The Factors Associated with Obesity among the Older Adults in the Gulf Coast Area, with Comparison to the U.S.

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Abstract: This paper tries to examine the social, demographic, and behavioral factors on obesity in three Gulf Coast states, namely Alabama, Louisiana, and Mississippi, which has shown higher obesity prevalence in the U.S. One assumes that contributing factors on obesity in this area would follow the national trend: the lower the socioeconomic status, being a minority, African American, and less exercise increases the odds of having obesity. By using the logistic regression, the study found that the Gulf Coast Area did not fully follow the national trend from the 2012 BRFSS data. Rural older males are less likely to be obese, which is surprising. The effect of SES and female African American in the Gulf Coast Area were greater than those in the U.S. The SES variables constructed by education and household income here estimated the unequal effect of SES on obesity clearer: only the highest SES category was statistically significant, unlike the education showed a linear relationship in other studies. It would be appropriate to consider the result of this study for more effective policies and/or programs.

Keywords: Older, obesity, gulf coast area, ses, rural, odds ratio.

INTRODUCTION

Obesity is the one of the most important public health concerns in the U.S. as well as in the world [1-7]. It causes several other serious chronic diseases such as heart diseases, diabetes, hypertension, cancer, and stroke [1,2,8-13]. Obese people are more likely to have problems with activities of daily lives (ADL) and lower scores on quality of life, [1,11,13-18] and have higher mortality rate than non-obese people [1,19]. The prevalence of obesity is increasing for both adults and older adults [1-7]. The cost of health problems including hospitalization is higher for the obese people than non-obese ones [1,12,15,20,21].

Prior studies reported that social, demographic, and health behavioral variables as contributing factors to obesity. For instance, as you get aged, the chance of being obese increases for adults, [20,22-24] but the chance of being obese decreases for the older adults [3,25]. Males are more likely to be obese, [20,22,24] but this relationship reverses in the older males [3,4,25,26]. Older minorities are more likely to be obese, [2,20,22,24] but this relationship becomes not significant for an older male minority [25]. Education and Socioeconomic Status (SES) show the negative relationships with obesity. The longer the educational attainment or the higher the SES, the lower the being obese [23,27-29]. Marital status showed that non-married including divorced, widowed, and separated people compared to married ones had lower likelihood of being obese [24]. Adults living in rural area showed the higher likelihood of being obese, [20] yet older ones did not show a significant relationship [30]. Exercise or physical activity has reported its benefit to health. For instance, exercise helps to lose weight. Even exercise did not lead to the weight loss, obese people with exercise lowers the likelihood of having other illnesses [31-35]. As such, exercise lowers the likelihood of being obese [2-4,13,23,32,36,37].

The geographic area of focus in this study is the Gulf Coast Area, including Alabama, Louisiana, and Mississippi (an alphabetical order), because these three states have shown the higher prevalence of obesity than that of the national average [38,39]. The older people in this area also show the higher prevalence of obesity [40-43].

A general assumption on the associated factors with obesity is that these three states would follow the national trends. No direct investigation, however, has been done on the contributing factors on obesity in this area. Therefore, the main goal of this paper is to see whether these associated factors follow the national trends, with comparison with the U.S. This study also expects to provide the meaningful policy implications for older obese people in this area.

DATA AND METHODS

The data used in this study were obtained from the 2012 BRFSS. The BRFSS is a representative-sample survey including 500,000 interviews each year by the Federal Agency, the Center for Disease Control and Prevention (CDC), and administering by telephone interview to adult residents. The principle objective of the survey is to monitor state-level prevalence of the

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major behavioral risks among adults associated with premature morbidity and mortality and collect data on actual behaviors, rather than on attitudes or knowledge, which would be especially useful for planning, initiating, supporting, and evaluating health promotion and disease prevention programs [44].

This study employed a logistic regression model and the STATA 13.0 version statistical package was used for the analysis because the dependent variable with dichotomous outcome (yes=1, no=0), whether a respondent was obese [45,46].

