Journal of Public Health in the Deep South

Volume 1 | Number 1 Article 10

2019

The Relationship Between Obesity and Depression Among Federally Qualified Health Center Patients

Hwanseok Choi
University of Southern Mississippi, hwanseok.choi@usm.edu

Follow this and additional works at: https://scholarsjunction.msstate.edu/jphds

Recommended Citation
Choi, Hwanseok (2019) "The Relationship Between Obesity and Depression Among Federally Qualified Health Center Patients," *Journal of Public Health in the Deep South*: Vol. 1: No. 1, Article 10.
Available at: https://scholarsjunction.msstate.edu/jphds/vol1/iss1/10

This Research Studies is brought to you for free and open access by Scholars Junction. It has been accepted for inclusion in Journal of Public Health in the Deep South by an authorized editor of Scholars Junction. For more information, please contact scholcomm@msstate.libanswers.com.

The Relationship Between Obesity and Depression Among Federally Qualified Health Center Patients

Hwanseok Choi
University of Southern Mississippi

Joohee Lee
University of Southern Mississippi

Stephanie T. McLeod
University of Southern Mississippi

Rambod A. Rouhbakhsh
Forrest General Hospital

Michelle Brazeal
University of Southern Mississippi

Tim Rehner
University of Southern Mississippi

David M. Cochran
University of Southern Mississippi

Background: Obesity has reached epidemic levels in Mississippi. In the shadow of these skyrocketing obesity levels, there are comorbid high levels of depression. Both obesity and depression complicate and, in many cases, compromise critical health outcomes. A significant association between obesity and depression has been suspected for decades. *Purpose*: The purpose of this study is to examine the relationship between obesity and depression among patients receiving medical care from a Federally Qualified Health Center (FQHC) in a southern state. *Methods*: The sample was comprised of 3,272 subjects. The Patient Health Questionnaire (PHQ-9) was used to measure the severity of depression, and the Body Mass Index (BMI) was used to measure obesity. *Results*: Multiple logistic regression analysis revealed that the likelihood of depression decreased as the level of BMI increased, which is the opposite of the results in most previous research. Good physical health lessened the likelihood of depression. Less stress and fewer traumatic life events and greater self-esteem lowered the chance of depression. *Conclusion*: The findings indicated a need for health education and interventions to influence changes within communities and to address the medical and emotional needs of individuals with obesity and depression.

Keywords: obesity, depression, Duke health profile, mental health, traumatic life events

Introduction

Obesity is a complex and growing public-health issue at both the national and state levels. The prevalence of obesity among adults in the United States from 2013 to 2014 was 37.7% (Flegal, Kruszon-Moran, Carroll, Fryar, & Ogden, 2016). Mississippi was ranked second highest in the U.S. for its prevalence of obesity in 2016 (Segal, Rayburn, & Beck, 2017). Mississippi's prevalence rate of obesity has risen considerably in the last decade; more than one-third of Mississippi adults were obese in 2016 (Mendy, Vargas, Cannon-Smith, & Payton, 2017; Segal et al., 2017). This trend can be expected to continue, especially considering the high rate of childhood obesity in Mississippi (Grant et al., 2016; Segal et al., 2017; UMCC, n.d.). The Child and Youth Prevalence of Obesity Survey reported that more than 40% of school-aged children in the state are classified as overweight or obese (Kolbo et al., 2016).

The Centers for Disease Control and Prevention (CDC) lists obesity as a risk factor associated with depression (2015). Multiple studies have reported positive associations between obesity and depression, especially among women (Dearborn, Robbins, & Elias, 2018; de Wit et al., 2010; Hung et al., 2014; Luppino et al., 2010; Mannan, Mamun, Doi, & Clavarino, 2016; Pereira-Miranda, Costa, Queiroz, Pereira-Santos, & Santana, 2017; Xiang & An, 2015). Like obesity, depression is a growing health concern as its prevalence rate has increased among adults. In the United States, the prevalence of depression was 8.1% from 2013 to 2016, and an estimated 46 million people in the nation will be diagnosed with depression by 2050 (Brody, Pratt, & Hughes, 2018; Heo, Murphy, Fontaine, Bruce, & Alexopoulos, 2008). In 2008, Mississippi was ranked first in the U.S. for its prevalence of depression (Gonzalez et al., 2010).

Both obesity and depression have been linked to decreased physical health and quality of life, and both co-occur with similar health problems, such as type 2 diabetes, cardiovascular disease, cancer, and mortality associated with these and other health issues (CDC, 2015; Lépine & Briley, 2011; Nigatu, Reijneveld, de Jonge, van Rossum, & Bültmann, 2016; Pan et al., 2010; Segal et al., 2017; U.S. Preventive Services Task Force [USPSTF], 2016; World Health Organization [WHO], 2018a; WHO, 2018b). Unsurprisingly, health outcomes are often worsened when obesity and depression co-occur (Nigatu et al., 2016).

In addition to their association with myriad negative health outcomes, obesity and depression are costly illnesses. In the U.S, obesity-related health-care costs in 2014 were approximately $150 billion, and the cost of depressive disorders in 2013 was roughly $71 billion (Dieleman et al., 2016; Kim & Basu, 2016). Health-care costs associated with obesity in Mississippi are expected to approach $3.9 billion in 2018 (Grant et al., 2016; Mendy et al., 2017; UMMC, n.d.).

