



Original Article

Hospital length of stay and healthcare costs among African American women due to obesity and diabetic conditions in United States: A model for correlation studies comparing ethnicity, co-morbidities and hospital resources

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Abstract

Objective: To examine obesity and diabetes associations with United States hospital use and healthcare costs for African American women, to explore the relationship between co-morbidities of interest (obesity and diabetes) and hospital resources [length of stay (LOS) and costs].

Methods: A retrospective, correlation, quantitative analysis for lengths of hospital stay and cost among adult African American women categorized according to their weight status with type 2 diabetes. Healthcare Cost and Utilization Project (HCUP) data which contains the Nationwide Inpatient Sample was used. Focused on 803,163 African American, female inpatients between the ages of 21 and 55 in the United States from 2008 to 2010. Researcher explored the relationship between individual health factors of interest (obesity and diabetes) and the effects on hospital LOS and healthcare costs. All statistical analysis will be performed using Stata v12. All inferential tests will be two-sided and will utilize a 95% significance level. Two separate multiple regressions will be used.

Results: A total of 758,874 records were retained for analysis. The patients in the weighted population ranged in age from 21 to 55 years. The patient LOS ranged from 0 to 333 days. The patients had approximately 2 procedures on average, and presented with approximately 3 chronic conditions on average. The total charges (Cost) ranged from 106 to over 1 million US dollars. The size and direction of the relationship between LOS, healthcare costs and the independent variables of diabetes and obesity suggests that both LOS and health care cost decreased for African American female patients with diabetes or obesity. There is a statistically significant relationship between at least one of the individual health factors of interest (obesity and diabetes) and hospital LOS ($F = 13,394.00$, $P < 0.0005$, $R^2 = 0.440$) and hospital costs ($F = 10,171.23$, $P < 0.0005$, $R^2 = 0.502$).

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Conclusions: There is evidence of racial and ethnic disparities in health care quality in hospital treatment of African American patients. After accounting for social determinants and insurance statuses, African Americans may receive lower-quality care than the population at large. African Americans are admitted to the hospital, but services and LOS are shorter than the general population partially due to disparities in evaluating and offering treatment.

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Keywords: Diabetes; Obesity; African American; Length of stay; Hospital costs

Introduction

Obesity is the second leading cause of preventable death in the United States and the most prevalent, fatal, chronic, relapsing disorder of the 21st century.¹ Rising obesity and its associated comorbidities result in deleterious effects on health status^{2,3} and a significant increase in health burdens.^{4,5} Excess cost attributable to overweight and obesity was reported to be approximately 92.6 billion US dollars, comprising between 6 and 10% of the total health care expenditure of the US.^{6,7} Obese individuals had 36% higher annual health care costs than non-obese individuals. For all ethnicity of women, the rate of obesity is highest in LOS. African American women and they are affected by obesity related comorbidities disproportionately.^{7,8} At least three reasons may account for the racial and ethnic differences in obesity. First, racial and ethnic groups differ in behaviors that contribute to weight gain; second explanation may be differences in individual attitudes and cultural norms related to body weight; third explanation may be differences in access to affordable, healthful foods and safe locations to be physically active.

Many experts believe there is no coincidence that the rise in obesity among Americans correlates with a staggering increase in diabetes, which has reached epidemic proportions, more notably in the African American population. The relationship between obesity and hospital health care use has received very little attention. An even smaller body of literature has focused on use of hospital care resources and hospital length of stay (LOS) among obese African American with diabetes; and the research that is available failed to provide consistent results. The substantial prevalence of overweight and obese may pose a threat to future hospital services. To further address the burden of overweight and obesity in hospitals, research is needed to provide data about consequences of obesity on LOS, use of hospital resources and overall hospital cost.

