

A Comparison of Obesity across Geographic Areas and Selected Socio-Economic Indicators

Jin Zhang, MD. MS. MPH¹
Sam Mozee, Jr., Ph.D.¹

¹ Jackson State University

Abstract

This study compared obesity prevalence in Mississippi across selected geographic and socio-economic factors. A unique aspect of this study was the examination of obesity from the perspective of its possible relationship to depression in rural and urban areas. Data used to conduct county-level obesity comparisons were based on the years 2006 to 2009. Independent t-tests and Pearson correlation results were calculated to compare obesity between counties statistically coded as urban or rural, and to compare selected socio-economic differences in obesity at the national, state, and county levels. Findings indicated rural counties were more obese than urban counties, although there was not a statistically significant difference between the two areas. Strong associations between obesity and depression both in Mississippi and at the national level were also found. Study findings also indicated lacking adequate social-emotional support has a strong relationship with obesity at the county level. Factors such as an area's racial composition, educational level, income level, access to healthy foods, and mental health status were also found to be important in understanding obesity and food choices at the county level in Mississippi. Policy recommendations included promoting culturally- and geographically-sensitive strategies to address obesity in Mississippi.

Key Words: obesity, urban, rural, mental health

Introduction

Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have a negative effect on health. According to the U.S. Centers for Disease Control and Prevention, when a person's body mass index (BMI) is 30 or higher, he or she is considered to be obese Centers for Disease Control and Prevention [CDC], 2012). Since the early 1970s, the overall percentage of obese persons in the United States and Mississippi has been increasing (National Center for Health Statistics, 2012). In reviewing estimates covering the years 1995 to 2012, the prevalence of obesity nearly doubled in Mississippi (19.5% to 34.6%) and the U.S. (15.9% to 27.6%) (CDC, n.d.). It has been estimated obesity costs the U.S. healthcare system over \$100 billion a year (Davis, Bennett, Befort, & Nollen, 2011).

As discussed in more detail later, there are many factors that have been linked with rising obesity rates, including mental health factors such as depression. Mississippi's population is slowly becoming more urban in composition, ranging from being approximately 44.5% urban in 1970 to 49.35% in 2010 (United States Census Bureau, 2010). These trends of increasing urbanization and obesity rates raise many issues that have research, policy, and programmatic implications. This study examined whether there is a connection between obesity, mental health, and geographic location as has been found in other studies comparing rural and urban areas (Romans, Cohen, & Forte, 2011; Taylor, Merritt, & Austin, 2013; Linn, Husaini, & Whitten-Stovall, 1990; Amato & Zuo, 1992). With obesity becoming more of a public health concern and financial resources being limited at the federal, state, and local levels, this study seeks to provide officials with research-backed evidence for use in making policy and programmatic decisions related to reducing obesity in Mississippi.

Contributing Risk Factors

In examining the research and medical literature regarding risk factors contributing to obesity, there are numerous factors listed as being possible contributors. For example, factors commonly found contributing to obesity include having an obese genetic background; consuming various obese-inducing medications; experiencing emotional stress; cigarette smoking; aging; pregnancy; lack of sleep; an inactive lifestyle; and an environment that does not support healthy lifestyle habits (e.g., a lack of neighborhood sidewalks, safe places for recreation, oversized food portions and limited access to healthy foods) (National Institutes of Health [NIH], 2012). Many times, an obese person may have more than one of the previously listed risk factors. Being overweight and/or obese usually happens over a period of time and occurs when a person takes in more calories than they use. According to the NIH (2012), a lack of energy balance most often causes overweight and obesity. Energy balance means that the energy a person takes "IN" (via food) equals the energy a person puts "OUT" (via calories burned).

Obesity and Mental Health

Obesity is one of the top public health concerns since it affects not only physical health, but also mental health (Diamond, 2010). For example, overweight or obese people are commonly considered as compulsive eaters who are anxious, depressed, under stress, or trying to compensate for deficiencies in their lives (Scott & Oakley-Browne, 2008). The following conditions and/or relationships have been found to exist between obesity and mental health: anxiety and mood disorder prevalence increasing with increasing obesity severity; a stronger association between anxiety disorders and obesity than between mood disorders and obesity; obese patients being more anxious than those persons who were within normal weight; a link between weight problems and

mental disorders; and that depression and anxiety were the most common emotional health issues induced by obesity (Diamond, 2010).

Comparing Urban and Rural Obesity

Obesity has become more of a public health issue both nationally and internationally over the last thirty years (Wang, 2001; Sondik, 2001; Ahern, Brown, & Dukas, 2011; Neuman, Kawachi, Gortmaker, & Subramanian, 2013). One question emerging from this growing trend is whether obesity impacts urban or rural communities more adversely. In reviewing the research literature, there appears to be an emerging consensus that overall, obesity is more prevalent in rural communities than urban communities (Befort, Nazir, & Perri, 2012; Bennett, Probst, & Pumkam, 2011; Dunn, Sharkey, & Horel, 2012; Liu, et al., 2012; Michimi & Wimberly, 2010).