The relationship between obesity and depression has been disputed for decades. Several studies have identified a positive relationship between obesity and depression. Specifically, research has

shown that, as the level of depression increases, so does the level of obesity (Dearborn et al., 2018; de Wit et al., 2010; Hung et al., 2014; Luppino et al., 2010; Mannan et al., 2016; Pereira-Miranda et al., 2017; Xiang & An, 2015). Yet some studies have found that there is an inverse relationship between depression and obesity. Assari (2014) found that the direction of association between depression and obesity differed based on demographic factors like ethnicity and gender. Some found a negative association between the two where depression decreased as obesity increased (Chang & Yen, 2012). Others have found a curvilinear relationship between the two or no association (de Wit, van Straten, van Herten, Penninx, & Cuijpers, 2009; John, Meyer, Rumpf, & Hapke, 2005).

Specific demographic characteristics have been found to predict greater risk for obesity and depression. Middle-aged female and Black or Latino individuals have higher rates of obesity (Flegal et al., 2016; National Center for Health Statistics, 2017). A study of Mississippians found similar results; being female, Black, aged between 25 and 44, and having less education and lower income were associated with higher rates of obesity (Qobadi & Payton, 2017). Several national studies have found that females, younger people, multiracial people, and individuals with lower income levels were more at risk for higher rates of depression (Brody et al., 2018; Gonzalez et al., 2010; Heo et al., 2008; National Institute of Mental Health [NIMH], 2017; USPSTF, 2016).

The diagnosis and treatment of depression and obesity in underserved areas is difficult. Mississippi was ranked 50th in access to health care and 51st in access to mental health care in 2018, which suggests that many people in the state do not have access to health services (Mental Health America, 2018; U.S. News & World Report, 2018). In addition, obesity and depression are both associated with negative stigma, so some individuals may avoid seeking professional help even if it is available (Harvard Law School Mississippi Delta Project, 2014; WHO, 2018a; Williams, Mesidor, Winters, Dubbert, & Wyatt, 2015).

If the barrier to access is resolved, a potential solution to these challenges would be to integrate mental and behavioral health-care services into primary-care clinics (Harvard Law School Mississippi Delta Project, 2014). When mental and physical health are considered together, it is possible to use the presence of one condition as an indicator to screen for the other condition (Luppino et al., 2010; Pereira-Miranda et al., 2017; Xiang & An, 2015).

The purpose of this study was to examine the association between obesity and depression among patients at a Federally Qualified Health Center (FQHC) in South Mississippi, while controlling for various covariates including socio-demographic factors, physical health, and psychosocial factors. While a considerable body of research has focused on the association between obesity and depression, relatively limited studies have included people in the southern part of the U.S. and those of low socioeconomic status. Therefore, this study will expand current knowledge of

the relationship between obesity and depression as well as factors that are significantly associated with depression among disadvantaged patients in South Mississippi who received care through an FQHC.

Methods

Sample and Sampling Procedures

The sample used in this study was comprised of patients who received medical and behavioral health services at any of several FQHC clinic sites in South Mississippi. Inclusion criteria for this study were as follows: (a) patient at a participating FQHC clinic between May 2014 and October 2017, (b) received services from a social worker at the FQHC, and (c) at least 18 years of age or older at the time services were provided. A total of 3,272 patients were included in this study. During their first encounter with the social worker, patients were assessed using various standardized and established instruments to determine their baseline medical and mental-health status. Patients' responses to the assessments were recorded into a HIPPA-compliant, web-based database, which was designed to allow the social work clinician to minimize scoring and input errors and monitor patient outcomes. All patients provided consent for their respective data to be used for research purposes. All data received by researchers were de-identified. The project was approved by the University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services regulations (45 CFR Part 46), and university guidelines (date of approval: February 26, 2016).

Measures

Depression. The nine-item Patient Health Questionnaire (PHQ-9) was used to measure patients' severity of depression (Kroenke, Spitzer, & Williams, 2001). Each patient was asked to describe the frequency with which each symptom had been present over the past 2 weeks using a 4-point scale that ranged from 0 ("not at all") to 3 ("nearly every day"). The nine items were summed to form a total score ranging from 0 to 27, with higher scores representing greater depressive symptoms. Scores of 10 or higher indicated the possible presence of clinical depression (Kroenke et al., 2001). Past studies have shown the PHQ-9 to have good internal consistency and criterion and construct validity (Arroll et al., 2010; Kroenke et al., 2001). Cronbach's alpha calculated in the current study was 0.86.

Physical health. The five-item subscale of the Duke Health Profile (The DUKE) – Physical Health was used to measure the level of physical health (Parkerson, Broadhead, & Tse, 1990). Items assessed somatic symptoms (2 items), pain (1 item), and ambulation (2 items). For each of the five statements, respondents were asked to choose the frequency with which that symptom had affected them using a scale ranging from 0 ("a lot") to 2 ("none"). The raw scores were then multiplied by 10 to become 0, 10, and 20, respectively (Parkerson et al., 1990). The five values

Relationship Between Obesity and Depression

were then summed to find the overall physical health score, which ranged from 0 to 100 with higher scores indicating better physical health. The DUKE – Physical Health scale has been shown to have acceptable internal consistency and construct validity (Parkerson et al., 1990). Cronbach's alpha calculated in the current study was 0.68.

Traumatic life events. The frequency of exposure to different traumatic events was measured by a nine-item lifetime traumatic events checklist: natural disaster, life disrupted by Deepwater Horizon oil spill, emotional abuse, sexual abuse, physical abuse, domestic violence, illness/medical trauma, war, and serious injuries. Patients were prompted to identify any and all of the negative life events that they had experienced throughout their lives. Events that had not happened to that particular subject were scored as 0. Thus, each event was given an equal weight. The number of positive responses was summed, and scores ranged from 0 to 9; higher scores indicated more traumatic life events.