The independent variables are selected from the previous studies and used to predict obesity include the respondent's age, sex, race/ethnicity, marital status, SES, exercise, and rural residence, all of which have been identified as contributing factors to these diseases. The variables are as follows: 1) Age is measured in years from age 65 to 99; 2) Female is a dummy variable indicating whether the respondent is female; if yes, it is coded as 1; 3) African American is a dummy variable indicating whether the respondent is African American; if yes, it is coded as 1; 4) Hispanics is a dummy variable indicating whether the respondent is Hispanics; if yes, it is coded as 1; 5) Asian is a dummy variable indicating whether the respondent is Asian; if yes, it is coded as 1; and 6) Other is a dummy variable indicating whether the respondent belongs to other ethnic categories; if yes, it is coded as 1 (with White used as the reference group); 7) Married is a dummy variable indicating whether s/he is married; if yes, it is coded as 1 (with non-married used as the reference group); 8) Exercise is a dummy variable indicating whether s/he does exercise; if yes, it is coded as 1. The BRFSS measures it whether a respondent participates in any of exercises last 30 days other than a job related exercise; 9) Rural Residence is a dummy variable indicating whether s/he lives in rural area; if yes, it is coded as 1.

This study also constructed four SES variables by using education and household income to measure the complexity of the SES better, because using the education only to measure the SES was not enough [47]. One of the popular SES variables often used is income. The income in the BRFSS, however, was measured as a household income so that it could not be used as an individual variable. Hence, the two variables were combined into one with four categories: less than college education with lower household income (under $55,000), less than college education with higher household income (over $55,000), college education with lower household income, and college education with higher household income. The SES group consisting of families with less than college education and household income below $55,000, which was the median household income in the BRFSS data, was used as the reference group. Thus, this paper will not have education variables to avoid multicollinearity, [47-49] and expects that the models with this constructed SES provide us a better estimation on obesity among older people than the models with education only.

As the CDC report has showed the different results on obesity by gender, [39,44] this study also conducts the logit regression models by gender. A series of logit models (all, male, and female) will be conducted for the U.S. and the Gulf Coast Area older adults separately, which makes the total of six logit models. The interpretations, however, will be focused on the Gulf Coast Area older adults.

RESULTS

The results of this research showed that the percentages of obesity for all, male, and female older adults in the Gulf Coast Area are higher those in the U.S. as expected. The percentages of the obesity for females are higher than those of the males.

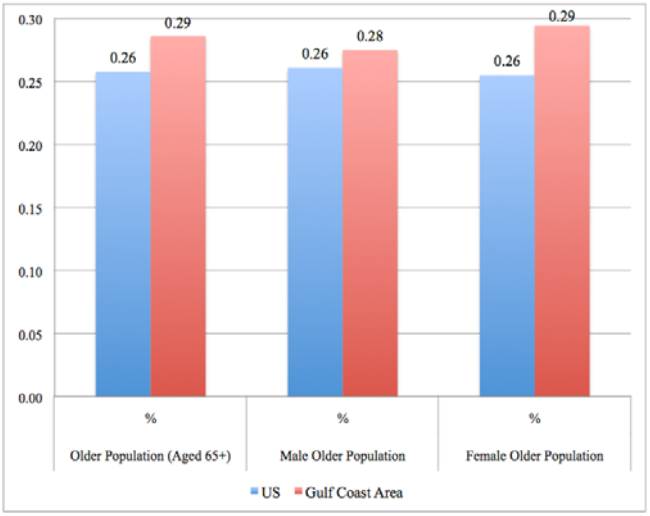

Figure 1: The percentage of obesity among older adults in the gulf coast area.