Social, economic, and demographic differences between urban and rural areas have been theorized to have different health-related implications for each of those geographic areas (Bethea, Lopez, Cozier, White, & McClean, 2012). For example, urban areas are thought to have a higher number and better access to healthcare services and providers than rural areas; whereas, rural areas are thought to have lesser exposure to crime, pollution, and infectious diseases (Bethea, et al., 2012). Because there are numerous factors that may contribute to health-related differences between urban and rural areas, this section concentrates on examining these differences from the perspective of obesity.

Many theories and explanations have been put forth seeking to explain differences in obesity rates between urban and rural areas. Some of these include cultural differences in diet and eating habits; lack of physical exercise; more physical isolation in rural communities; higher rates of using certain types of electronics (e.g., TV, video games); and challenges in accessing healthcare services (Befort, et al., 2012; Davis, et al., 2011). Other explanations include the limited number and availability of food outlets, and differences in socio-economic characteristics such as race, age, gender, income, poverty level, and education (Befort, et al., 2012; Bennett, et al., 2011; Michimi & Wimberly, 2010). Although socio-economic status does appear to play an important role in determining urban and/or rural obesity rates, it can be contextual depending upon the environment in which those factors exist. For example, research has found that in some cultures and countries, a high socio-economic status is associated with higher obesity rates; whereas, in other cultures and countries, a lower socio-economic status is also associated with higher obesity rates (Wang, 2001; Michimi & Wimberly, 2010). This seemingly contradiction serves to highlight that other contextual factors need to be considered before reaching any definitive conclusions regarding obesity rates in urban and rural areas.

Literature Review Conclusions

A general consensus in the research literature was that there are significant differences in obesity rates between urban and rural areas, and selected population groups (e.g., African Americans and non-White Hispanics generally have higher obesity rates than Whites regardless of geographic area). Another general consensus was that rural obesity tends to contribute to higher levels of chronic diseases, food insecurity, and poor dietary behaviors in comparison to urban areas. While there does appear to be a general consensus of rural areas having higher overall obesity rates than urban areas, this generalization is contingent upon many factors such as the specific geographic community/area under study; the methodological techniques used to conduct the analysis; the proximity of rural communities to larger urban areas; the demographic composition of the study area; the educational and income factors of the area; and the ability of area residents to access healthcare

services (Bethea, et al., 2012; Michimi & Wimberly, 2010). This is not to say that geography does not play a role in influencing urban or rural obesity rates, on the contrary, as established in the research literature reviewed for this study, geography clearly plays a role depending upon the specific area being studied. A conclusion that can be drawn from the above literature findings is that geography must be considered along with other factors (e.g., socio-economic status, level of physical activity, and health behaviors) in terms of influencing the prevalence of obesity rates.

Research Methodology

Design

This study incorporated a quantitative comparative design using secondary data. The purpose of this design was to compare obesity rates using an urban/rural geographic dichotomy, and to identify significant factors related to obesity in urban and rural areas. The methodology used to compare urban and rural counties was based upon the U.S. Office of Management and Budget's (OMB) definition of metro and non-metro counties. According to this definition, all counties that are not part of a Metropolitan Statistical Area (MSA) are considered rural (Office of Management and Budget, 2013). Each of Mississippi's 82 counties was classified urban or rural based upon the OMB definition.

Data

Secondary data used in this study were collected from the following data sources: (1) the Behavioral Risk Factor Surveillance System (BFRSS) produced by the U.S. Department of Health and Human Services, Centers for Disease Control and Prevention; (2) the Mississippi State Department of Health's County Health Rankings & Roadmaps - 2010 to 2013; and (3) the U.S. Census Bureau American Community Survey's (ACS) 2009 5-Year Estimates. The primary unit of analysis was data collected at the county-level in Mississippi (N=82). The variables used in this study included race, income (median household), age, percent completing high school or higher, percent of population with access to healthy foods, and percent of county population African American.

Procedures

Independent t-tests were used to compare: (1) area obesity levels statistically coded into two categories – urban or rural; (2) racial differences in obesity at the national and Mississippi levels; and (3) selected depression/mental health indicators by race. Pearson correlation tests were conducted on Mississippi and national race, income, age, depression and obesity data to assess statistical relationships. Chi-square tests were conducted to assess relationships between variables categorically grouped into nominal data. All data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 18. The statistical significance level for this study was established at $p < 0.05$.

Limitations

The availability and grouping of county-level obesity and other selected data resulted in comparisons across different time periods. For example, county-level obesity data were available and grouped by the years 2006, 2006-2008, and 2009; whereas, the socio-economic data of education, income, and race were derived from the American Community Survey's 2009 5-Year Estimates (2004-2009). In order to make the analyses more comparable, the county-level obesity data sets were combined into a 3-year average and then compared against the ACS 2009 reported average. Another limitation was the small sample size used for the

National/Mississippi data comparisons regarding reported correlations and t-test findings. The sample size used for those calculations was for a 17-year period from 1995 to 2012.

In order to facilitate the use of Chi-square analysis, this study's obesity data were converted into dichotomous categorical measures (i.e., above median/below median) that differed from the traditional BMI measurement categories of normal weight, overweight, and obese. The dichotomous grouping was used because all 82 Mississippi counties (for the time period selected) exhibited BMI measures above the normal weight category; thereby necessitating the grouping of Mississippi county-level data into a comparable two-category measure. For consistency purposes, the independent variables were also dichotomously group based upon Mississippi mean/median indicators, and not national mean/median indicators for those variables. Because of the limitations cited, the reader is advised to be cautious in over-generalizing these findings across population groups and other time periods.