This study will serve as a model for future studies on hospital LOS and health care cost in high risk

populations of primary diseases with comorbidities. The study will provide baseline research for one high risk population, obese African American women with diabetes. Obesity is associated with health problems, such as diabetes and cardiovascular disease and one consequence of the obesity epidemic may be increased hospital use and LOS.⁹ By means of a retrospective, correlation, quantitative analysis, baseline data will be provided on lengths of hospital stay and cost among adult African American women individuals categorized according to their weight status with type 2 diabetes mellitus (T2DM). The aim of this research is to study the effects of obesity and diabetes on hospital resources for African American women between the ages of 21 and 55 providing a model for conducting obesity outcome research involving other racial/ethnic minorities and socioeconomically disadvantaged groups.

Methods

This retrospective, correlational, quantitative study examines obesity and diabetes associations with United States hospital use and healthcare costs for African American women to explore the relationship between co-morbidities of interest (obesity and diabetes) and hospital resources (LOS and costs).

As the aim of the study is to estimate the hospital LOS and associated cost, related to obesity in African American women with T2DM; The cost of illness study would suggest that hospital costs could potentially be saved if obesity would be eliminated.¹⁰ Primary prevention by health promotion campaigns and secondary by mental and dietary treatment can significantly decrease hospital costs obesity inflicts on society.¹¹

Research design

This study will follow a retrospective, quantitative, correlational design. A quantitative correlational design seeks to examine potential relationships between variables.^{12–15} Further insight into why this

design selection is appropriate for this study can be seen by examining the three parts of the design separately (retrospective, quantitative, and correlational).

This data will be retrospective due to the use of archival data for analysis. In retrospective studies, the outcome of interest has already occurred at the time the study is initiated. For this study, the data is archival, and the outcome of interest occurred in 2008, 2009, or 2010. Retrospective studies allow the researcher to estimate the effect of an exposure on an outcome and obtain measures of association, both of which are objectives of this study.

Quantitative research attempts to identify relationships between variables using trends, meanings, and suggested characteristics.^{14,16–19} Using a quantitative design for this study will allow the researcher to explore the relationship between individual health factors of interest (obesity and diabetes) and the effects on hospitals (hospital LOS and healthcare costs).

Correlational studies should be used when independent variable variation has occurred without researcher control. In this study, the researcher is not able to control any of the independent variables; the variation within the independent variables occurred prior to data collection. All data is retrospective and; therefore, the researcher is unable to introduce any type of intervention, only examine the relationships between variables. The basic purpose of a correlational study is to determine the relationship between variables, but not the cause of this relationship. According to Triola (1998), coming to the conclusion that the results of a correlational study imply causality must be avoided.²⁰

Population and sample criteria

The focus of this study will be 803,163 African American, female inpatients between the ages of 21 and 55 in the United States from 2008 to 2010. The rationale for using an age range of 21–55 was primarily due to the risk of developing cardiovascular disease and T2DM increases with age. Age ranges for studies reviewed which focused on diabetic and cardiovascular disorders were age 55–60 for female adults. In an attempt to not confound the study results with other comorbidity conditions, the study uses a conservative approach and focused on aged 21 and older to a maximum age of 55 years. For this study, Healthcare Cost and Utilization Project (HCUP) data will be used. The HCUP data contains the Nationwide Inpatient Sample (NIS). The NIS contains data on more than seven million hospital stays each year. The NIS is sampled from the State

Inpatient Database (SID), which contains all inpatient data that are currently contributed to HCUP. NIS depends on the hospitals to ensure accuracy, completeness, and consistency of the data. Validity and reliability of the data from the hospitals to HCUP is out of the researcher's realm of control. HCUP is a family of health care databases developed through a Federal-State-Industry partnership and sponsored by the Agency for Healthcare Research and Quality. HCUP databases bring together the data collection efforts of State data organizations, hospital associations, private data organizations, and the Federal government to create a national information resource of encounter-level health care data. HCUP includes the largest collection of longitudinal hospital care data in the United States, with all-payer, encounter-level information and these databases enable research on a broad range of health policy issues, including cost and quality of health services, medical practice patterns, access to health care programs, and outcomes of treatments at the national, State, and local market levels.²¹ Despite the lack of control validity and reliability of the data, due to the federal protocols and its use in a large number of studies, the NIS proves to provide a good source of “real-world” health care data for reliably reported data.²²