Table **1** through **3** present frequency distributions of all independent variables for all, male, and female older adults in the U.S. and the Gulf Coast Area from the 2012 BRFSS data. Table **1** is for the all-older adults. The average ages of older adults for both areas were

Table 1: Descriptive Statistics for the Older Adults in the U.S. and the Gulf Coast Area

	The U.S.			The Gulf Coast Area		
	(Weighted; N = 30,825,428)			(Weighted; N = 1,142,836)		
	%	(95% CI)		%	(95% CI)	
Age*	74.03	73.95	74.11	73.75	73.53	73.97
Female	0.55	0.54	0.56	0.56	0.54	0.58
Race/Ethnicity						
White	0.81	0.81	0.82	0.78	0.76	0.79
African American	0.08	0.08	0.08	0.19	0.17	0.20
Hispanics	0.06	0.06	0.06	0.02	0.01	0.02
Asian	0.02	0.02	0.03	0.00	0.00	0.00
Other	0.02	0.02	0.02	0.02	0.01	0.02
Married	0.56	0.56	0.57	0.55	0.53	0.57
Socioeconomic Status						
Low Income-Less than College	0.41	0.40	0.41	0.52	0.50	0.53
Low Income-College	0.27	0.27	0.28	0.25	0.23	0.26
High Income-Less than College	0.07	0.07	0.08	0.06	0.05	0.07
High Income-College	0.25	0.24	0.25	0.18	0.17	0.19
Exercise	0.70	0.69	0.70	0.67	0.65	0.68
Rural Residence	0.21	0.21	0.22	0.39	0.38	0.41

Note: * is an average.

similar, around 74 years old. Little more than half of them were female. While around eight out of ten adults were White in both areas, the percentage of African American was more than twice higher in the Gulf Coast Area. The percentage of non-white Hispanics, Asians, and the other were very small and even close to zero in the Gulf Coast Area. More than half of them were married for both areas. The SES in the Gulf Coast Area was little bit more unequally distributed than that of the U.S. The Gulf Coast Area had the higher proportion of the lowest SES (52%) compared to that of the U.S. (41%), and the lower proportion of the highest SES (18%) compared to that of the U.S. (25%). Almost seven out of ten older adults exercise for both areas, but the percentage of exercise in the Gulf Coast Area (67%) was lower than that of the U.S. (70%). Almost twice more Gulf Coast Area older adults than the U.S. older ones lived in the rural area, 39% and 21% respectively.

Table **2** shows the different distributions for both areas. Compared to older adults in Table **1**, the percentages of married and exercise for older males were higher; the percentage of lowest SES was lower; and the percentage of highest SES was higher than those of the national average. Other variables such as age, race/ethnicity, and rural residence were similar to those in Table **1**.

Table **3** also shows the different distributions of the older female adults for both areas. Compared to older males in Table **2**, the average ages for females were slightly older; the percentages of married for females were significantly lower, which made sense considering the longer life expectancy for females; fewer older females exercised; the percentage of lowest SES was higher and the percentage of highest SES was lower. The SES difference between male and female was wider in the Gulf Coast Area; the percentages of African Americans was higher, and the higher proportion of African American older females was more salient in the Gulf Coast Area; the percentages of exercise were lower than those of males, and the percentage of exercise for the Gulf Coast Area older females even lower than that of the U.S. females.

Table **4** present the results of the logistic regression analyses for the U.S. and the Gulf Coast Area older adults; Table **5** for the older males; and Table **6** for the older females. As for the U.S. older adults, most

Table 2: Descriptive Statistics for the Older Male Adults in the U.S. and the Gulf Coast Area