Findings

Obesity and Race

In the past 18 years, the average prevalence of obesity among the black population was 13% higher ($p < 0.001$) in Mississippi and 11.35% higher ($p < 0.001$) in the U.S. when compared against the prevalence of obesity among Whites at these same geographical levels (see Figure 1).

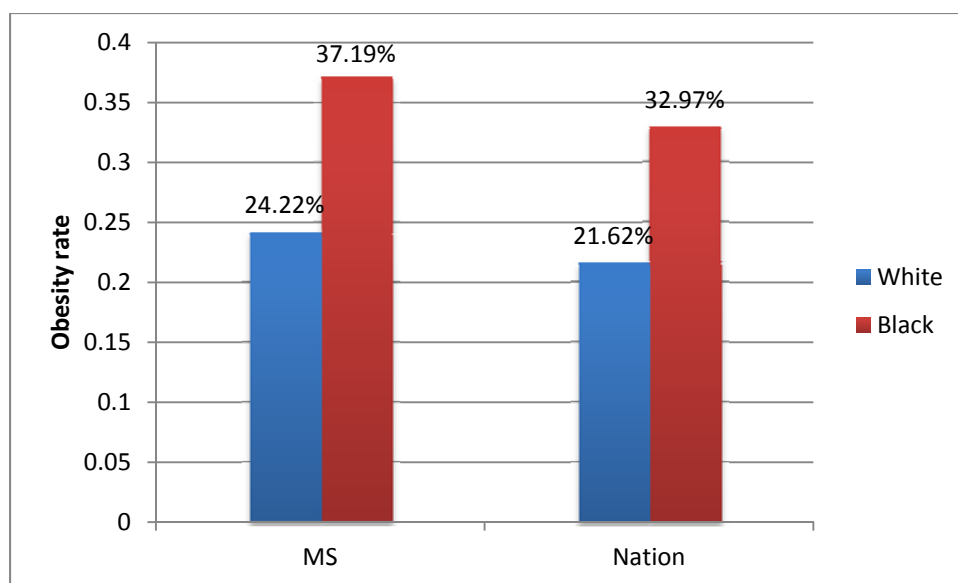


Figure 1. Comparison of obesity by race (1995-2012)

Obesity, Income, and Age

In Pearson correlation results for the nation and Mississippi, there was a strong negative correlation between income levels and obesity at both geographic levels (see Table 1). There was also a moderately strong, statistically significant correlation between age groups and obesity rates for the nation.

Table 1

Comparison of Obesity Rates and Selected Factors

Factors	MS (Obesity rate)	Nation (Obesity rate)
Income	-0.835 *	-0.93 *
Age	0.221	0.554 *

* $p < .05$

Obesity, Depression and Age

The prevalence of obesity and depression exhibited similar trend line patterns and statistical associations with the age variable. Pearson correlation results indicated a strong relationship between obesity and depression both in Mississippi and the nation (see Table 2). Figures 2 and 3 show obesity and depression prevalence rates generally increasing until the 35-44 age group is reached. After that age group, Mississippi's obesity

prevalence rate begins to decline while the national obesity prevalence rate continues to increase until the 55-64 age grouping is reached before declining.

Table 2

Comparison of Depression and Obesity Rates

	Depression/Obesity (Mississippi)	Depression/Obesity (Nation)
Pearson correlation	0.88*	0.79
* $p < .05$		

