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The relationship between rural status, individual characteristics, and self-rated health in the Behavioral Risk Factor Surveillance System

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Abstract

Purpose—To examine rural status and social factors as predictors of self-rated health in community-dwelling adults in the United States.

Methods—This study uses multinomial logistic and cumulative logistic models to evaluate the associations of interest in the 2006 US Behavioral Risk Factor Surveillance System, a cross-sectional survey of 347,790 non-institutionalized adults.

Findings—Self-rated health was poorer among rural residents, compared to urban residents (OR = 1.77, 95% CI: 1.54, 1.90). However, underlying risk factors such as obesity, low income, and low educational attainment were found to vary by rural status and account for the observed increased risk (OR = 1.03, 95% CI: 0.94, 1.12). There was little evidence of effect modification by rural status, though the association between obesity and self-rated health was stronger among urban residents (OR = 2.50, 95% CI: 2.38, 2.64) than among rural residents (OR = 2.18, 95% CI: 2.03, 2.34).

Conclusions—Our findings suggest that differences in self-rated health by rural status were attributable to differential distributions of participant characteristics and not due to differential effects of those characteristics.

Keywords

epidemiology; health disparities; obesity; self-rated health; social determinants of health

More than 90% of the landmass of the United States (US) comprises rural areas; however, less than one-fourth of the US population resides in these areas with estimates varying according to the definition of rural.^{1–5} Most often, the definition of rural varies by scale, such as census tract, metropolitan area, or county. For example, the US Department of

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Agriculture's Economic Research Service identified that 17% of the US population (approximately 49 million individuals) lived in "nonmetropolitan counties" in 2000, whereas the 2000 US Census estimated that 21% of the population (approximately 58 million individuals) lived "outside a metropolitan area."^{3,5} Using the same data, the 2000 US Census found that the proportion was similar (approximately 59 million individuals) when rural was defined as "outside an urban area;" however, these criteria captured different segments of the population, as illustrated by the fact that the estimate dropped to 12% (approximately 33 million individuals) when rural was defined as both "outside a metropolitan area" and "outside an urban area."² Definitions can also be based on urbanization or land use, administrative or economic considerations, distance from a metropolitan area, or population density.⁴ The differentiation between urban and rural status has been theorized to be important for public health and health interventions due to differential access to amenities and disamenities that may influence health. The concept of an *urban health advantage* centers on the idea that city dwelling benefits health, possibly due to socioeconomic heterogeneity, greater opportunities for social support and cohesion, exposure to varied economic development, frequent contact with health-promoting built environments, and other characteristics of urban areas.⁶ In contrast, the literature on *urban health penalty* suggests that living in urban areas harms health through exposure to concentrations of crime, pollution, poverty, poor housing, inadequate medical care, infectious disease, and other conditions.^{7,8}

Research studies evaluating the implications of rural status often highlight a specific outcome that is either more or less prevalent in urban areas and assesses the environmental features associated with the outcome.^{9,10} Conceptualizing rural as simply the opposite of urban, however, may ignore attributes or influences that are unique to the rural environment. Such characteristics are hypothesized to include exposure to agricultural, forestry, or mining methods, reduced water quality, landscape-induced isolation, access to resources, and aggregation of disadvantage.^{11,12}

Accordingly, rural areas have a higher prevalence of many social, behavioral, and environmental factors that may affect health risk. For example, a higher percentage of both male and female rural residents smoke tobacco products, compared to urban residents.¹³ Residents experience higher levels of poverty and unemployment in rural areas than in urban areas.^{14,15} In rural areas, the population is more likely to be older in age, to suffer from activity limitations due to chronic morbidities, and to be uninsured.¹³ Most rural counties are health professional shortage areas.¹² As a result, individuals living in rural areas have more problems accessing health care, including assisted living facilities, dental professionals, mental health professionals, primary care physicians, and specialists other than family medicine practitioners, compared to those living in urban areas.^{13,16–18} Such differential access to care may be due to the cost or distance of travel to health care and often results in an impaired ability to attain both preventive services and timely health care.^{19–21}

Co-morbidities such as non-fatal injuries, depression, and obesity are a few of the potential effects of this geographic health disparity.^{22,23} In particular, rural areas have a higher prevalence of obesity.¹³ Rural living has also been associated with higher rates and higher odds of obesity.^{24,25} The prevalence of overweight and obesity in the US has been growing in all areas during recent decades.^{26–29} This rapid growth has been labeled as an "obesity epidemic."³⁰ The obesity epidemic has continued, despite interventions such as Healthy People 2010, which included a goal of reducing adult obesity to 15% by 2010; however, in 2010, adult obesity was estimated at approximately 27.5%.³¹ Similar to other factors that could result from rural-urban disparities, obesity has been associated with a number of co-morbidities, such as hypertension, coronary heart disease, and cardiovascular disease;

stroke; sleep apnea and respiratory problems; Type 2 diabetes; and breast, endometrial, prostate, and colon cancers.³² Not only do obesity and other factors increase the national disease burden, but these characteristics and the resultant morbidity increase economic burdens on individuals, workplaces, and governments.³³

Previous studies have typically investigated the extent to which these social factors vary by urban or rural status or the extent to which such social factors are associated with adverse health effects. Accordingly, our goal was to identify the characteristics that may account for differences in health by rural status and to determine whether the relationship between social factors and health is modified by rural status.