Power analysis

Power analysis for multiple regression was performed using G*Power 3.1.9.2 using a two-tailed test, a small effect size of 0.02, an alpha of 0.05, a power of 0.80, and while testing for two predictors, with an estimated total number of predictors set at 40.²³ The total number of predictors was estimated to be high since this study will be adding control variables to the model based on correlations being greater than or equal to 0.30; with the high number of possible predictors to be added as control, the total number of predictors was estimated to account for the possibility of a large number of potential control variables with correlations above or at 0.30. The results of the power analysis indicated that in order to power the multiple regression with the ability to detect small effects, a sample of size $n = 485$ is necessary.

Power analysis was also performed for correlational analysis using G*Power 3.1.9.2 using a two-tailed test, a small effect size of 0.10, an alpha of 0.05, a power of 0.80, and a correlation for the null hypothesis of 0. The results indicated that in order to power this *Pearson's r* correlational analysis, a sample of size $n = 782$ is necessary. For some of the variables in this study,

Spearman's rank order correlations will be used due to the use of ordinal variables. The sample size required for Pearson's *r* correlations will be used in tandem with the asymptotic relative efficiency (ARE) in order to calculate the required sample size for *Spearman's* rank order correlation. The required sample size can then be calculated by dividing the calculated sample size for *Pearson's r* ($n = 782$) by the ARE (0.91), which gives a required sample of $n = 840$. The required sample size chosen will be the largest of the three power analyses, $n = 840$.

Data collection procedures

NIS Core and Severity datasets for 2008 to 2010 will be used for analysis in this study. These datasets will be obtained from the HCUP Central Distributor.

Data analysis

All statistical analysis will be performed using Stata v12. All inferential tests will be two-sided and will utilize a 95% significance level. Prior to hypothesis testing, descriptive statistics will be included to examine measures of central tendency (mean, median, standard deviation, and range) for all continuous variables in the study. Frequencies and percentages will be included for all categorical variables. All inferential tests will be performed using survey data analysis which will take into account the variable DISCWT from the NIS Core database. This variable is a weight variable which is used to make the sample more representative of national estimates. According to Heeringa, West, and Berglund (2010), weighting of survey data is required in order to “map the sample back to an unbiased representation of the population”.²⁴

Two separate multiple regressions will be used. Prior to hypothesis testing, the assumptions (absence of outliers, normality, linearity, and homoscedasticity) will be checked for both models. Multiple regression is robust from deviations from normality as long as the homoscedasticity assumption is met.^{25,26} Visual inspection of a histogram and Normal Q-Q plots was performed on the dependent variable of the study to check for deviations from normality. If the normality assumption is severely violated (mean and 5% trimmed mean vary greatly, and the mean and median vary greatly), then logarithmic or other transformation of the dependent variable will be considered to meet the normality assumption. Homoscedasticity will be checked using the plot of residuals with the regression analysis.

One of the two multiple regressions will use LOS as the dependent variable in analysis, and the following as

independent variables: (a) obesity, (b) diabetes, and (c) variables with a correlation of 0.30 or greater with LOS to be used as control variables. The other multiple regression will use hospital costs as the dependent variable in analysis, and the following as independent variables: (a) obesity, (b) diabetes, and (c) variables with a correlation of 0.30 or greater with hospital costs to be used as control variables.

Ethical considerations

Ethical considerations for the use of this data are assured by the required HCUP Data Use Agreement (DUA) training. The DUA has specific requirements which must be followed by the researcher in order to preserve patient rights. The DUA emphasizes the importance of data protection and makes this an individual responsibility of the researcher. The DUA focuses on protection of individual identities. All data elements which can be used to directly identify an individual have been previously removed. Hospital names will not be reported, and any tabulated data in a cell size of ten or less cannot legally be reported.