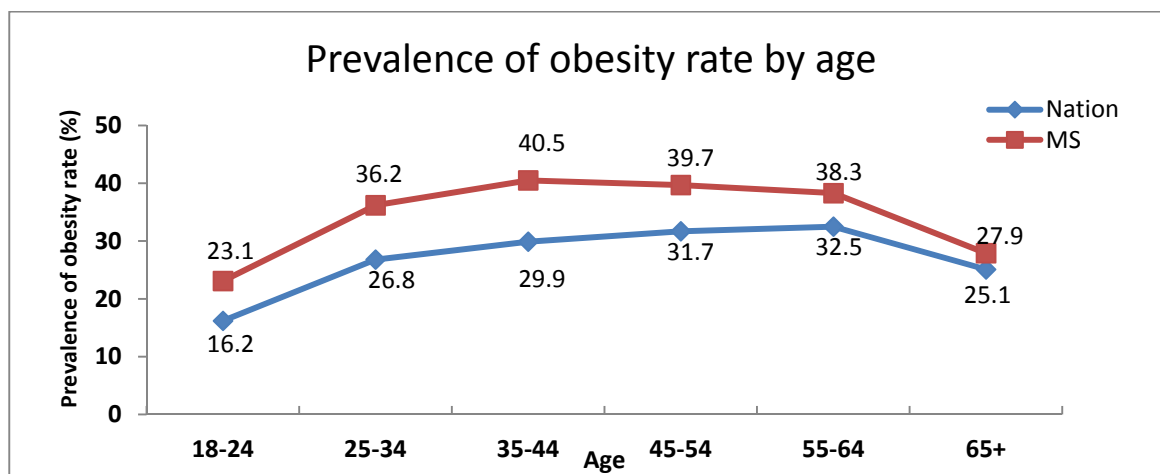


Figure 2. Trend line comparison of obesity by age

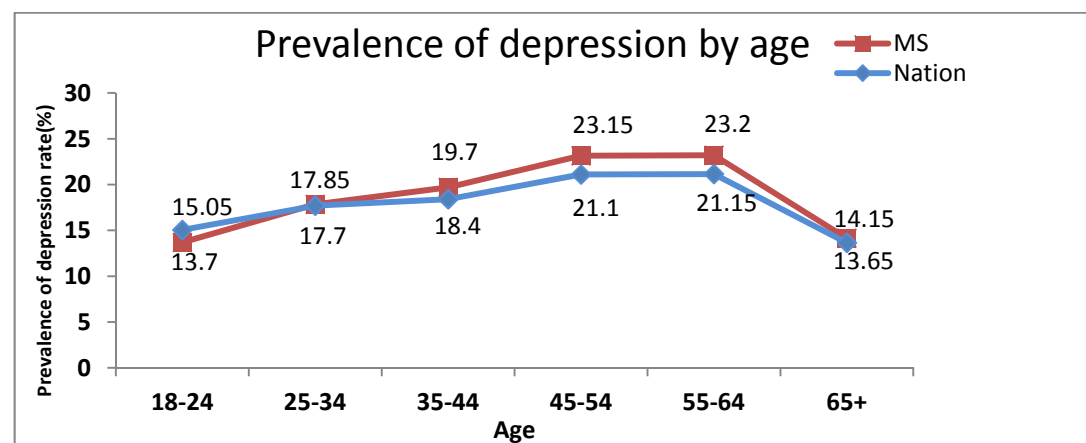


Figure 3. Trend line comparison of depression by age

Depression by Race and Age

In comparing t-test results for the nation and Mississippi, the depression rate of Whites was 6.2% higher in Mississippi, and 4.1% higher in the nation when compared to blacks at the same geographical levels (see Figure 4). Both national and state percentages were found to be statistically significant ($p < .05$).

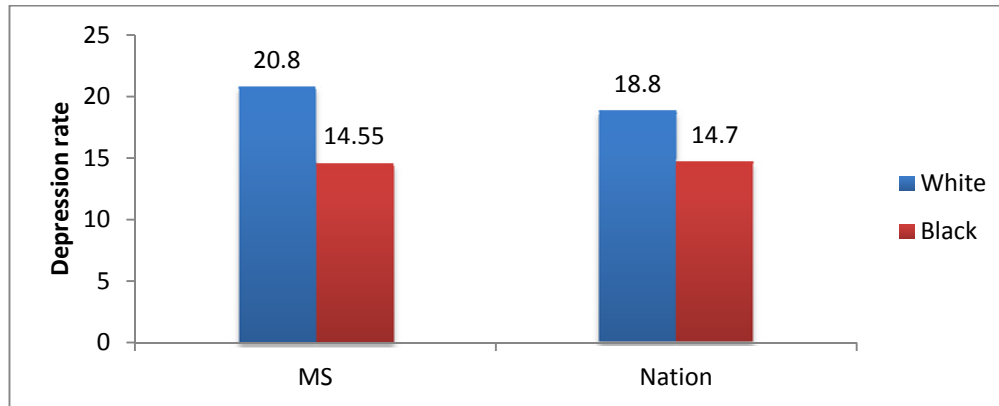


Figure 4. Comparison of depression rates by race

Comparison of Urban and Rural Obesity

Figure 5 presents a summary of the mean obesity measures. On average, for the years reviewed, rural counties had higher obesity rates ($M = 35.6\%$, $SE = .6668$) than urban counties ($M = 34.2\%$, $SE = .3815$). However, this difference was not found to be statistically significant $t(80) = -1.80$, $p (.076) > .05$, and the observed magnitude effect was small $r = .038$.

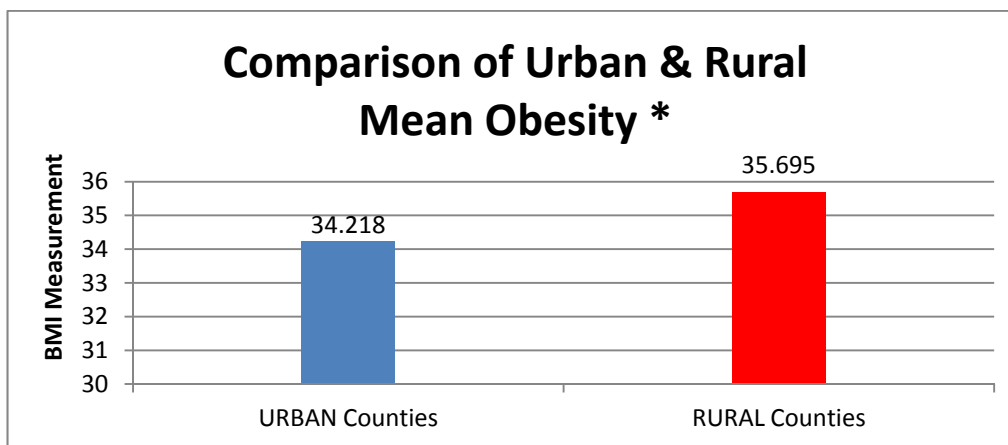


Figure 5. Comparison of urban and rural obesity

* N = 17 Urban Counties / 65 Rural Counties

Chi-square Tests Results

In order to conduct the chi-square tests, the selected variables were statistically grouped into dichotomous, nominal-level categories. For each independent variable tested against the dependent obesity variable, a statistically significant association was found. Three variables (median household income; high school graduation; percent AA population) were found to have an inverse relationship to the obesity variable; thus indicating decreases within these variables were accompanied with increases in the obesity variable. The “percent African American population” variable exhibited the strongest statistical association with the obesity variable. Table 3 provides a summary of the chi-square test findings for the variables under investigation in this study.