METHODS

Study Population

The Behavioral Risk Factor Surveillance System (BRFSS) includes data collected from annual, nationally representative telephone surveys that are administered to non-institutionalized adults over the age of 18 years in each US state, the District of Columbia, the Commonwealth of Puerto Rico, the US Virgin Islands, and Guam using random-digit dialing and structured interviews.^{34–36} Participants are sampled based on a complex survey design, involving multi-stage clusters.³⁵ The survey data include weights to allow the annual sample population to represent the national distribution of age, sex, and race/ethnicity.³⁷ The present study utilized data from the 2006 iteration of the BFRSS, which are publicly available.³⁸

Rural Status

Rural status was coded as a dichotomous variable using the BRFSS data for metropolitan statistical code, which is based on metropolitan statistical areas (MSAs). An MSA is defined by the US Office of Management and Budget as a metropolitan area that is distinct from another metropolitan area.³⁹ The MSA categories included: in the center city of an MSA; 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; and not in an MSA. Preliminary analyses indicated that no statistically significant difference existed between MSAs with respect to self-rated health or obesity, except for the category of “not in an MSA.” Therefore, rural status included the category of “not in an MSA” (which is analogous to outside a metropolitan area), while the remaining categories comprised urban status.

Self-Rated Health

The variable “self-rated health” was selected to measure health because it has been shown to provide a valid measure of health status, performing as an independent predictor of morbidity and mortality.^{40–42} For example, a study of adults in the United Kingdom found that self-rated health was strongly associated with specific outcomes such as cancer and diabetes.⁴³ Over 10 years of follow-up, decreased self-rated health was associated with increased odds of numerous conditions, including asthma and other respiratory symptoms.⁴³ Self-rated health was categorized using 5 levels: excellent, very good, good, fair, and poor.

Statistical Analyses

The data were cleaned and analyzed using Stata/SE 11.0 (StataCorp LP, College Station, Texas) and SAS 9.1 (SAS Institute Inc., Cary, North Carolina). For each variable, non-responses that included unasked questions, refusal to answer, and unknown/unsure were coded as missing data. We modeled the 5-level outcome of self-rated health using 2 approaches. The first, a multinomial logistic model, models the log of the odds for each of

the 5 categories of self-rated health. The reported odds ratios (ORs) compare the odds of 1 of the 4 categories (“very good,” “good,” “fair,” “poor”) versus the baseline/reference category (“excellent”) for the covariate specified. Second, we used the cumulative logistic model, a method of ordered logistic regression, which reports a single odds ratio that describes the odds of increasing by 1 category of the outcome for a 1-unit change in the covariate.⁴⁴ The cumulative regression model takes into account the order of the outcome categories such that the effects of an independent variable would be compounded if comparing across non-adjacent categories of self-rated health, such as poor versus very good. We report 95% confidence intervals (CIs) for all of the ORs reported. The analyses accounted for the complex survey design by adjusting the data by primary sampling unit (PSU), strata, and final sampling weight. Multivariate analyses controlled for a number of demographic, health-related, and socioeconomic factors. Demographic characteristics included age, sex, race/ethnicity, and marital status; health-related variables included body mass index, physical activity, smoking status, and alcohol consumption; and socioeconomic factors included educational attainment, household income, and health care coverage. In the BRFSS data set, body mass index (BMI) was calculated and categorized as neither overweight nor obese, overweight, or obese. Physical activity and alcohol consumption were categorized as dichotomous yes/no variables in the BRFSS, with the physical activity variable measuring participation in “physical activity or exercise during the past 30 days other than [a] regular job” and alcohol consumption measuring consumption of “at least one drink of any alcoholic beverage such as beer, wine, a malt beverage or liquor” within the past 30 days.³⁸ Three income equivalence scales were evaluated as surrogates for household income. The income variable provided in the BRFSS data set characterized income better than the Organization for Economic Co-operation and Development (OECD) equivalence scale, OECD modified scale, and square root equivalence scale.⁴⁵ Subpopulation data sets were created for urban and rural respondents in which PSUs with 0 or 1 observations were removed from the data set due to the clustered sampling in the complex survey design. PSUs with 0 or 1 respondent cannot contain inter-cluster variability, which prevents adjustment for the non-random sampling. Stratified analyses were undertaken to compare the relationship between social factors and self-rated health in urban and rural environments.