	The U.S.			The Gulf Coast Area		
	(Weighted; N = 14,099,520)			(Weighted; N = 516,164)		
	%	(95% CI)		%	(95% CI)	
Age*	73.67	73.55	73.80	73.53	73.15	73.91
Race/Ethnicity						
White	0.81	0.80	0.82	0.81	0.78	0.83
African American	0.07	0.07	0.08	0.15	0.13	0.17
Hispanics	0.06	0.06	0.07	0.02	0.01	0.03
Asian	0.03	0.02	0.03	0.00	0.00	0.00
Other	0.02	0.02	0.03	0.02	0.02	0.03
Married	0.72	0.71	0.73	0.72	0.69	0.74
Socioeconomic Status						
Low Income-Less than College	0.36	0.35	0.37	0.47	0.44	0.50
Low Income-College	0.24	0.23	0.25	0.22	0.19	0.24
High Income-Less than College	0.08	0.08	0.09	0.06	0.04	0.07
High Income-College	0.31	0.31	0.32	0.25	0.23	0.28
Exercise	0.74	0.73	0.74	0.72	0.69	0.74
Rural Residence	0.22	0.21	0.23	0.39	0.36	0.42

Note: * is an average.

Table 3: Descriptive Statistics for the Older Female Adults in the U.S. and the Gulf Coast Area

	The U.S.			The Gulf Coast Area		
	(Weighted; N = 16,725,908)			(Weighted; N = 626,340)		
	%	(95% CI)		%	(95% CI)	
Age*	74.32	74.22	74.43	73.93	73.68	74.17
Race/Ethnicity						
White	0.81	0.81	0.82	0.75	0.74	0.77
African American	0.09	0.08	0.09	0.22	0.20	0.23
Hispanics	0.06	0.05	0.06	0.01	0.01	0.02
Asian	0.02	0.02	0.03	0.00	0.00	0.00
Other	0.02	0.02	0.02	0.01	0.01	0.02
Married	0.44	0.43	0.45	0.42	0.40	0.44
Socioeconomic Status						
Low Income-Less than College	0.45	0.44	0.45	0.55	0.53	0.57
Low Income-College	0.29	0.29	0.30	0.27	0.25	0.29
High Income-Less than College	0.07	0.06	0.07	0.06	0.05	0.07
High Income-College	0.19	0.19	0.20	0.12	0.11	0.13
Exercise	0.67	0.66	0.67	0.62	0.60	0.64
Rural Residence	0.21	0.20	0.21	0.39	0.38	0.41

Note: * is an average.

Table 4: The Results of Logit Regression Analysis for the All Older Adults

Variable	The U.S. (Weighted; N = 30,825,428)			The Gulf Coast Area (Weighted; N = 1,142,836)		
	OR	(95% CI)		OR	(95% CI)	
Age	0.94*	0.93	0.94	0.94	0.93	0.95
Female	0.92**	0.87	0.98	1.04	0.89	1.23
Race/Ethnicity						
African American	1.48*	1.30	1.68	1.78	1.48	2.15
Hispanics	1.11	0.94	1.32	1.82	0.77	4.26
Asian	0.27*	0.15	0.49	0.25	0.03	2.57
Other	1.20	1.00	1.44	1.44	0.88	2.34
Married	0.97	0.91	1.03	0.86	0.73	1.02
Socioeconomic Status						
Low Income-College	0.87*	0.81	0.93	0.94	0.79	1.13
Hi Income-Less than College	0.81*	0.72	0.91	0.95	0.62	1.44
Hi Income-College	0.67*	0.62	0.73	0.96	0.76	1.20
Exercise	0.51*	0.48	0.54	0.58*	0.50	0.69
Rural Residence	1.01	0.96	1.07	0.89	0.76	1.03
Constant	73.47*	50.51	106.86	59.58*	22.35	158.82

Note: *: < .001; **: < .01; ***: < .05.