Results

Descriptive statistics

A total of 758,874 records were retained for analysis. [Table 1](#) presents the measures of central tendency (mean, median, standard deviation, and range) for

Table 1
Measures of central tendency for continuous variables for the sample and the population.

Variable	Mean	SD	Median	Range
LOS(days)				
Sample	4.15	5.64	3.00	0–333
Population	4.15	5.66	3.00	0–333
Cost (US dollars)				
Sample	25,502.19	41,426.80	15,010.00	106–1,469,196
Population	25,665.26	41,772.48	15,075.00	106–1,469,196
Age (years)				
Sample	37.21	10.54	37.00	21–55
Population	37.23	10.54	37.00	21–55
NumProc				
Sample	1.54	1.72	1.00	0–31
Population	1.54	1.72	1.00	0–31
NumChronic				
Sample	2.85	2.74	2.00	0–22
Population	2.85	2.74	2.00	0–22

Sample $n = 758,874$; Population $n = 3,794,690$; SD: standard deviation; LOS: length of stay in hospital, measured in days; NumProc: number of the procedures; NumChronic: number of the chronic conditions of the patient.

sample and the weighted population data, for the continuous variables in the study. The patients in the weighted population ranged in age from 21 to 55 years. The patient LOS ranged in value from 0 to 333 days. The patients had approximately 2 procedures on average, and presented with approximately 3 chronic conditions on average. The total charges (Cost) ranged from 106 to over 1 million US dollars.

Table 2 presents the measures of central tendency (mean, median, standard deviation, and range) for sample and the weighted population data, for the continuous variables in the study, for the Northeast region. The weighted population of patients in the Northeast ranged in age from 21 to 55 years. The patient LOS ranged in value from 0 to 311 days. The patients had approximately 2 procedures on average, and presented with approximately 3 chronic conditions on average. The total charges (Cost) ranged from 142 to over 1 million US dollars.

Table 3 presents the frequencies and percentages of the health variables of interest for the sample and population. Approximately 14.9% of the patients in the weighted population presented with the individual health factor of diabetes, 13.9% of the patients presented with the individual health factor of obesity.

Table 4 presents the frequencies and percentages of the health variables of interest for the sample and population, according to region. Patients with diabetes ranged from 13.9% in the Northeast to 16.2% in the Midwest. Obesity was lower in the Northeast (11.1%) than in the other three regions (14.3%–14.7%).

Table 2
Measures of central tendency for the continuous variables for the Northeast region.

Variable	Mean	SD	Median	Range
LOS (days)				
Sample	4.52	6.99	3.00	0–248
Population	4.53	7.01	3.00	0–311
Cost (US dollars)				
Sample	30,708.52	49,500.68	17,932.00	142–1,469,196
Population	31,091.34	50,285.21	18,082.00	142–1,469,196
Age (years)				
Sample	37.89	10.32	38.00	21–55
Population	37.89	10.32	38.00	21–55
NumProc				
Sample	1.51	1.70	1.00	0–25
Population	1.51	1.70	1.00	0–25
NumChronic				
Sample	2.67	2.43	2.00	0–18
Population	2.67	2.42	2.00	0–18

Sample $n = 155,026$; Population $n = 800,980$; SD: standard deviation; LOS: length of stay in hospital, measured in days; NumProc: number of the procedures; NumChronic: number of the chronic conditions of the patient.

Table 3
Frequencies and percentages of sample and population findings for health factors of interest variables.

Variable	Sample, n (%)	Population, n (%)
Diabetes		
Yes	113,364 (14.9)	113,342 (14.9)
No	645,510 (85.1)	645,532 (85.1)
Obesity		
Yes	105,282 (13.9)	105,082 (13.9)
No	653,592 (86.1)	653,792 (86.1)

Sample $n = 758,874$; Population $n = 3,794,690$.