Table 3

Summary of Chi-square Results

Variables / Categories		Obesity <=50%	Obesity >50%	DF	X ²	p < .05	Phi
Median household income	<\$31,281	13	28	1	15.89	.000	-.44
	>\$31,281	31	10				
High school graduation %	<74.45	17	24	1	4.9	.027	-.245
	>74.45	27	14				
Healthy food accessibility %	<45	16	26	1	8.387	.004	-.32
	>45	28	12				
Percent of AA population	<50%	43	15	1	33.42	.000	.638
	>50%	1	23				

Obesity and Mental Health Findings

For the years reviewed (2010-2013), the average number of poor mental health days taken between urban (M = 4.1, SE = 0.17) and rural counties (M = 4.17, SE = 0.09) is similar. Rural areas had a higher average rate for the “inadequate social-emotional support” variable (M=25.94, SE=0.75) than the urban areas (M=23.05, SE=1.44). However, this difference was not found to be statistically significant (t = -1.838, p > 0.05). Figures 6 and 7 provide a comparison between urban and rural counties.

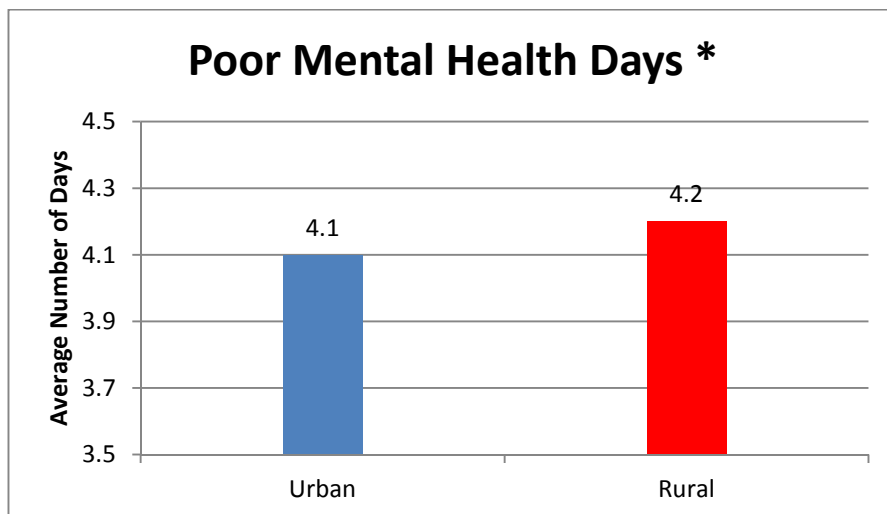


Figure 6. Comparison of poor mental health days by area
* N = 17 Urban Counties / 65 Rural Counties

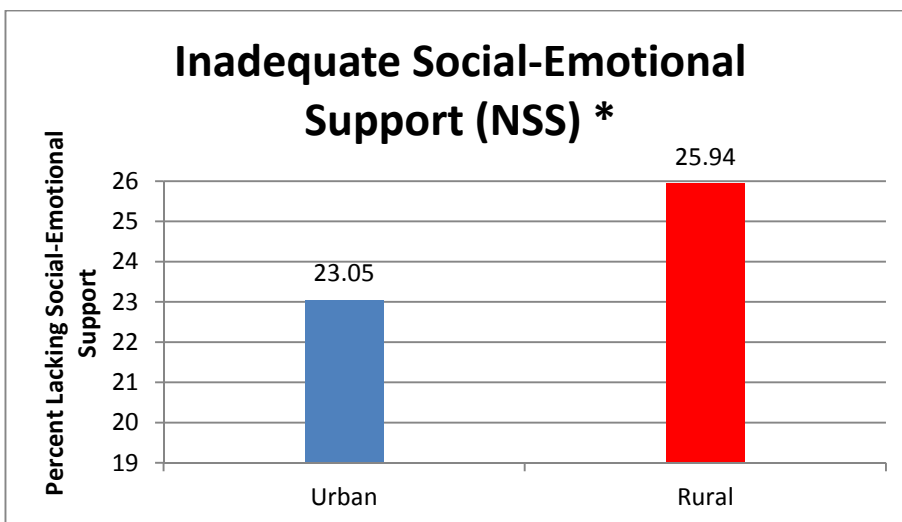


Figure 7. Comparison of inadequate social-emotional support by area
* N = 17 Urban Counties / 65 Rural Counties

In examining whether a statistically significant relationship existed between “poor mental health days” / “inadequate social-emotional support” and obesity, the Pearson Correlation test was performed. The results from this test indicated there was a significantly strong association between obesity and “lacking of adequate social-emotional support” ($r = 0.62$, $p < 0.000$). The relationship between the number of poor mental health days and obesity indicated a weak, but statistically significant association between the two variables ($r = -0.269$, $p < 0.05$) (see Table 4).