Current stressors. The number of current stressors was measured by a stressor checklist. Patients were prompted to identify stressors that were currently causing stress, such as strained relationships, legal problems, or health issues. Currently experienced stressors were scored as 1, while those that were not being experienced were scored as 0. Each stressor was given equal weight. The number of positive responses was summed, and scores ranged from 0 to 23; higher scores indicated more current stressors.

Self-esteem. Patient self-esteem was assessed using the Duke Health Profile (The DUKE) – Self-Esteem scale, which was comprised of five items that measured patients' perception of themselves (e.g., I like who I am; I am comfortable being around people; Parkerson et al., 1990; Parkerson, Broadhead, & Tse, 1991). Patients were prompted to select the most accurate response from two response options that included "Yes that describes me exactly" or "No that doesn't describe me at all." The raw scores were multiplied by 10 to become 0, 10, and 20 (Parkerson et al., 1990). The five values were then summed to find the overall self-esteem score, which ranged from 0 to 100 with higher scores indicating better self-esteem. The DUKE – Self-Esteem has been shown to have acceptable internal consistency and construct validity (Parkerson et al., 1990). Cronbach's alpha calculated in the current study was 0.64.

BMI group. Obesity and BMI groups were measured using the Body Mass Index (BMI), which is calculated by dividing an individual's weight in kilograms by the square of height in meters (i.e., kg/m^2; CDC, 2016). A BMI of 30.0 or higher falls within the obese category. For this study, the entire sample was divided into five categories based on BMI scores: underweight, <18.5; normal weight, 18.5–24.9; overweight, 25–29.9; obese, 30–34.9; extremely obese, > 35.0.

Statistical Analysis Plan

Descriptive analyses of the socio-demographic variables as well as potential risk factors of depression and obesity were conducted to explore the status of the sample. Additional descriptive analyses for PHQ-9 scores and BMI variables were performed to examine rates of depression (PHQ-9 $\geq$ 10) and BMI groups. Secondly, the relationship between each independent variable and two dependent variables, depression and BMI group, was examined at the bivariate level with a significance level at 0.05. For the BMI group variable, the chi-square test of independence was performed for categorical variables, while the ANOVA test was used for continuous variables. To explore which variables were significantly associated with depression at the bivariate level, the chi-square independent test and t-test were conducted with a significance level at 0.05. The Mantel Haenszel chi-square test was performed when both variables were ordinal-scale variables. If the equal variance assumption was violated, the Satterthwaite t-test was performed. Lastly, a multiple logistic regression analysis was performed to identify the variables that can be used to predict depression as well as how those predictors contribute to the presence of depression. The likelihood ratio test (LR test) and the Hosmer-Lemeshow test (HL test) were performed to determine the degree of model fit and predictability. SAS version 9.3 was used for all statistical analyses.

Results

Sample Characteristics

A total of 3,272 patients visited the FQHC in South Mississippi from May 1, 2014, to October 31, 2017. These patients were 18 years of age or older at the time of their first visit. Among them, almost 60% were Caucasian, and 32% were African American. About one-third of participants were male (n = 1,080, 34.21%). The average age of the participants was 47.45 years (SD = 12.72). Almost 70% of the cohort had a high school diploma or less, while only 6% of the total sample had a college degree or higher. More than 24% of the cohort lived alone, whereas around 70% of them lived with family (59.8%) or with friends (9.7%). Among the cohort, 31.6% were married, 40.4% were single, and more than 37% were divorced or widowed. Table 1 presents descriptive statistics of sample characteristics.

Relationship Between Obesity and Depression

Table 1
Descriptive Statistics of the Study Sample (N = 3,272)

Variable	N (%)	Mean (SD)
Race		
Caucasian	1,863 (59.52%)	
African American	1,009 (32.24%)	
Other	400 (12.22%)	
Gender		
Female	2,077 (65.79%)	
Male	1,080 (34.21%)	
Age		47.45 (12.72)
Education		
Some high school	521 (25.60%)	
High school diploma	885 (43.49%)	
2-year college	503 (24.72%)	
4-year college	97 (4.77%)	
More than 4-year college	29 (1.43%)	
Living		
Alone	685 (24.10%)	
With family	1,686 (59.82%)	
With friends	275 (9.68%)	
Foster care/shelter	29 (1.02%)	
Homeless	49 (1.72%)	
Other	118 (4.15%)	
Marital status		
Single	1,049 (40.39%)	
Married	821 (31.61%)	
Divorced	574 (22.10%)	
Widowed	153 (5.89%)	

Table 2 presents descriptive statistics of study variables. More than 56% of the participants were either obese (22.8%) or extremely obese (33.8%), while 20% of participants were either underweight (1.7%) or normal weight (18.6%). Almost 38% of participants showed signs of depression (PHQ-9 $\geq$ 10). Of those who fell within the obese category, 36.4% showed signs of depression. Interestingly, higher prevalence of depression was found in participants who were underweight (51.5%) or normal weight (46.2%). Fifty-two percent of those who were underweight and 46% of those who were normal weight showed signs of depression, while 38% of those who were overweight, 34% of those who were obese, and 38% of those who were extremely obese showed signs of depression. Figure 1 shows the prevalence of depression by BMI group. The underweight groups had more frequency of depression. And, as severity of obesity increased from normal to overweight to obese, the percentages of depression decreased.