Table 5 presents the frequencies and percentages of the life factor variables for the sample data and the weighted population. Almost half of the patients in the weighted population had an income of 25,000 US dollars or less (48.3%), 40.7% of the patients in the weighted population had Medicaid.

Multiple regression analysis

The relationship between individual health factors of interest (obesity and diabetes) and hospital LOS among African American females

A check of the full correlation table was performed prior to building the regression model. The variables of Cost ($r = 0.650$, $P < 0.0005$) and Severity ($r = 0.338$, $P < 0.0005$) were directly correlated with LOS at the $r \geq 0.30$ threshold, and none of the other variables met the criteria. However, the correlations between LOS and the variables of number of procedures (NumProc) and number of chronic conditions of the patient (NumChronic) were close in value to the $r \geq 0.30$ threshold, with correlation coefficients for NumProc and NumChronic of $r = 0.280$ and $r = 0.226$ respectively.

The dependent variable was LOS. Independent variables included the individual health factors of obesity

Table 4
Frequencies and percentages of sample and population findings for health factors of interest variables, according to region.

Variable/Strata	Sample, n (%)	Population, n (%)
Diabetes		
Northeast	21,532 (13.9)	21,514 (13.9)
South	64,297 (15.0)	64,268 (15.0)
Midwest	18,394 (16.2)	18,459 (16.2)
West	9141 (14.9)	9135 (14.9)
Obesity		
Northeast	17,148 (11.1)	17,140 (11.1)
South	63,038 (14.7)	63,010 (14.7)
Midwest	16,133 (14.2)	16,220 (14.3)
West	8963 (14.7)	8903 (14.6)

Sample $n = 758,874$; Population $n = 3,794,690$.

Table 5
Frequencies and percentages of sample and population findings for life factor variables.

Variable	Sample, <i>n</i> (%)	Population, <i>n</i> (%)
SES, US dollars		
0 to 25,000	366,753 (48.3)	367,399 (48.4)
25,001 to 30,000	169,318 (22.3)	168,875 (22.3)
30,001 to 35,000	132,580 (17.5)	132,244 (17.4)
35,001 and above	90,223 (11.9)	90,355 (11.9)
Medicare pay		
Yes	96,650 (12.7)	96,943 (12.8)
No	662,224 (87.3)	661,931 (87.2)
Medicaid pay		
Yes	309,301 (40.8)	309,177 (40.7)
No	449,573 (59.2)	449,697 (59.3)
Private insurance pay		
Yes	257,240 (33.9)	257,402 (33.9)
No	501,634 (66.1)	501,472 (66.1)
Self-pay		
Yes	63,091 (8.3)	63,141 (8.3)
No	695,783 (91.7)	695,733 (91.7)
No charge		
Yes	6833 (0.9)	6813 (0.9)
No	752,041 (99.1)	752,061 (99.1)
Other		
Yes	25,759 (3.4)	25,398 (3.4)
No	733,115 (96.6)	733,476 (96.7)

SES: Social economic status of patient, measured using the median household income in US dollars for the patient's zip code.

and diabetes. Independent variable controls included Cost, Severity, NumProc, and NumChronic. The variables of Cost, NumProc, and NumChronic were mean centered for use in the regression model. The DISCWT variable was used as the weighting variable, and Region was used as the stratification variable. Results of the regression are presented in Table 6.