Table 5: The Results of Logit Regression Analysis for the Older Male Adults

Variable	The U.S. (Weighted; N = 14,099,520)			The Gulf Coast Area (Weighted; N = 516,164)		
	OR	(95% CI)		OR	(95% CI)	
Age	0.94*	0.93	0.95	0.93*	0.91	0.95
Female						
Race/Ethnicity						
African American	0.92	0.75	1.12	1.37	0.96	1.97
Hispanics	1.15	0.88	1.52	3.31	0.91	12.09
Asian	0.22*	0.10	0.46	0.63	0.04	9.85
Other	1.04	0.80	1.36	1.60	0.76	3.37
Married	1.15**	1.04	1.27	0.97	0.73	1.29
Socioeconomic Status						
Low Income-College	0.90	0.80	1.01	1.19	0.86	1.65
Hi Income-Less than College	0.98	0.82	1.16	1.04	0.56	1.92
Hi Income-College	0.72*	0.64	0.81	1.23	0.88	1.72
Exercise	0.59*	0.53	0.65	0.64**	0.48	0.85
Rural Residence	0.94	0.87	1.03	0.75***	0.58	0.96
Constant	57.76*	34.12	97.78	116.90*	21.37	639.60

Note: *: < .001; **: < .01; ***: < .05.

Table 6: The Results of Logit Regression Analysis for the Older Female Adults

Variable	The U.S. (Weighted; N = 16,725,908)			The Gulf Coast Area (Weighted; N = 626,340)		
	OR	(95% CI)		OR	(95% CI)	
Age	0.94*	0.93	0.94	0.95*	0.93	0.96
Female						
Race/Ethnicity						
African American	2.05*	1.74	2.42	2.10*	1.69	2.61
Hispanics	1.07	0.88	1.31	0.93	0.43	2.00
Asian	0.33***	0.13	0.83			
Other	1.35***	1.05	1.74	1.29	0.70	2.36
Married	0.87**	0.80	0.94	0.84	0.68	1.05
Socioeconomic Status						
Low Income-College	0.85*	0.77	0.93	0.82	0.66	1.01
Hi Income-Less than College	0.66*	0.56	0.77	0.93	0.52	1.66
Hi Income-College	0.61*	0.54	0.68	0.66***	0.48	0.90
Exercise	0.45*	0.42	0.49	0.55*	0.45	0.67
Rural Residence	1.07	1.00	1.15	1.00	0.84	1.21
Constant	89.67	53.80	149.47	34.41*	11.07	106.98

Note: *: < .001; **: < .01; ***: < .05.

coefficients were statistically significant and showed the expected associations with obesity in Table **4**. For easier understanding of logit coefficients, this paper converted the coefficients to the odds ratios [45,46]. Additional age decreased to have obesity by 6% among the older adults in the first column in Table **4**. Female decreased the likelihood of having obesity by 8%. African American increased the likelihood of having obesity by 48%; Asian decreased the likelihood of having obesity by 73%. The higher the SES, the lower the likelihood of being obese: a respondent with lower income and college education was 13% less likely to be obese; a respondent with higher income and less than college education was 19% less likely to be obese; a respondent with higher income and college education was 33% less likely to be obese compared to one with lower income and less than college education. A respondent who exercised was 47% less likely to be obese. Rural residence did not show any significant relationship with obesity among the older adults. As for the Gulf Coast Area, this study found only one variable was significant; a respondent who exercised was 42% less likely to be obese.

In Table **5**, the results of older male in the U.S. showed that fewer variables were significant than those in Table **4**. African American and two lower socioeconomic status variables became not significant in the U.S. results, while two more variables, age and rural residence, became significant in the Gulf Coast Area results: When one got aged, one was 5% less likely to be obese, which supported the previous studies. A respondent who live in the rural area was 4% less likely to be obese, which was surprising.

The U.S. older females in Table **6** showed that almost all variables were significant in expected ways. The Gulf Coast Area older females, however, showed only four variables such as age, African American, the highest SES, and exercise were significant. When an older female got aged, she was 5% less likely to be obese. An African American older female was 110% more likely to be obese. An older female in the highest SES was 34% less likely to be obese. When an older female exercised, she was 45% less likely to be obese.

DISCUSSIONS

Although the higher prevalence of obesity is one of the important public health concerns in the Gulf Coast Area, there is no clear understanding how the contributing factors are associated with obesity. It is assumed that the influential factors are the same as the U.S. national trends [2,3,13,22-24,28,29,36,37,50-52].