Table 2

Descriptive Statistics of Study Variables (N = 3,272)

Variable	N (%)	Mean (SD)
Obesity group		
Underweight (BMI < 18.5)	33 (1.73%)	
Normal (18.5 ≤ BMI < 25.0)	355 (18.62%)	
Overweight (25.0 ≤ BMI < 30.0)	431 (22.60%)	
Obese (30.0 ≤ BMI < 35.0)	439 (23.02%)	
Extremely obese (35.0 ≤ BMI)	649 (34.03%)	
Depression		
Yes	1,243 (37.99%)	
No	2,029 (62.01%)	
Diabetes		
Yes	523 (15.98%)	
Not known	2,749 (84.02%)	
Smoking		
Yes	177 (5.41%)	
No	3,095 (94.59%)	
Self-esteem		67.98 (25.06)
Physical health		39.36 (26.53)
Life stressors		3.24 (2.95)
Traumatic events		2.50 (1.99)

Relationship Between Obesity and Depression

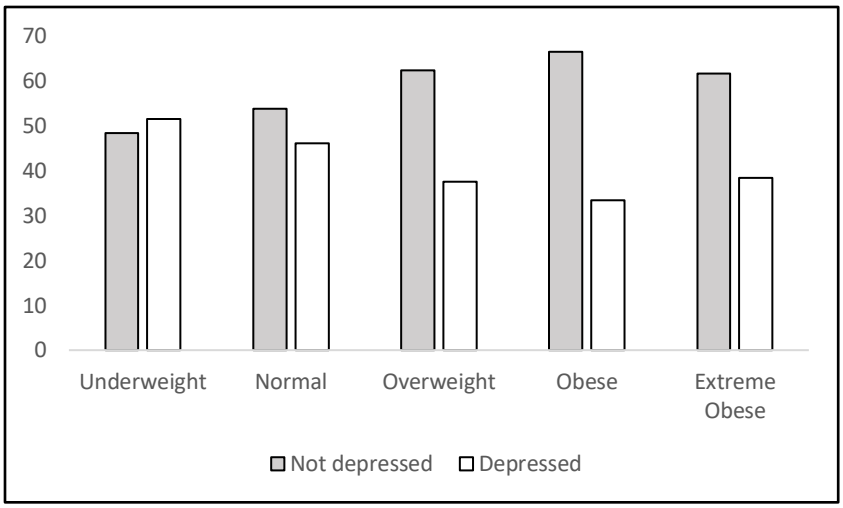

Figure1. Prevalence of depression by BMI group. The underweight groups had more frequency of depression. As severity of obesity increased from normal to overweight to obese, the percentages of depression decreased.

There were few patients in the smoking group (5.41%), and around 16% of patients reported having a diabetes diagnosis (15.98%). The average physical health score was 39.36 (SD = 26.5), and the average self-esteem score was 67.98 (SD = 25.1). The average number of life stressors was above 3, whereas the average number of traumatic life events was 2.5.

Bivariate Analyses

Based on the results, depression and BMI groups were statistically significantly related to each other ($\chi^2 = 15.97$, $p = .03$). The BMI group was significantly related to the following variables: race, gender, age, self-esteem, perceived health, number of life stressors, and physical health scores at the 0.05 level of significance. Table 3 shows the bivariate analyses results.

Another set of bivariate analyses was performed between depression and other independent variables to find confounding factors that would be effective for both main variables (depression and obesity) at the multivariate analyses. Results revealed that depression was significantly related to the following variables: race, gender, age, smoking, number of traumatic life events, number of life stressors, perceived health, self-esteem, and physical health scores.

Table 3

Bivariate Analyses Between Obesity and Potential Risk Factors (N = 3,272)

Variable 1	Variable 2	Test	Test Statistic	*p*
BMI group (5 groups)	Depression	χ^2	15.97	0.003
BMI group	Race	χ^2	40.34	< .0001
	Gender	χ^2	19.01	0.001
	Age	*F*	5.45	< .0001
	Living status	χ^2	28.91	0.090
	Education	*MH**	1.96	0.162
	Marital status	χ^2	16.43	0.173
	Diabetes	χ^2	2.28	0.685
	Smoking	χ^2	2.77	0.596
	Self-esteem	*F*	3.22	0.012
	Perceived health	*F*	8.45	< .0001
	Physical health score	*F*	6.93	< .0001
	Life stressors	*F*	5.22	< .0001
	Traumatic events	*F*	0.56	0.693
Depression	Race	χ^2	104.53	< .0001
	Gender	χ^2	55.79	< .0001
	Age	t-test	8.28	< .0001
	Living status	χ^2	0.18	0.674
	Education	χ^2	6.82	0.146
	Marital status	χ^2	5.97	0.113
	Diabetes	χ^2	2.87	0.090
	Smoking	χ^2	8.00	0.005
	Self-esteem	t-test**	23.28	< .0001
	Perceived health	t-test**	6.31	< .0001
	Physical health score	t-test**	20.03	< .0001
	Life stressors	t-test**	14.42	< .0001
	Traumatic events	t-test**	11.99	< .0001

*Mantel Haenszel chi-square test was performed because both variables are ordinal scale variables.