The test of the model indicated that at least one predictor was significantly different from zero [$F(6, 758,865) = 13,394.00, P < 0.0005 R^2 = 0.440$]. The Rsquare value of 0.440 indicated that approximately 44% of the variability in the dependent variable of LOS was predicted by the six independent variables in the model. Five predictors were significant for the outcome of LOS: Diabetes, Obesity, Cost, and NumChronic. The squared semi-partial correlation for the predictor of Cost was 0.267, indicating that this variable contributed 27% of unique variance to the LOS outcome. The squared semi-partial correlations for the predictors of Diabetes and NumChronic were 0.020 each, indicating that each of the variables provided 2% unique variance to the LOS model. Obesity and Severity each had squared semi-partial correlations of 0.010 and 0.014 respectively, indicating that each of the variables provided 2% unique variance to the LOS model. The size and direction of the relationship between LOS and

Table 6
Results of multiple regression of the relationship between individual health factors of interest (obesity and diabetes) and hospital length of stay (LOS) among African American females.

Variable	<i>B</i>	<i>SE</i>	<i>t</i>	<i>P</i> value	95% Confidence Interval	
					Upper	Lower
Diabetes	-0.22	0.02	-12.24	<0.0005	-0.26	-0.19
Obesity	-0.20	0.02	-11.84	<0.0005	-0.23	-0.17
Cost	<0.005	<0.005	81.80	<0.0005	<0.005	<0.005
Severity	0.98	0.01	91.02	<0.0005	0.96	1.00
NumProc	-0.01	0.01	-0.95	0.344	-0.03	0.01
NumChronic	0.03	<0.005	10.25	<0.0005	0.03	0.04
Constant	2.41	0.02	115.58	<0.0005	2.37	2.45

B: Unstandardized Regression Coefficient; *SE*: Standard Error; *t*: t-test statistic.

the independent variables of diabetes and obesity suggests that LOS in the hospital decreased for patients with diabetes or obesity compared to patients without the conditions. Increases in cost were associated with increased LOS. Increases in level of Severity and the number of chronic conditions for a patient were also associated with a longer LOS. There is sufficient evidence to indicate that there is a statistically significant relationship between at least one of the individual health factors of interest (obesity and diabetes) and hospital LOS among African American females.

The relationship between individual health factors of interest (obesity and diabetes) and hospital costs among African American females

A check of the full correlation table was performed prior to building the regression model, in order to check for primary diagnoses, comorbidities, and life factor variables that had a correlation with Cost of a magnitude of 0.30 or greater. The variables of LOS ($r = 0.650, P < 0.0005$), NumProc ($r = 0.433, P < 0.0005$), and Severity ($r = 0.320, P < 0.0005$) were directly correlated with Cost at the $r \geq 0.30$ threshold, and none of the other variables met the criteria. However, the correlation between Cost and the variable of NumChronic was close in value to the $r \geq 0.30$ threshold ($r = 0.240, P < 0.0005$).

The dependent variable was cost. Independent variables included the individual health factors of obesity and diabetes. Independent variable controls included LOS, Severity, NumProc, and NumChronic. The variables of cost, NumProc, and NumChronic were mean centered for use in the regression model. The DISCWT variable was used as the weighting variable, and Region was used as the stratification variable. Results of the regression are presented in Table 7.

The test of the model indicated that at least one predictor was significantly different from zero [$F(6, 758,865) = 10,171.23, P < 0.0005 R^2 = 0.502$]. The R^2 value of 0.502 indicated that approximately 50% of the variability in the dependent variable of Cost was predicted by the six independent variables in the model. All six predictors were significant for the outcome of Cost: Obesity LOS, NumProc and NumChronic. The squared semi-partial correlation for the predictor of LOS was 0.238, indicating that this variable contributed 24% of unique variance to the Cost outcome. The squared semi-partial correlation for the predictor of NumProc was 0.067, indicating that NumProc contributed 7% of unique variance to Cost. NumChronic had a squared semi-partial correlation coefficient of 0.004, which meant that NumChronic contributed about 4% unique variance to the Cost outcome. Diabetes, Obesity, and Severity contributed less than 1% unique variance each to the Cost outcome. The size and direction of the relationship between Cost and the independent variables of Diabetes and Obesity suggests that hospital cost of care decreased for patients with diabetes or obesity compared to patients without the conditions. Increases in LOS were associated with increased cost of care. Increases in levels of Severity, the number of procedures, and the number of chronic conditions for a patient were also associated with increased costs of care.