RESULTS

The study population included the 347,790 respondents and approximately one-third of respondents (113,033) lived in rural areas, while approximately two-thirds of respondents were urban dwellers (234,757). Rural and urban areas did not have disparate distributions of sex in the respective populations. As shown in Table 1, rural respondents were more likely than urban respondents to be older, white, non-Hispanic, and a member of a couple (married or unmarried). Survey participants who lived in rural areas were also more likely than urban respondents to report poor self-rated health, less likely to engage in physical activity, and more likely to be categorized as overweight or obese. Specifically, 18.8% of individuals in rural areas had fair or poor health, compared to 15.6% of individuals in urban areas, and 72.9% of rural dwellers engaged in physical activity, compared to 75.4% of urban dwellers. Approximately 29% of rural residents were obese, whereas 24% of urban residents were obese. Overall, rural residents tended to have lower socioeconomic status than urban residents (Table 1).

In univariate analyses, rural residents experienced higher odds of poor self-rated health than urban residents (OR = 1.77, 95% CI: 1.54, 1.90) with excellent health as the reference category. Obese respondents had high odds of poor self-rated health (OR = 5.71, 95% CI: 5.18, 6.28), compared to respondents who were neither overweight nor obese. Individuals who did not engage in physical activity were also more likely to report poor self-rated health than participants who were physically active (OR = 8.84, 95% CI: 8.11, 9.65). Males were

less likely to report poor self-rated health than females (OR = 0.78, 95% CI: 0.72, 0.84). The groups with the highest likelihood of reporting poor self-rated health included adults over the age of 65 years and individuals who identified their racial category as “Other or Multiracial.” Socioeconomic variables were also associated with poor self-rated health. Respondents who did not graduate high school experienced a 21.36 odds (95% CI: 18.69, 24.40) of poor self-rated health compared to college graduates, while individuals who earned less than \$15,000 annually experienced a crude odds of 34.22 (95% CI: 28.80, 40.65) compared to those who earned more than \$50,000.

Table 2 presents the multivariate analysis evaluating predictors of self-rated health. Once adjusted for covariates, the association between rural status and poor self-rated health decreases to 1.03 (95% CI: 0.94, 1.12). In general, the relationship between other covariates and self-rated health remained consistent in multivariate models and some factors, such as age, race/ethnicity, marital status, smoking status, alcohol consumption, and health care coverage, did not have an effect on the association between rural status and self-rated health. Participants who were obese experienced an odds ratio of 4.63 (95% CI: 4.10, 5.23) for poor self-rated health in multivariate analyses. After controlling for covariates, males were less likely than females to report poor self-rated health, though this difference was no longer statistically significant (Table 2).

In cumulative logistic regression models, rural respondents experienced a 22% increased odds of poorer self-rated health than urban residents (OR = 1.22, 95% CI: 1.19, 1.26) in the univariate analysis, an effect that was no longer observed when controlling for covariates (OR = 0.99, 95% CI 0.95, 1.02). The relationship between obese BMI and poorer self-rated health decreased only slightly from a univariate association of 2.73 (95% CI: 2.64, 2.84) to an adjusted association of 2.43 (95% CI: 2.33, 2.53).

As in the multinomial logistic models, adults age 65 and older had the highest odds of poorer health (Adjusted OR = 2.75, 95% CI: 2.52, 3.00) of all the age groups. Respondents with the following characteristics also experienced higher odds of poorer self-rated health compared to the reference groups: Asian, non-Hispanic; being physically inactive; being a current smoker; consuming alcohol; not graduating from high school; and earning less than \$15,000 per year (Table 3).

Table 4 presents the results of analyses evaluating the association of social factors on self-rated health, stratified by rural status. The primary observed difference by rural status was for BMI, where being overweight was associated with a slightly higher risk of poorer self-rated health in urban residents (OR = 1.38, 95% CI: 1.32, 1.45) as compared to rural (OR = 1.28, 95% CI: 1.20, 1.37), and being obese was associated with a significantly higher risk in urban residents (OR = 2.50, 95% CI: 2.38, 2.62) as compared to rural (OR = 2.18, 95% CI: 2.03, 2.34). Additionally, the risk for poorer self-rated health was higher for all categories of non-white urban residents than for non-white rural residents. Only one additional characteristic, never married, exhibited notable differences in risk of poorer self-rated health among rural respondents (OR = 0.85, 95% CI: 0.76, 0.95) as compared to urban (OR = 1.03, 95% CI: 0.96, 1.10). Otherwise, relationships between the covariates and self-rated health were observed to be similar among rural- and urban-living respondents (Table 4).