**Due to the unequal variance problem, the Satterthwaite t-test was performed.

Multivariate Analyses

Multiple logistic regression analyses were conducted to examine the relationship between BMI group (i.e., underweight, normal, overweight, obese, and extremely obese) and depression, while controlling for confounding factors. Based on the results of bivariate analyses, the following were included in the multivariate analyses as control variables: demographic variables (i.e., age, gender, and race/ethnicity), health-related variables (i.e., smoking, physical health, perceived health), life events variables (i.e., traumatic events, life stressors), and self-esteem. The global

model likelihood ratio test indicated that the overall model was statistically significant (χ^2 = 479.99, *df* = 11, $p < .001$). The Hosmer and Lemeshow goodness-of-fit test results showed that this model has a good fit for prediction (χ^2 = 4.13, *df* = 8, $p = 0.845$). Race, smoking, and perceived health were not statistically significant at $\alpha = 0.05$. Considering all of the potential confounding factors, the BMI group was statistically significant with depression. As BMI changed from underweight to normal to overweight, the chance of depression decreased 30% (*OR* = 0.70, 95% CI: 0.59 – 0.83, $p < .001$).

Age had a negative relationship with depression, which means that a participant in this population will have lower odds of depression when he or she is older (*OR* = 0.95, 95% CI: 0.94–0.97, $p < .001$). If a participant was male, he had almost 50% less odds of being depressed (*OR* = 0.51, 95% CI: 0.34–0.75, $p < .001$). For the life events variables, with each additional traumatic event, the odds of depression increased more than 14% (*OR* = 1.14, 95% CI: 1.04–1.26, $p = .008$). Also, with one additional life stressor, the odds of depression increased by more than 13% (*OR* = 1.13, 95% CI: 1.05–1.23, $p = .002$). The physical health score was statistically significant with depression. If the physical health score went up one unit, the odds of depression went down 4.3% (*OR* = 0.96, 95% CI: 0.95–0.97, $p < .001$). Self-esteem score had a negative relationship with depression. If the self-esteem score went up one unit, then the odds of being depressed went down 3.6% (*OR* = 0.96, 95% CI: 0.96–0.97, $p < .001$). Table 4 presents results of the multiple logistic regression analyses.

Table 4

Multiple Logistic Regression Analyses Results for the Dependent Variable, Depression

Variable	*B*	Odds (95% CL)	*p*
Age	-0.0500	0.943 (0.920 – 0.967)	< 0.001
Gender	-0.6797	0.507 (0.341 – 0.754)	0.001
Race			
Caucasian vs. other	0.2749	1.574 (0.828 – 2.989)	0.049
African American vs. other	-0.0965	1.085 (0.549 – 2.144)	0.533
Smoking status	-0.1527	0.858 (0.482 – 1.530)	0.605
Self-esteem	-0.0367	0.964 (0.955 – 0.973)	< 0.001
Perceived health	0.0014	1.001 (0.997 – 1.006)	0.532
Physical health score	-0.0438	0.957 (0.948 – 0.966)	< 0.001
Life stressors	0.1250	1.133 (1.046 – 1.227)	0.002
Traumatic events	0.1338	1.143 (1.035 – 1.262)	0.008
BMI group	-0.3591	0.698 (0.591 – 0.825)	< 0.001

Discussion

This study examined the association between obesity and depression among patients at multiple sites of an FQHC in South Mississippi. Fifty-seven percent of the respondents fell within the obese or extremely obese categories. This is considerably higher than Mississippi's overall adult obesity rate (37.3%; The State of Obesity, 2016). Of those who fell within the obese category, 36.4% showed depression. Interestingly, although this figure is quite high, even greater prevalence rates of depression were found among participants who were underweight (51.5%) or normal weight (46.2%).

The association between the severity of obesity (i.e., underweight, normal, overweight, obese, extremely obese) and depression was further examined at the multivariate level, while adjusting for potential confounders including socio-demographic variables, physical health, self-esteem, life stressors, and traumatic events. Results revealed that there was a significant and negative relationship between BMI group and depression, which means that higher BMI was associated with a lower risk of depression. This finding is inconsistent with previous studies (Dearborn et al., 2018; de Wit et al., 2010; de Wit et al., 2009; Hung et al., 2014; Luppino et al., 2010; John et al., 2005; Mannan et al., 2016; Pereira-Miranda et al., 2017; Xiang & An, 2015). For example, a meta-analysis study regarding the association between obesity and depression reported that those considered obese were more likely to show symptoms of depression (de Wit et al., 2010). The population included in that study, however, was the general population; our study included only individuals who received services from an FQHC. Individuals receiving services from FQHCs have lower socioeconomic status and are more likely to be uninsured and have Medicaid than the general public (Nath, Costigan, & Hsia, 2016). Moreover, our study population had a uniquely high prevalence of obesity, even by Mississippi standards. Our findings suggest social normalization of obesity may influence the prevalence of depression. The association between obesity and depression may differ by various factors such as gender, race, ethnicity, and region (Assari, 2014). Future studies should examine how these factors play a role in the relationship between obesity and depression.

Of the covariates examined in this study, being female, being younger, having more frequent exposure to traumatic events and stressors, having lower levels of physical health, and having lower self-esteem were associated with increased likelihood of depression. These findings are supported by existing literature. Younger age and being female have been found to increase the chances of depression (Brody et al., 2018; Gonzalez et al., 2010; Heo et al., 2008; NIMH, 2017; USPSTF, 2016). Stressful life events have been linked to the development of depression, and physical health scores have been found to be worse among depressed individuals compared to non-depressed individuals (Phillips, Carroll, & Der, 2015; Verma et al., 2010). Self-esteem has been found to have a negative association with depression (Orth, Robins, Meier, & Conger, 2016).