There is sufficient evidence to indicate that there is a statistically significant relationship between at least one of the individual health factors of interest (obesity and diabetes) and hospital costs among African American females.

Discussions

Obesity and diabetes are the major worldwide health problems that are increasing in prevalence each year and affecting the African American population

disproportionately. Treatments for managing the effects of obesity and diabetes are improving, but these tend to focus upon remedying individual comorbidities, rather than treating or reversing the actual cause, obesity. Adding to the challenge of reversing the obesity epidemic is a lack of supportive environment and understanding of societal attitudes and opinions needed to provide motivation at the individual level to execute long term behavior change.

Previous studies examined the link between obesity and diabetes and hospital LOS and hospital costs. However, there is a gap in the literature about the relationship obesity and diabetes and hospital LOS and hospital costs among African American females. The purpose of this quantitative correlational design was to fill these gaps by determining the relationship between individual health factors of interest (obesity and diabetes) and hospital LOS and hospital costs among African American females. The researcher analyzed data using correlation and regression analyses to assess the correlation between several variables. The researcher conducted the study to examine (1) whether a correlation existed between individual health factors of interest (obesity and diabetes) and hospital LOS among African American females, (2) whether a correlation existed between individual health factors of interest (obesity and diabetes) and hospital costs among African American females, and (3) whether a correlation existed between co-morbidities and life factors and individual health factors of interest (obesity and diabetes) among African American females.

Interpretation of the findings

In the present study, LOS in the hospital decreased for patients with diabetes or obesity ($P < 0.05$). Hospital cost of care decreased for patients with diabetes or obesity ($P < 0.05$). There is a statistically significant

Table 7

Results of multiple regression of the relationship between individual health factors of interest (obesity and diabetes) and hospital costs among African American females.

Variable	B	SE	t	P value	95% Confidence Interval	
					Upper	Lower
Diabetes	−503.26	130.48	−3.86	<0.0005	−758.99	−247.52
Obesity	−1490.01	115.90	−12.86	<0.0005	−1717.17	−1262.86
LOS	3958.53	55.42	71.43	<0.0005	3849.91	4067.15
Severity	2673.29	100.30	26.65	<0.0005	2476.71	2869.88
NumProc	6592.79	64.03	102.97	<0.0005	6467.30	6718.28
NumChronic	1339.45	24.33	55.05	<0.0005	1291.76	1387.14
Constant	21,040.40	187.40	112.28	<0.0005	20,673.11	21,407.69

B: Unstandardized Regression Coefficient; SE: Standard Error; t: t-test statistic.

correlation between either co-morbidities or life factors, and at least one of the individual health factors of interest (obesity and diabetes).

In the present study, the size and direction of the relationship between LOS and the independent variables of diabetes and obesity suggests that LOS in the hospital decreased for patients with diabetes or obesity ($P < 0.05$). Findings do not support the findings of the below studies that obese individuals with diabetes experience longer hospital stays than normal weight individuals without diabetes. Thus, findings do not confirm knowledge in the discipline.

Zizza et al (2004) conducted a longitudinal study to demonstrate a time trend in associations between weight status and LOS,⁷ they examined where lengths of hospital stay among individuals categorized according to weight status and found individuals with body mass indexes (BMIs) of 35 kg/m² or above, those with BMIs of 30–34 kg/m², and those with BMIs of 25–29 kg/m² had crude LOS rates greater than those of normal-weight individuals. Zizza et al (2004) concluded that obese individuals experience longer total LOS than normal weight individuals.⁷

Padwal et al examined the relationship between obesity and hospital LOS by conducting a *t*-test,²⁷ they randomly selected 42 severely obese subjects and 42 non-obese controls, and found that obese subjects with diabetes experienced longer hospital stays than non-obese controls without diabetes.