Table 4

Obesity, Poor Mental Health Days, Social-Emotional Support

	Poor mental health days	No adequate social-emotional support
Obesity rate	-0.269*	0.62*

* $p < .05$

Discussion

A review of the research literature revealed an emerging consensus that rural areas have a higher overall obesity prevalence than urban areas. Reasons often cited for higher rural obesity included limited access to healthy foods, higher rates of poverty and unemployment, and a more growing sedentary lifestyle due to agricultural mechanization. This study's findings also produced evidence showing that rural counties tended to be more obese than urban counties, although there was not a statistically significant difference between the two areas. Factors such as an area's racial composition, educational level, income level, and access to healthy foods were also found to be important in understanding obesity at the county level in Mississippi. These findings were consistent with similar findings contained in the research literature.

The Chi-square finding on the "percent of African American population" having a significant relationship with obesity was also consistent with research literature findings. It appears race/ethnicity seems to have a more significant relationship with obesity than other factors we usually think of such as income and education. However, if we look at the culture of African Americans' food choices, this finding is not that surprising. By way of comparison, one survey analyzing food consumption across several racial/ethnic groups found that fruits, vegetables, and dairy products were consumed by 70-80% of the sample population, and 18-42% of the respondents reported eating whole grain breads, legumes, nuts, and seeds. However, meat and meat product consumption was reported by more than 75% of the sample populations (Hightower, 2010). African Americans consumed fewer fruits, vegetables, whole grains, and dairy products when compared to whites and Hispanics. African Americans also had a tendency to consume culturally relevant foods such as greens, sweet potatoes, grits, and chicken at a higher rate (Hightower, 2010; Loren, et al., 2005).

Research indicated that food choices and intake habits are influenced by a complex interaction of psychosocial factors which include nutrition knowledge, attitudes, beliefs, perceptions of food, and socio-demographic factors including income, gender, age, and race/ethnicity (Shiva & Dindayal, 2004). Among these factors, race and ethnicity play an important role in determining the selection of food. For example, some African American diets are characterized by eating what is known as '*soul food*'. These foods include chicken, French fries, baked and boiled poultry, pork, and beef along with greens, sweet potatoes, black-eyed peas, and cornbread. African Americans enjoy these foods especially during holidays and during Sunday dinners, a traditional time in which families gather in the African American culture (Shiva & Dindayal, 2004). However, whites ate more beef, fruits and vegetables, breads, and skim milk. These findings suggest that race/ethnicity is a key factor impacting food intake (Hightower, 2010). Race and ethnicity affects food choices not only through

ingrained cultural belief patterns, but also through specific life habits especially regarding food choices (Shiva & Dindayal, 2004). This means factors such as their outlook and attitudes towards life and people, health and even food choices will be greatly influenced by their ethnic group affiliation. These factors among others are learned by individuals of these groups at an early age. The different values, which influence these factors, come from the country where each of these ethnic groups originated. For example, African and Afro-Caribbean groups will usually consume foods containing various meats, wheat, and rice. Eastern and far eastern groups will consume foods containing various herbs and spices. Typical western groups will consume high meat content foods which are much dryer than other ethnic groups (Shiva & Dindayal, 2004). Choosing food such as meats high in fat, cholesterol, refined sugars, refined oils; rather than choosing the right amount of fruits, vegetables, whole grains, and lean meats to manage weight and reduce the risk of chronic diseases like cancer, diabetes, and cardiovascular diseases is not as easy as it sounds.

Thus, food choices are choices about what to eat, and factors influencing those choices. Therefore, it is not a surprise that taste, cost, convenience, individual food preferences, psychological and sociological factors, demographic, and geographic factors are key influences on dietary choices. These findings, along with this study's finding of race/ethnicity having a significant relationship to obesity, suggest that proposed interventions need to be culturally- and geographically sensitive to different race/ethnic populations being targeted.

Obesity and Mental Health

Many researchers and clinicians now argue that obesity is more than a simple physical health problem, and that instead, it should be considered a mental problem related to stress release (Vega, 2012). People with mood disorders may console themselves with comfort food which is usually high in fat, sugar, and calories because they are anxious, lonely, angry, or suffering from low self-esteem. Overeating is one of the classic symptoms of atypical depression. A depressed person's appetite may increase or decrease, although an increase is more typical. In addition, depression is also often associated with smoking and drinking, dopaminergic deficits, increased cortisol levels, lower grades of inflammation, abnormal levels of leptin and adiponectin, and reduced physical activity, all of which contribute to the development of obesity (Vega, 2012). In this study, we found similar strong associations between obesity and depression both in Mississippi and in the nation.