Implications for Practice and Policy

The findings from this study are at odds with previous investigations that identified a correlation between obesity and depression (Luppino et al., 2010). As previously mentioned, samples used in these other studies were drawn from the general population. Our study only included patients receiving services from an FQHC located in South Mississippi. This population is comprised of lower socioeconomic status individuals, many of whom are either uninsured or underinsured. In addition, Mississippi has the second highest obesity rate in the nation at 37.3% (The State of Obesity, 2016).

The difference in results between our sample and others may be found in the way the individuals and their communities view obesity. Studies have revealed that body image is negatively impacted as weight increases (Schwartz & Brownell, 2004). However, as the rate of obesity in our study sample is higher than the general population, our sample may not have experienced the discrimination or stigma reported in previous investigations that identified a link between obesity and psychological distress (Carr & Friedman, 2005). Past research has also shown that race/ethnicity and culture have an effect on body satisfaction and body size, particularly among African American people, who have reported greater acceptance of larger body sizes compared to other racial/ethnic groups (Caprio et al., 2008; Powell & Kahn, 1995). Our results underscore the need to explore the role of cultural norms in body image. It is possible that our sample views obesity in a more favorable light than the general population.

It has been argued that depression can lead to obesity. This idea developed based on studies connecting physical activity and unhealthy eating habits to depression (Adamson, Yang, & Motl, 2016; Paans et al., 2018). Such factors clearly influence weight. It is possible, however, that the rate of obesity in our study population is related to a lack of food choices in low-income communities and not a result of depressive symptoms. For example, a 2009 study revealed a link between food choice and income level, as women purchasing food for their families believed that healthy food was unaffordable (Dammann & Smith, 2009). This would suggest that other factors might have more important roles in determining individual weight.

Our results indicate that depression is not as prevalent among obese patients in low-income communities. This information highlights the need for health-education efforts and interventions to focus on influencing changes within communities as well as addressing the medical and emotional needs of individuals. This finding highlights the need to fund obesity prevention and intervention efforts at the community level, especially in low-income communities.

Limitation

This is cross-sectional research, so we cannot infer a causal relationship between the severity of obesity and depression symptoms. We have a participation bias since the study sample voluntarily visited the clinics for health problems. To determine obesity more clearly, it would be

better to obtain more information such as waist circumference or body fat percent. The general population of South Mississippi might show a relationship between obesity and depression that is more in line with the results of previous research.

References

Adamson, B. C., Yang, Y., & Motl, R. W. (2016). Association between compliance with physical activity guidelines, sedentary behavior and depressive symptoms. *Preventive Medicine, 91,* 152–157. doi:10.1016/j.ypmed.2016.08.020

Arroll, B., Goodyear-Smith, F., Crengle, S., Gunn, J., Kerse, N., Fishman, T., & Hatcher, S. (2010). Validation of PHQ-2 and PHQ-9 to screen for major depression in the primary care population. *The Annals of Family Medicine, 8*(4), 348–353. doi:10.1370/afm.1139

Assari, S. (2014). Association between obesity and depression among American Blacks: Role of ethnicity and gender. *Journal of Racial and Ethnic Disparities, 1,* 36–44. doi:10.1007/s40615-014-0007-5

Brody, D. J., Pratt, L. A., & Hughes, J. P. (2018). *Prevalence of depression among adults aged 20 and over: United States, 2013–2016.* NCHS Data Brief No. 303. Retrieved from https://www.cdc.gov/nchs/data/databriefs/db303.pdf

Caprio, S., Daniels, S. R., Drewnowski, A., Kaufman, F. R., Palinkas, L. A., Rosenbloom, A. L., & Schwimmer, J. B. (2008). Influence of race, ethnicity, and culture on childhood obesity: Implications for prevention and treatment. *Diabetes Care, 31*(11), 2211–2221. doi:10.2337/dc08-9024

Carr, D., & Friedman, M. A. (2005). Is obesity stigmatizing? Body weight, perceived discrimination, and psychological well-being in the United States. *Journal of Health and Social Behavior, 46*(3), 244–25.

Centers for Disease Control and Prevention [CDC]. (2015). *The health effects of overweight and obesity*. Retrieved from https://www.cdc.gov/healthyweight/effects/index.html

Centers for Disease Control and Prevention [CDC]. (2016). *Defining adult overweight and obesity*. Retrieved from https://www.cdc.gov/obesity/adult/defining.html

Chang, H. H., & Yen, S. T. (2012). Association between obesity and depression: Evidence from a longitudinal sample of the elderly in Taiwan. *Aging & Mental Health, 16*(2), 173–180. http://dx.doi.org/10.1080/13607863.2011.605053

Dammann, K. W., & Smith, C. (2009). Factors affecting low-income women's food choices and the perceived impact of dietary intake and socioeconomic status on their health and weight. *Journal of Nutrition Education and Behavior*, *41*(4), 242–253.