DISCUSSION

Residence in rural areas was initially found to be associated with poorer self-rated health; however, we were able to identify the underlying risk factors that vary by rural status and account for this observed increased risk. Obesity, low income, and low education were a few of the key factors that were found to be more prevalent among rural respondents such that

rural status was not associated with poorer self-rated health once these and other characteristics were included as covariates. We further explored the possibility that observed risks associated with rural status could be due to the effect of the same factors being different in an urban setting versus a rural setting. On the contrary, there was little evidence of effect modification by rural status, and obesity was actually observed to have a stronger effect on self-rated health among urban residents as compared to rural, further suggesting that the initial differences observed by rural status were attributable to differential distributions of characteristics and not differential effects of those characteristics.

Few investigations of rural status and self-rated health have been undertaken in the US. A study by Kim and Kawachi found a protective association between rural living and self-rated health; however, this association reversed once the model controlled for community-level predictors, such as mean age, low educational attainment, low income, and social capital, and for the interaction between social capital and urbanicity.⁴⁶ Our findings likely differ because we included body mass index, smoking status, alcohol consumption, and health care coverage as covariates in our models and had a larger rural population of participants. The body of literature regarding urban or rural status and health outcomes is inconsistent, depending on the outcome measure for health. For instance, rural status has been found to be protective for some mental health conditions, such as distress, while higher risk of suicide has been associated with rural living.^{47–50} Higher rates of low birthweight, preterm birth, and infant mortality have been found in rural areas, though this disparity is not constant for all types of rural communities and may be attributable to factors such as race/ethnicity, degree of rurality, rates of smoking during pregnancy, and other community-level factors.^{51–56} The relationship between rural status and mortality seems to vary by race/ethnicity; however, this inequity may be due to differential distribution of characteristics such as poverty, residential segregation, access to medical care, stress, community disruption, and the proximate cause of mortality.^{57,58} One study on rural and urban mortality rates found that the older age distribution of rural areas explains much of the observed disparity.⁵⁹

Accordingly, the analyses presented here controlled for a number of covariates. These factors are significant for understanding the role of individual-level characteristics and self-rated health in rural health disadvantage. As shown in the present study, rural status may be confounding the association between BMI and self-rated health, but there does not seem to be any effect modification that explains the rural disadvantage that we observed (Table 4). The finding of a stronger association between obesity and self-rated health among urban respondents than among rural respondents may be due to the statistical power of the study. Also, the odds ratio is a relative measure of association, so it is affected by the slightly higher background prevalence of obesity in the rural population, compared to the urban population. Respondents often assess self-rated health by comparing with the health of a peer group.⁶⁰ If our results are reflecting a “true” difference in the relation of obesity to self-rated health between rural and urban areas, this outcome could be attributable to social and cultural differences in rural and urban areas.

Adjusting for covariates reduces the magnitude of the association between obesity and self-rated health. This finding is consistent with other studies that have investigated the relationship between self-rated health and bodyweight or BMI.^{60,61} Several studies have found an association between increased bodyweight/BMI and reduced self-rated health.^{62–64} For example, in a cohort study of Danish nurses, women who gained weight during the 6 years of follow-up had higher odds of reporting poorer self-rated health, and women who were normal weight and reported poorer self-rated health at baseline experienced higher odds of later weight gain.⁶⁵ In addition, a paper by Okosun and colleagues found an increased odds of reduced health with higher levels of obesity, while controlling for age,

smoking status, and alcohol consumption and stratifying by gender and race/ethnicity.⁶³ As with the present study, the odds ratios were higher for obese individuals than for overweight individuals, which were categorized as preobese. Both studies utilized cross-sectional data; however, the present study was able to assess additional covariates with a much larger sample size. Notably, the Okosun paper was unable to adjust for socioeconomic status, which has been found to be inversely associated with self-rated health.^{66,67}

