylvania	20.34	24.01	-18.04	3
Rhode Island	N/A	25.53	N/A	44
South Carolina	15.33	17.31	-12.88	21
South Dakota	15.71	14.29	9.04	45

rural adults' fruit and vegetable consumption

<b>Table 5. Percentage of Rural and Non-Rural Adults Consuming 5 or More Daily Servings of Fruits and Vegetables</b>				
<b>2009 BRFSS Data and 2007 USDA Census Data</b>				
<b>State</b>	<b>% Rural Adults</b>	<b>%Non-Rural Adults</b>	<b>% Difference Between Rural and Non-Rural Adults</b>	<b>National Ranking for Fruit and Vegetable Production*</b>
Tennessee	19.73	23.26	-17.90	18
Texas	22.70	22.75	-0.22	10
Utah	19.10	23.25	-21.73	30
Vermont	28.74	27.81	3.26	39
Virginia	22.60	26.89	-19.00	16
Washington	22.60	24.90	-10.17	2
West Virginia	15.90	16.18	-1.81	36
Wisconsin	20.04	21.95	-9.53	13
Wyoming	23.14	21.25	8.20	50
U.S.	20.38	23.07	-13.19	
* USDA Census 2007 Data on Number of Farms and Acreage Dedicated to Fruit and Vegetable Production by State were used to compute ranking				



**Figure 1. States With Either Smaller Or Larger Proportions Of The Rural Adult Population Consuming 5 Or More Daily Servings Of Fruits And Vegetables In Comparison To Non-Rural Counterparts  
2009 BRFSS Data**