Dearborn, P. J., Robbins, M. A., & Elias, M. F. (2018). Challenging the "jolly fat" hypothesis among older adults: High body mass index predicts increases in depressive symptoms over a 5-year period. *Journal of Health Psychology, 23*(1), 48–58. https://doi.org/10.1177/1359105316675209

Relationship Between Obesity and Depression

de Wit, L., Luppino, F., van Straten, A., Penninx, B., Zitman, F., & Cuijpers, P. (2010). Depression and obesity: A meta-analysis of community-based studies. *Psychiatry Research, 178*(2), 230–235. doi:10.1016/j.psychres.2009.04.015

de Wit, L. M., van Straten, A., van Herten, M., Penninx, B. W., & Cuijpers, P. (2009). Depression and body mass index, a U-shaped association. *BMC Public Health, 9*(14). doi:10.1186/1471-2458-9-14

Dieleman, J. L., Baral, R., Birger, M., Bui, A. L., Bulchis, A., Chapin, A., … Murray, C. J. (2016). U.S. spending on personal health care and public health, 1996–2013. *Journal of the American Medical Association, 316*(24), 2627–2646. doi:10.1001/jama.2016.16885

Flegal, K. M., Kruszon-Moran, D., Carroll, M. D., Fryar, C. D., & Ogden, C. L. (2016). Trends in obesity among adults in the United States, 2005 to 2014. *Journal of the American Medical Association, 315*(21), 2284–2291. doi:10.1001/jama.2016.6458

Gonzalez, O., Berry, J. T., McKnight-Eily, L. R., Strine, T., Edwards, V. J., Lu, H., & Croft, J. B. (2010). Current depression among adults – United States, 2006 and 2008. *Morbidity and Mortality Weekly Report*. Retrieved from https://www.cdc.gov/mmwr/preview/mmwrhtml/mm5938a2.htm?s_cid=mm5938a2_w

Grant, T., Lott, L., Courtney, C., II., Johnson, X., Sutton, V., & Zhang, L. (2016). *Mississippi obesity action plan 2016.* Mississippi State Department of Health.

Harvard Law School Mississippi Delta Project. (2014). *Mental health in Mississippi: Analysis and recommendations.* Retrieved from http://www.deltadirections.com/wp-content/uploads/2013/05/Mental-Health-in-Mississippi-.pdf

Heo, M., Murphy, C. F., Fontaine, K. R., Bruce, M. L., & Alexopoulos, G. S. (2008). Population projection of U.S. adults with lifetime experience of depressive disorder by age and sex from year 2005 to 2050. *International Journal of Geriatric Psychiatry, 23*(12), 1266–1270. doi:10.1002/gps.2061

Hung, C.-F., Rivera, M., Craddock, N., Owen, M. J., Gill, M., Korszun, A., … McGuffin, P. (2014). Relationship between obesity and the risk of clinically significant depression: Mendelian randomization study. *The British Journal of Psychiatry, 205*(1), 24–28. https://dx.doi.org/10.1192%2Fbjp.bp.113.130419

John, U., Meyer, C., Rumpf, H.-J., & Hapke, U. (2005). Relationships of psychiatric disorders with overweight and obesity in an adult general population. *Obesity Research, 13*(1), 101–109.

Kim, D. D., & Basu, A. (2016). Estimating the medical care costs of obesity in the United States: Systematic review, meta-analysis, and empirical analysis. *Value in Health, 19*, 602–613. http://dx.doi.org/10.1016/j.jval.2016.02.008

Kolbo, J. R., Zhang. L, Werle, N., Molaison, E. F., Harbaugh, B., Kirkup, M., & Walker, E. (2016). Overweight and obesity prevalence and trends among Mississippi public school students: A decade of data between 2005 and 2015. *Journal of the Mississippi State Medical Association, 57*(10), 1–9.

Kroenke, K., Spitzer, R. L., & Williams, J. B. (2001). The PHQ-9: Validity of a brief depression severity measure. *Journal of General Internal Medicine, 16*(9), 606–613.

Lépine, J.-P., & Briley, M. (2011). The increasing burden of depression. *Neuropsychiatric Disease and Treatment, 7*(Suppl 1), 3–7. doi: 10.2147/NDT.S19617

Luppino, F. S., de Wit, L. M., Bouvy, P. F., Stijnen, T., Cuijpers, P., Penninx, B. W., & Zitman, F. G. (2010). Overweight, obesity, and depression: A systematic review and meta-analysis of longitudinal studies. *Archives of General Psychiatry, 67*(3), 220–229. doi:10.1001/archgenpsychiatry.2010.2

Mannan, M., Mamun, A., Doi, S., & Clavarino, A. (2016). Prospective associations between depression and obesity for adolescent males and females: A systematic review and meta-analysis of longitudinal studies. *PLoS ONE, 11*(16). doi:10.1371/journal.pone.0157240

Mendy, V. L., Vargas, R., Cannon-Smith, G., & Payton, M. (2017). Overweight, obesity, and extreme obesity among Mississippi adults, 2001–2010 and 2011–2015. *Preventing Chronic Disease, 14*. https://doi.org/10.5888/pcd14.160554

Mental Health America. (2018). *Mental health in America – Access to care data*. Retrieved from http://www.mentalhealthamerica.net/issues/mental-health-america-access-care-data

Nath, J. B., Costigan, S., & Hsia, R. Y. (2016). Changes in demographics of patients seen at Federally Qualified Health Centers, 2005–2014. *JAMA Internal Medicine, 176*(5), 712–714.