The results presented here support previous studies on the relationship between socioeconomic status and health. In addition to obesity, we found that educational attainment and household income are significant contributors to self-rated health. A study on socioeconomic status and self-rated health found that education had a significant relationship to health among middle-aged and elderly respondents, with less educated participants being more likely to report fair or poor health.⁶⁸ Subjects with a high school diploma or less education had higher odds of reporting fair or poor health in a study of non-Hispanic white and Hispanic participants.⁶⁹ In that study, education and income had the greatest impact on the association between ethnicity and poorer health, compared to the other covariates, which included age, gender, reported illnesses, medications, hospitalizations, smoking, alcohol, physical activity, and negative feelings. Education has a strong association with poorer self-rated health in our analyses, along with income and age. This finding is congruent with other work. For example, the probability of self-reported poorer health was lowest for high-income groups, followed by middle-income groups and low-income groups, in a nationally representative study.⁷⁰ Another study found that there was a dose-response relationship between decreasing household income and the odds of fair or poor health.⁷¹ Our analyses also demonstrate a dose-response relationship, as the odds of poorer health increase with decreasing levels of income. A prospective study of adults in the US found that income had a stronger association with health, as measured by mortality, than educational attainment.⁷² Consistent with these findings, in each of the tables presented in our study, household income had a stronger association with self-rated health than completed education.

Most studies investigating self-rated health do not include rural status or a variable for location as a covariate unless rural living is a part of the hypothesis. The findings of the present study raise the issue of the external validity of such studies. Findings based on an urban sample may not be generalizable to an entire population of both urban and rural residents; similarly, findings based on a sample of rural and urban residents may not be generalizable to a rural population. Without a consideration of rural status, the measure of association should only differ in magnitude. However, as shown by this data, ignoring the influence of location leaves the potential for substantial confounding. This residual confounding may endanger the validity of the findings.

The use of the BRFSS data limits the analysis due to the underrepresentation of subpopulations that are not as likely to have a telephone in their homes, such as individuals of lower socioeconomic status. Additionally, the rural population of the US may be overrepresented in our study due to the sampling methodology of the BRFSS.⁷³ However, the size and representativeness of the sample and the annual consistency of the survey are strengths of the data set.³⁷ In this study and others, physical activity has been shown to be associated with self-rated health.^{74–78} We were unable to carefully adjust for physical activity because the only variable for physical activity available in the 2006 BRFSS was a crude measure. Even so, the bias resulting from our dichotomous variable constitutes non-differential misclassification and likely weakened the magnitude of the results. Dissimilarities in how rural and urban residents think about health could reduce the comparability of a global measure such as self-rated health or influence the pathways by which self-rated health affects morbidity and mortality. Thus, if a difference exists in how

rural and urban populations conceptualize self-rated health, then this difference could add another limitation to our study.

Additional research must be undertaken to identify health-relevant characteristics of rural environments and culture in the context of urban and suburban environments and cultures.^{11,79} Defining and examining such factors will help illumine the relationship between rural status and health, as well as help determine whether rural status constitutes an independent risk factor or serves as a proxy for some other risk factor. As with the example of bodyweight, any health outcome may be due to “a combination of genetic, metabolic, behavioral, environmental, cultural, and socioeconomic influences.”⁸⁰ Further studies should investigate the relationship between these factors and how these relationships may differ between rural and urban areas. Longitudinal studies are necessary to understand the directionality of the relationship between health-related factors, such as obesity, and self-rated health. The mechanism or directionality may differ based on some physical or behavioral characteristics, which may be pertinent for improving rural health.

An essential aspect to further research is to distinguish between the effects of context and composition. Composition means that rural health disparities are due to differences in who lives in urban and rural areas. If the rural health disparities observed are arising from differences between the characteristics of rural and urban populations, then there are compositional influences on the health outcome.⁸¹ However, contextual factors are characteristics that stem from aspects that are unique to the rural environment.⁸¹ Thus, context means that rural health disparities are caused by differences in what constitutes a rural or an urban environment.

The present findings extend previous work by demonstrating that differences between rural and urban populations in sociodemographic, health and/or behavioral factors may constitute a significant portion of the association. Smith and colleagues noted that rural status “may exacerbate the effects of socioeconomic disadvantage, ethnicity, poorer service availability, higher levels of personal risk and more hazardous environmental, occupational and transportation conditions.”⁴⁸ However, this assertion implies that there are differential effects of factors associated with rural status, which is an effect modification that we did not observe in our analyses. Furthermore, our results indicate that measures to improve rural health must consider characteristics of the individuals that compose the population. Many health care reforms in rural areas focus on area-level factors, such as the available medical/health professional workforce; however, providing access to health-promoting amenities does not guarantee utilization by the population. Addressing compositional factors such as obesity and socioeconomic status, which explained most of the difference in self-rated health between rural and urban populations in our study, will be essential to the success of health care reforms in rural areas.

Our findings indicate that the poorer self-rated health observed among rural residents as compared to urban residents can be attributed to differential distributions of characteristics such as a higher prevalence of obesity, lower education, and lower income among rural residents. Our results further suggest that the initial differences observed by rural status were attributable to differential distributions of characteristics and not differential effects of those characteristics.