This study also showed that lacking adequate social-emotional support has a strong relationship with obesity at the county level, and with disparities existing in depression among the groups examined. The depression rate in whites is significantly higher than the rates in blacks, while the obesity rate is significantly higher in blacks than whites, both in Mississippi and the nation. Such unexpected, opposite results could be a result of the limitations of this study. For example, only two years (2006-2009) of data related to depression status were available in the *Behavioral Risk Factor Surveillance System (BRFSS)* dataset used at the time of this study (Mississippi State Department of Health [MSDH], 2009a); thus, this limited data may not reflect the true trend of depression in the population as a whole. Secondly, at the county level, the association between the number of poor mental health days is negatively and weakly associated with obesity in Mississippi. This finding is counter to what we found in the relationship between depression and obesity in Mississippi and the nation. One reason for such divergence may be related to the different indicators used in the surveys. Specifically, the question asked in the BRFSS is: "Have you ever been told you have a form of depression?" whereas, the question in the Mississippi State Department of Health's *County Health Rankings and Roadmaps* asks, "Thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good" (MSDH, 2009b). The answer to the former question is based on a medical diagnosis while the answer to the latter question is based on a subjective

self-feeling, inconsistent indicator reflecting depression. Another possible explanation is that people with longer poor mental health day periods may have a decreased appetite which results in weight loss. Just as the causes of obesity are multi-factorial, treatments need to be multi-factorial as well. Successful interventions to reduce the prevalence of obesity and mental health will require the cooperation between primary care physicians and the mental health community (Maguen, et al., 2013).

Policy Implications

The consensus of obesity being higher among the poorest and least educated population groups, whether rural or urban, provides some policy guidance regarding recommendations for addressing obesity in Mississippi's urban and rural areas. Based upon the statistical linkages identified in this study, short-term policy recommendations include promoting culturally- and geographically-sensitive anti-obesity strategies (e.g., public service campaigns, local community forums), and tax incentives strategies encouraging more healthy food choices (e.g., grocery stores, farmers markets) in targeted areas. Long-term policy recommendations include continued efforts promoting higher educational attainment (e.g., dropout prevention programs, expanded tutorial and remedial services for low-income students) and higher income levels (e.g., expanded job training and job placement opportunities); requiring healthier food choices in public institutions such as schools, prisons, mental health facilities; improving and/or expanding mental health services; and ongoing public education campaigns promoting the benefits of maintaining a healthy weight and good mental health.

Mississippi's near equal urban/rural population mix suggests that geographically-sensitive strategies (verses a "one size fits all" strategy) are needed to help curb obesity rates and costs in the state. However, it is somewhat misleading to view Mississippi's obesity problem only through an "urban/rural" lens due to this problem being significantly impacted by wider measures such as race, education, income, access to healthy foods, and mental health status. These factors strongly suggest that both targeted and comprehensive measures are needed to address the obesity epidemic occurring in Mississippi. Policymakers, healthcare professionals, community groups, and concerned individuals should consider targeting and coordinating anti-obesity strategies based upon contextual measures such as geographic location and cultural considerations.

References

- Ahern, M., Brown, C., & Dukas, S. (2011). A national study of the association between food environments and county-level health outcomes. *The Journal of Rural Health*, 27, 367-379.
- Amato, P., & Zuo, J. (1992). Rural poverty, urban poverty, and psychological well-being. *Sociological Quarterly*, 33(2), 229-240.
- Befort, C., Nazir, N., & Perri, M. (2012). Prevalence of obesity among adults from rural and urban areas of the United States: Findings from NHANES (2005-2008). *The Journal of Rural Health*, 28, 392-397.
- Befort, C., Nazir, N., & Perri, M. (2012). Study shows greater likelihood of obesity in rural America than urban communities. *Managed Care Outlook*, 25(20), 1, 8-9.
- Bennett, K., Probst, J., & Pumkam, C. (2011). Obesity among working age adults: the role of county-level persistent poverty in rural disparities. *Health & Place*, 17(5), 1174-1181.
- Bethea, T. N., Lopez, R., Cozier, Y., White, L., & McClean, M. (2012). The relationship between rural status, individual characteristics, and self-rated health in the behavioral risk factor surveillance system. *The Journal of Rural Health*, 28, 327-338.
- Centers for Disease Control and Prevention. (n.d.). *Behavioral Risk Factor Surveillance System* 1995 and 2012. Retrieved from <http://apps.nccd.cdc.gov/brfss>
- Centers for Disease Control and Prevention. (2012). *Overweight and Obesity*. Retrieved from <http://www.cdc.gov/obesity/adult/defining.html>
- Cureton, S. (2011). Environmental victims: Environmental injustice issues that threaten the health of children living in poverty. *Reviews on Environmental Health*, 26(3), 141-147.
- Davis, A. M., Bennett, K., Befort, C., & Nollen, N. (2011). Obesity and related health behaviors among urban and rural children in the United States: Data from the national health and nutrition examination survey 2003-2004 and 2005-2006. *Journal of Pediatric Psychology*, 36(6), 669-676.
- Diamond, L. (2010). Links between obesity and mental health. *The Clinical Advisor*. Retrieved from <http://www.clinicaladvisor.com/links-between-obesity-and-mental-health/article/164957>
- Dunn, R., Sharkey, J., & Horel, S. (2012). The effect of fast-food availability on fast-food consumption and obesity among rural residents: an analysis by race/ethnicity. *Economics and Human Biology*, 10(1), 1-13.
- Finkelstein, E. (2009). Estimated annual medical spending attributable to obesity: payer- and service-specific. *Health Affairs*, 28(5).