National Center for Health Statistics. (2017). *NCHS fact sheet: National Health and Nutrition Examination Survey*. Retrieved from https://www.cdc.gov/nchs/data/factsheets/factsheet_nhanes.pdf

National Institute of Mental Health [NIMH]. (2017). *Major depression*. Retrieved from https://www.nimh.nih.gov/health/statistics/major-depression.shtml

Nigatu, Y. T., Reijneveld, S. A., de Jonge, P., van Rossum, E., & Bültmann, U. (2016). The combined effects of obesity, abdominal obesity, and major depression/anxiety on health-related quality of life: The LifeLines cohort study. *PLoS ONE, 11*(2). doi:10.1371/journal.pone.0148871

Orth, U., Robins, R. W., Meier, L. L., & Conger, R. D. (2016). Refining the vulnerability model of low self-esteem and depression: Disentangling the effects of genuine self-esteem and narcissism. *Journal of Personality and Social Psychology, 110*(1), 133–149. http://dx.doi.org/10.1037/pspp0000038

Paans, N. P., Bot, M., Brouwer, I. A., Visser, M., Roca, M., Kohls, E., & Penninx, B. W. (2018). The association between depression and eating styles in four European countries: The MooDFOOD prevention study. *Journal of Psychosomatic Research, 108*, 85–92. doi:10.1016/j.jpsychores.2018.03.003

Pan, A., Lucas, M., Sun, Q., van Dam, R. M., Franco, O. H., Manson, J. E., … Hu, F. B. (2010). Bidirectional association between depression and type 2 diabetes in women. *Archives of Internal Medicine, 170*(21), 1884–1891. doi:10.1001/archinternmed.2010.356

Parkerson, G. R., Jr., Broadhead, W. E., & Tse, C. K. (1990). The Duke Health Profile: A 17-item measure of health and dysfunction. *Medical Care, 28*(11), 1056–1072.

Parkerson, G. R., Jr., Broadhead, W. E., & Tse, C. K. (1991). Development of the 17-item Duke Health Profile. *Family Practice, 8*(4), 396–401.

Pereira-Miranda, E., Costa, P. R., Queiroz, V. A., Pereira-Santos, M., & Santana, M. L. (2017). Overweight and obesity associated with higher depression prevalence in adults: A systematic review and meta-analysis. *Journal of the American College of Nutrition, 36*(3), 223–233. doi:10.1080/07315724.2016.1261053

Phillips, A. C., Carroll, D., & Der, G. (2015). Negative life events and symptoms of depression and anxiety: Stress causation and/or stress generation. *Anxiety Stress Coping, 28*(4), 357–371. doi:10.1080/10615806.2015.1005078

Powell, A. D., & Kahn, A. S. (1995). Racial differences in women's desires to be thin. *International Journal of Eating Disorders, 17*(2), 191–195.

Qobadi, M., & Payton, M. (2017). Racial disparities in obesity prevalence in Mississippi: Role of socio-demographic characteristics and physical activity. *International Journal of Environmental Research and Public Health, 14*(258). doi:10.3390/ijerph14030258

Segal, L. M., Rayburn, J., & Beck, S. E. (2017). *The state of obesity: Better policies for a healthier America 2017*. Retrieved from https://stateofobesity.org/wp-content/uploads/2018/08/stateofobesity2017.pdf

Schwartz, M. B., & Brownell, K. D. (2004). Obesity and body image. *Body image, 1*(1), 43–56.

The State of Obesity. (2016). *Adult obesity in the United States*. Retrieved from https://stateofobesity.org/adult-obesity/

University of Mississippi Medical Center [UMMC]. (n.d.). *Obesity in Mississippi*. Retrieved from https://www2.umc.edu/Administration/Centers_and_Institutes/Mississippi_Center_for_Obesity_Research/Obesity_in_Mississippi.aspx

U.S. News & World Report. (2018). *Best states 2018: Ranking performance throughout all 50 states*. Retrieved from https://media.beam.usnews.com/72/92/aae484e24a139c33fd2658193683/171206-best-states-overall-rankings-2018.pdf

U.S. Preventive Services Task Force [USPSTF]. (2016). *Final recommendation statement: Depression in adults: Screening*. Retrieved from https://www.uspreventiveservicestaskforce.org/Page/Document/RecommendationStatementFinal/depression-in-adults-screening1

Verma, S. K., Luo, N., Subramaniam, M., Sum, C. F., Stahl, D., Liow, P. H., & Chong, S. A. (2010). Impact of depression on health related quality of life in patients with diabetes. *Annals of the Academy of Medicine, Singapore, 39*(12), 913–919.

Williams, E. P., Mesidor, M., Winters, K., Dubbert, P. M., & Wyatt, S. B. (2015). Overweight and obesity: Prevalence, consequences, and causes of a growing public health problem. *Current Obesity Reports, 4*, 363–370. doi:10.1007/s13679-015-0169-4

World Health Organization [WHO]. (2018a). *Depression*. Retrieved from http://www.who.int/mediacentre/factsheets/fs369/en/

World Health Organization [WHO]. (2018b). *Obesity and overweight*. Retrieved from http://www.who.int/mediacentre/factsheets/fs311/en/

Xiang, X., & An, R. (2015). Obesity and onset of depression among U.S. middle-aged and older adults. *Journal of Psychosomatic Research, 78*, 242–248. http://dx.doi.org/10.1016/j.jpsychores.2014.12.008

Author Note

Hwanseok Choi, Department of Public Health, University of Southern Mississippi; Joohee Lee, School of Social Work, University of Southern Mississippi; Stephanie T. McLeod, School of Social Work, University of Southern Mississippi; Rambod A. Rouhbakhsh, Family Medicine Resident, Forrest General Hospital; Michelle Brazeal, School of Social Work, University of Southern Mississippi; Tim Rehner, School of Social Work, University of Southern Mississippi; and David M. Cochran, Department of Geography and Geology, University of Southern Mississippi.

Correspondence concerning this article should be addressed to Hwanseok Choi, Department of Public Health, University of Southern Mississippi, 118 College Drive #5122, Hattiesburg, MS 39406-0001. E-mail: Hwanseok.Choi@usm.edu