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Table 1

Characteristics of Survey Population

	Rural		Urban		p-value of χ^2 test
Total	N	(%)	N	(%)	(67.50)
Sex					
male	43,723	(48.43)	88,829	(48.62)	
female	69,310	(51.57)	145,928	(51.38)	.6267
Age					
age 18–24	4,707	(13.49)	10,283	(13.00)	
age 25–34	11,646	(16.05)	28,684	(18.30)	
age 35–44	16,952	(16.89)	42,019	(19.98)	
age 45–54	23,917	(19.19)	50,511	(19.05)	
age 55–64	23,558	(15.03)	44,508	(13.55)	
age 65+	32,253	(19.36)	58,752	(16.13)	< .001
Race/Ethnicity					
White, non-Hispanic	94,430	(82.77)	181,995	(67.28)	
Black, non-Hispanic	5,239	(6.19)	21,631	(10.18)	
Asian, non-Hispanic	1,128	(0.54)	4,395	(3.16)	
Hispanic	5,098	(6.18)	16,233	(15.61)	
Other/Multiracial	6,006	(4.33)	7,928	(3.76)	< .001
Marital Status					
married or member of unmarried couple	67,383	(65.24)	133,961	(63.64)	
divorced, separated, widowed	33,822	(18.85)	67,236	(17.31)	
never married	11,478	(15.91)	32,436	(19.05)	< .001
Completed Education					
didn't graduate high school	14,029	(13.82)	21,375	(11.49)	
graduated high school	39,571	(37.76)	65,913	(27.29)	
attended college or technical school	30,281	(26.59)	61,593	(26.19)	

	Rural		Urban		p-value of χ^2 test
	N	(%)	N	(%)	
graduated college or technical school	28,890	(21.83)	85,190	(35.03)	< .001
Household income					
< \$15K	13,659	(11.92)	21,059	(9.82)	
\$15K to < \$25K	19,805	(20.21)	31,919	(15.01)	
\$25K to < \$35K	14,633	(15.18)	24,408	(11.48)	
\$35K to < \$50K	17,424	(18.30)	31,970	(14.85)	
\$50K	31,672	(34.38)	92,344	(48.84)	< .001
Body Mass Index					
neither overweight nor obese	38,255	(35.21)	85,912	(39.55)	
overweight	39,671	(36.35)	80,886	(36.16)	
obese	29,841	(28.44)	56,197	(24.29)	< .001
Physical Activity					
yes	82,240	(72.86)	176,806	(75.39)	
no	30,637	(27.14)	57,704	(24.61)	< .001
Self-Rated Health					
excellent	19,118	(18.12)	47,006	(21.55)	
very good	35,038	(32.00)	76,759	(32.83)	
good	35,141	(31.04)	69,512	(30.02)	
fair	15,557	(13.03)	28,716	(11.70)	
poor	7,734	(5.80)	11,876	(3.90)	< .001
Smoking Status					
current smoker	17,591	(18.36)	31,923	(13.51)	
occasional smoker	5,136	(5.42)	10,668	(5.23)	
former smoker	32,204	(24.58)	66,965	(24.38)	
never smoked	57,630	(51.64)	124,223	(56.88)	< .001
Alcohol Consumption					
yes	49,586	(44.92)	120,921	(54.15)	

	Rural		Urban		p-value of χ^2 test
	N	(%)	N	(%)	
no	62,428	(55.08)	111,456	(45.85)	< .001
Health care coverage					
yes	97,319	(82.80)	209,190	(84.59)	
no	15,366	(17.20)	24,966	(15.41)	< .001

Table 2
Multinomial Multivariate Association between Social Factors and Self-Rated Health