- Hightower, C. A. (2010). *Food choices of African Americans compared to other racial/ethnic U.S. Populations using NHANES, 2003-2006*. Retrieved July 2014, from ProQuest / Gradworks:
<http://gradworks.umi.com/34/19/3419576.html>
- Laska, M. N., Borradaile, K., Tester, J., Foster, G., & Gittelsohn, J. (2010). Healthy food availability in small urban food stores: A comparison of four U.S. cities. *Public Health Nutrition*, 13(7), 1031-1035.
- Lee, S., Sobal, J., Frongillo, E., Olson, C., & Wolfe, W. (2005). Parity and body weight in the United States: Differences by race and size of place of residence. *Obesity Research*, 13(7), 1263-1269.
- Linn, G., Husaini, B., & Whitten-Stovall, R. (1990). Race, social class and psychological distress in rural and urban southern communities. *Humanity & Society*, 14(2), 128-143.
- Liu, J., Bennett, K., Harun, N., & Probst, J. (2008). Urban-rural differences in overweight status and physical inactivity among US children aged 10-17 years. *Journal of Rural Health*, 24(4), 407-415.
- Liu, J., Jones, S., Sun, H., Probst, J., Merchant, A., & Cavicchia, P. (2012). Diet, physical activity, and sedentary behaviors as risk factors for childhood obesity: an urban and rural comparison. *Childhood Obesity*, 8(5), 440-448.
- Loren, C., Anthony, S., Staffan, L., Bruce, W., James, H., & Janette, B. (2005). Origins and evolution of the western diet: Health implications for the 21st Century. *American Journal of Clinical Nutrition*, 81(2), 341-354.
- Maguen, S., Madden, E., Cohen, B., Bertenthal, D., Neylan, T., Talbot, L., . . . Seal, K. (2013). The relationship between body mass index and mental health among Iraq and Afghanistan veterans. *Journal of General Internal Medicine, Supplement*(2), 563-570.
- Michimi, A., & Wimberly, M. (2010). Associations of supermarket accessibility with obesity and fruit and vegetable consumption in the conterminous United States. *International Journal of Health Geographics*, 9(49), 14. Retrieved from
<http://www.ij-healthgeographics.com/content/9/1/49>
- Mississippi State Department of Health. (2014a). *County Health Rankings & Roadmaps*. Retrieved April 2014, from <http://www.countyhealthrankings.org/app/mississippi/2014/factors/40/map>
- Mississippi State Department of Health. (2014b). Poor mental health days. *County Health Rankings & Roadmaps*. Retrieved from
<http://www.countyhealthrankings.org/app/mississippi/2014/measure/outcomes/42/description>
- National Center for Health Statistics. (2012). *Health, United States, 2012 with Special Feature on Emergency Care*. Retrieved from
<http://www.cdc.gov/nchs/data/hus/hus12.pdf>

- Neuman, M., Kawachi, I., Gortmaker, S., & Subramanian, S. (2013). Urban-rural differences in BMI in low- and middle-income countries: the role of socioeconomic status. *American Journal of Clinical Nutrition*, 97, 428-436.
- National Institutes of Health. (2012). *What causes overweight and obesity?* Retrieved from <http://www.nhlbi.nih.gov/health/health-topics/topics/obe/causes.html>
- Office of Budget and Management. (February 28, 2013). *Revised delineations of metropolitan statistical areas, and combined statistical areas, and guidance on uses of the delineations of these areas*. Retrieved from <http://www.whitehouse.gov/sites/default/files/omb/bulletins/2013/b-13-01.pdf>
- Romans, S., Cohen, M., & Forte, T. (2011). Rates of depression and anxiety in urban and rural Canada. *Social Psychiatry Psychiatric Epidemiology*, 46, 567-575.
- Scott, K., & Oakley-Browne, M. (2008). Obesity and mental disorders in the adult general population. *Journal of Psychosomatic Research*, 64, 97-105.
- Sharkey, J., Johnson, C., & Dean, W. (2011). Less-healthy eating behaviors have a greater association with a high level of sugar-sweetened beverage consumption among rural adults than among urban adults. *Food & Nutrition Research*, 55, 9. doi:10.3402/fnr.v55i0.5819
- Shiva, D., & Dindayal, S. (2004). How personal factors, including culture and ethnicity, affect the choices and selection of food we make. *Internet Journal of Third World Medicine*, 2. doi:10.5580/2231
- Sondik, E. J. (2001). *Health, United States, 2001 with urban and rural health chartbook*. Retrieved from <http://www.cdc.gov/nchs/data/hs/hs01cht.pdf>
- Taylor, M., Merritt, S., & Austin, C. (2013). Negative affect, delinquency, and alcohol use among rural and urban African-American adolescents: A brief report. *Journal of Child & Adolescent Substance Abuse*, 22(1), 69-84.
- Thorpe, K. (2009). *The future costs of obesity: The national and state estimates of the impact of obesity on direct health care expenses*. Retrieved from <http://www.nccor.org/downloads/CostofObesityReport-FINAL.pdf>
- United States Census Bureau. (2010). *Census urban and rural classification area criteria*. Retrieved October 2013, from U.S. Census Bureau: <http://www.census.gov/geo/reference/ua/urban-rural-2010.html>
- Vega, C. (2012). *Dangerous Associations Noted Between Mental Illness and Obesity*. Retrieved from <http://www.medscape.org/viewarticle/758808>
- Wang, Y. (2001, October). Cross-national comparison of childhood obesity: the epidemic and the relationship between obesity and socio-economic status. *International Journal of Epidemiology*, 30(5), 1129-1136.