This study tried to comprehend if this holds true by utilizing the 2012 BRFSS data, and found that the Gulf Coast Area did not fully follow the national trend. The rural older males in the Gulf Coast Area were less likely to be obese than their urban counterparts, which was the most surprising finding in this study. This could be explained the followings: one was that rural older adults had advantage over urban counterparts in obesity; and the other was that rural older adults already overcame the rural disadvantages by the survival effect, that obese people already had passed away [10,53]. Although further analysis is necessary, this paper is more favorable on the latter, because one cannot expect the disappearing the rural disadvantage without good reasons.

Although the directions of the associations with obesity were the same as in the U.S. model, the effect of the variables such as SES and African American was greater in the Gulf Coast Area. When we consider income and education together, only the highest SES level is less likely to be obese, other lower levels did not matter. The previous studies, however, found a linear relationship with obesity when we consider education only, [25,27,29] which did not show the striking difference between the highest and other lower SES in the Gulf Coast Area. This could be interpreted that the impact of unequal SES and being a minority was more severe in this area. That is why this study considered this approach is more appropriate to capture the complexity of the SES.

The African American older female had the highest odds ratio among the other factors, which supported the national trend, yet its magnitude in the Gulf Coast Area was stronger than that of the U.S. This might be related to the high poverty rate in this area. Another thing to consider for the higher level of obesity among African American older female is a cultural factor, although this was not the main focus in this study. Other studies argued that African American women have culture that they prefer to have a larger body size and that they have relatively lower stress on weight [3,54,55]. This could explain the well above average overweight and obesity among African American females. This culture, however, could not be the sole reason for the higher prevalence of obesity among them.

Finally, as expected, exercise lowered the odds of being obese. The percentage of exercise for male and female in the Gulf Coast Area, however, were lower than those of the U.S. The gap between male and female is wider in the Gulf Coast Area. For instance, the percentage of exercise in female (62%) was 10% lower than that of male (72%), and was 5% lower than the national average of the female (67%). This difference may relate to the SES: Finding time, affordability and accessibility for the facility membership could be challengeable for the socioeconomically disadvantaged. For instance, one would not like to exercise outdoor under the hot and humid weather, but not easy to go to the health facilities that requires a membership fee and a ride. In fact, people with lower socioeconomic status exercised less than people with higher socioeconomic status [37]. As there is no clear answer why Gulf Coast Area older people, female in particular, exercise less than the U.S. older adults, the further research is necessary.

In addition, we found greater positive effect of exercise on females for both areas, although female in both areas exercised less. If we would raise the exercise percentage of the female to that of the male, that positive effect went even greater? If so, increasing the exercise percentage of female itself could bring more benefits to public health than other programs and policies.

This study has some suggestions for further research. As mentioned above, we need to find a better answer why rural older male had lower odds ratio of having obesity. Second, if the African American female culture on body weight and image influence on obesity, we need to analyze the effect size of that culture. Third, as stated above we need better explanations about the lower level of exercise, females in particular, in the Gulf Coast Area. Fourth, we would like to know whether increasing the exercise percentage of female to the same level of male could lower down the female obesity. This answer might extend to the other U.S. states.

This study provides other meaningful implications on policies and programs for the Gulf Coast Area older population. As rural older male in the Gulf Coast Area has a lower likelihood of having obesity, it would be appropriate to develop policies and programs based on the results of this study. In addition, finding better answer for the African American female culture on body weight and the lack of exercise for Gulf Coast older adults, females in particular, could not only provide us a better understanding of the higher prevalence of obesity in the Gulf Coast Area but also help us to make more effective programs and policies to reduce obesity and overweight. Focusing on

exercise or lifestyle seems to be a better strategy to reduce the obesity. If the financial issue would be the reason to hinder exercise for the older adults in this area, providing low-cost health community facility might help them to exercise more. That can reduce not only obesity but also the other health problems. Finally, if the results of this study can extend to other states that have higher prevalence of obesity, we could develop more universal policies and programs.

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