	Very Good		Good		Fair		Poor	
	OR	95% C.I.	OR	95% C.I.	OR	95% C.I.	OR	95% C.I.
Rural Status								
urban	1.00	Ref.	1.00	Ref.	1.00	Ref.	1.00	Ref.
rural	1.01	(0.96, 1.07)	0.98	(0.93, 1.04)	0.95	(0.89, 1.02)	1.03	(0.94, 1.12)
Sex								
male	0.87	(0.83, 0.91)	0.94	(0.89, 0.99)	0.99	(0.92, 1.06)	1.02	(0.92, 1.12)
female	1.00	Ref.	1.00	Ref.	1.00	Ref.	1.00	Ref.
Completed Education								
didn't graduate high school	1.11	(0.96, 1.28)	2.03	(1.77, 2.34)	3.43	(2.93, 4.02)	3.39	(2.82, 4.08)
graduated high school	1.27	(1.19, 1.36)	1.81	(1.68, 1.94)	1.98	(1.80, 2.18)	1.81	(1.58, 2.08)
attended college or technical school	1.26	(1.19, 1.34)	1.48	(1.39, 1.58)	1.60	(1.46, 1.76)	1.84	(1.59, 2.12)
graduated college or technical school	1.00	Ref.	1.00	Ref.	1.00	Ref.	1.00	Ref.
Household income								
< \$15K	1.23	(1.06, 1.42)	2.16	(1.87, 2.49)	6.44	(5.48, 7.57)	15.50	(12.29, 19.54)
\$15K to < \$25K	1.27	(1.15, 1.40)	2.00	(1.81, 2.21)	4.10	(3.62, 4.65)	7.18	(5.89, 8.77)
\$25K to < \$35K	1.29	(1.18, 1.41)	1.77	(1.61, 1.95)	2.95	(2.60, 3.33)	3.51	(2.88, 4.27)
\$35K to < \$50K	1.14	(1.06, 1.22)	1.39	(1.29, 1.50)	1.92	(1.73, 2.12)	1.93	(1.61, 2.31)
\$50K	1.00	Ref.	1.00	Ref.	1.00	Ref.	1.00	Ref.
Body Mass Index								
neither overweight nor obese	1.00	Ref.	1.00	Ref.	1.00	Ref.	1.00	Ref.
overweight	1.52	(1.44, 1.61)	1.73	(1.63, 1.83)	1.65	(1.52, 1.80)	1.49	(1.33, 1.66)
obese	2.34	(2.18, 2.51)	4.05	(3.76, 4.36)	5.06	(4.60, 5.58)	4.63	(4.10, 5.23)
Physical Activity								
yes	1.00	Ref.	1.00	Ref.	1.00	Ref.	1.00	Ref.

	Very Good		Good		Fair		Poor	
	OR	95% C.I.	OR	95% C.I.	OR	95% C.I.	OR	95% C.I.
no	1.09	(1.02, 1.17)	1.64	(1.52, 1.77)	2.35	(2.16, 2.56)	4.09	(3.69, 4.54)

Table 3

Cumulative Association Between Social Factors and Self-Rated Health

	Univariate		Multivariate	
	OR	(95% C.I.)	OR	(95% C.I.)
Rural Status				
urban	1.00	Ref.	1.00	Ref.
rural	1.22	(1.19, 1.26)	0.99	(0.95, 1.02)
Sex				
male	0.92	(0.89, 0.94)	1.01	(0.98, 1.05)
female	1.00	Ref.	1.00	Ref.
Age				
age 18–24	1.00	Ref.	1.00	Ref.
age 25–34	0.97	(0.91, 1.03)	1.13	(1.04, 1.23)
age 35–44	1.04	(0.98, 1.10)	1.33	(1.22, 1.45)
age 45–54	1.35	(0.98, 1.10)	1.69	(1.56, 1.84)
age 55–64	1.79	(0.98, 1.10)	2.12	(1.95, 2.31)
age 65+	2.77	(2.61, 2.94)	2.75	(2.52, 3.00)
Race/Ethnicity				
White, non-Hispanic	1.00	Ref.	1.00	Ref.
Black, non-Hispanic	1.57	(1.50, 1.64)	1.08	(1.02, 1.14)
Asian, non-Hispanic	0.84	(0.75, 0.93)	1.37	(1.21, 1.56)
Hispanic	2.09	(1.98, 2.21)	1.36	(1.27, 1.46)
Other/Multiracial	1.48	(1.36, 1.61)	1.24	(1.13, 1.36)
Marital Status				
married or member of unmarried couple	1.00	Ref.	1.00	Ref.
divorced, separated, widowed	2.03	(1.97, 2.10)	1.02	(0.98, 1.06)
never married	0.92	(0.88, 0.96)	1.00	(0.94, 1.06)
Completed Education				
didn't graduate high school	6.52	(6.16, 6.89)	2.34	(2.17, 2.53)
graduated high school	2.59	(2.50, 2.68)	1.48	(1.42, 1.54)
attended college or technical school	1.74	(1.68, 1.80)	1.31	(1.26, 1.36)
graduated college or technical school	1.00	Ref.	1.00	Ref.
Household income				
< \$15K	7.12	(6.68, 7.58)	3.61	(3.34, 3.90)
\$15K to < \$25K	3.94	(3.76, 4.13)	2.28	(2.15, 2.42)
\$25K to < \$35K	2.48	(2.36, 2.61)	1.70	(1.61, 1.80)
\$35K to < \$50K	1.72	(1.65, 1.79)	1.34	(1.28, 1.40)
\$50K	1.00	Ref.	1.00	Ref.
Body Mass Index				

	Univariate		Multivariate	
	OR	(95% C.I.)	OR	(95% C.I.)
neither overweight nor obese	1.00	Ref.	1.00	Ref.
overweight	1.41	(1.37, 1.46)	1.36	(1.31, 1.42)
obese	2.73	(2.64, 2.84)	2.43	(2.33, 2.53)
Physical Activity				
yes	1.00	Ref.	1.00	Ref.
no	3.06	(2.95, 3.16)	1.87	(1.79, 1.95)
Smoking Status				
current smoker	1.99	(1.92, 2.07)	1.82	(1.74, 1.91)
occasional smoker	1.62	(1.51, 1.74)	1.58	(1.46, 1.72)
former smoker	1.47	(1.42, 1.51)	1.27	(1.23, 1.32)
never smoked	1.00	Ref.	1.00	Ref.
Alcohol Consumption				
yes	1.88	(1.83, 1.94)	1.26	(1.22, 1.31)
no	1.00	Ref.	1.00	Ref.
Health Care Coverage				
yes	1.62	(1.54, 1.69)	1.02	(0.96, 1.08)
no	1.00	Ref.	1.00	Ref.

Table 4

Cumulative Multivariate Association Between Social Factors and Self-Rated Health, Stratified by Rural Status

	Rural		Urban	
	OR	(95% C.I.)	OR	(95% C.I.)
Sex				
male	1.00	(0.95, 1.06)	1.02	(0.98, 1.06)
female	1.00	Ref.	1.00	Ref.
Age				
age 18–24	1.00	Ref.	1.00	Ref.
age 25–34	1.00	(0.86, 1.16)	1.15	(1.05, 1.27)
age 35–44	1.30	(1.12, 1.50)	1.34	(1.21, 1.47)
age 45–54	1.83	(1.58, 2.11)	1.66	(1.51, 1.83)
age 55–64	2.13	(1.84, 2.47)	2.11	(1.91, 2.33)
age 65+	2.56	(2.20, 2.97)	2.78	(2.52, 3.08)
Race/Ethnicity				
White, non-Hispanic	1.00	Ref.	1.00	Ref.
Black, non-Hispanic	1.04	(0.94, 1.15)	1.08	(1.02, 1.15)
Asian, non-Hispanic	1.28	(0.92, 1.78)	1.38	(1.21, 1.58)
Hispanic	1.22	(1.05, 1.43)	1.38	(1.28, 1.49)
Other/Multiracial	1.16	(0.99, 1.34)	1.26	(1.12, 1.41)
Marital Status				
married or member of unmarried couple	1.00	Ref.	1.00	Ref.
divorced, separated, widowed	0.99	(0.92, 1.06)	1.02	(0.97, 1.08)
never married	0.85	(0.76, 0.95)	1.03	(0.96, 1.10)
Completed Education				
didn't graduate high school	2.41	(2.17, 2.67)	2.32	(2.12, 2.54)
graduated high school	1.47	(1.37, 1.58)	1.48	(1.41, 1.56)
attended college or technical school	1.27	(1.18, 1.37)	1.32	(1.26, 1.38)
graduated college or technical school	1.00	Ref.	1.00	Ref.
Household income				
< \$15K	3.85	(3.43, 4.32)	3.55	(3.23, 3.89)
\$15K to < \$25K	2.43	(2.22, 2.67)	2.24	(2.08, 2.41)
\$25K to < \$35K	1.57	(1.44, 1.71)	1.74	(1.63, 1.87)
\$35K to < \$50K	1.30	(1.20, 1.40)	1.35	(1.28, 1.42)
\$50K	1.00	Ref.	1.00	Ref.
Body Mass Index				
neither overweight nor obese	1.00	Ref.	1.00	Ref.
overweight	1.28	(1.20, 1.37)	1.38	(1.32, 1.45)
obese	2.18	(2.03, 2.34)	2.50	(2.38, 2.62)

	Rural		Urban	
	OR	(95% C.I.)	OR	(95% C.I.)
Physical Activity				
yes	1.00	Ref.	1.00	Ref.
no	1.82	(1.71, 1.95)	1.88	(1.79, 1.97)
Smoking Status				
current smoker	1.89	(1.76, 2.04)	1.80	(1.70, 1.90)
occasional smoker	1.75	(1.52, 2.01)	1.56	(1.41, 1.71)
former smoker	1.36	(1.28, 1.44)	1.26	(1.21, 1.31)
never smoked	1.00	Ref.	1.00	Ref.
Alcohol Consumption				
yes	1.37	(1.29, 1.44)	1.24	(1.19, 1.29)
no	1.00	Ref.	1.00	Ref.
Health Care Coverage				
yes	0.97	(0.88, 1.05)	1.03	(0.96, 1.10)
no	1.00	Ref.	1.00	Ref.