However, in the present study, these findings are consistent according to Betancourt, 2006, which states Institute of Medicine (IOM) report, *Unequal Treatment*, the issue of racial and ethnic disparities in health care in the United States demonstrates that, in addition to racial and ethnic disparities in health status, there is evidence of racial and ethnic disparities in health care quality in hospital treatment. Minorities may receive lower-quality care than their white counterparts, even after taking into account social determinants and insurance status. This unequal treatment identified a set of root causes of racial and ethnic disparities that included, among others: (1) Health system factors to include issues related to the complexity of the health care system and how it may be disproportionately difficult to navigate the system for minority patients, (2) Care-process variables to include issues related to health care providers, including stereotyping, the impact of race/ethnicity on clinical decision-making, and clinical uncertainty due to poor communication, and (3) Patient-level variables to include refusal of services, poor adherence to treatment, and delay in seeking care. In other words, African Americans are

pushed through the health care system, not taken as seriously and screened as diligently when undergoing inpatient services. African Americans are admitted to the hospital, however services and LOS are shortened due to disparities in offering treatment.²⁸

In the present study, hospital cost of care decreased for patients with diabetes or obesity. Findings do not support the findings of the below studies that hospital cost of care increased for patients with diabetes or obesity. Thus, findings do not confirm knowledge in the discipline.

Vernice examined the relationship between obesity and diabetes and hospital costs, extracted totals of 176,540 obese records and 4,480,339 non-obese records. Vernice found that obesity and diabetes were significantly correlated with hospital costs.²⁹

Minhas et al (2015) conducted a multiple regression analysis, they randomly selected 1082 patients, examined the relationship between obesity and hospital costs, found that hospital costs were significantly correlated with obesity and diabetes.³⁰

The present study is significant in that previous research examining the association between weight status and hospital costs has been based on cross-sectional designs. However, cross-sectional studies cannot provide evidence regarding the temporal sequence of an association. The longitudinal investigation enabled the researcher to measure individuals' hospital use patterns subsequent to measurement of their weight.

As LOS is highly correlated with hospital cost, the present study may also relatively indicate the issue of inequity in health care rather than disease severity.²⁷ Hospitalization remains a less discretionary activity, with access and amount being influenced by health professional assessments of severity and type of illness, all of which are subject to personal biases. This present study may be used as the information for health policymakers to solve the inequity problem. An investigation of factors associated with hospitalizations may help health-care providers and administrators intervene to improve patient management and possibly reduce health-care costs in the future. Based on the results of this study, it is suggested that health-care providers and health policymakers may need to focus on the factors associated with an increase in health-care costs and hospitalizations to include disparities in quality of health care delivery to African American women.

Limitations

Three limitations have been addressed in this study. First, the administrative claims data used might be

limited without standardized claims data collection system and standardized data coding excluding International Classification of Diseases 9th Revision (ICD-9) codes across hospitals. This study used the claims data obtained from public hospitals and combined into one data set. Some different coding of administrative claims could exist which would not allow us to identify which type of health-care cost was either diabetic or nondiabetic-related treatment. Thus, in this study, all health-care costs consumed by patients with diabetes were used instead of the costs related to diabetic-related treatment only.

Second, limitation with relying on ICD-9 coding for obesity diagnosis at discharge is not optimal as a data source. In this study, subjects were limited to those that had one life factor of interest obesity or diabetes. To capture obesity as life factor, several codes measuring obesity were used to measure BMI(kg/m²), waist circumference and body densitometry in attempt to increase accuracy of measurements of body composition. Author recognizes that measures of weight and height are prone to bias as frequently these measurements are based on self-report from the patient.

A third limitation is related to threats to external validity. The focus of this study was 803,163 African American, female inpatients between the ages of 21 and 55 in the United States from 2008 to 2010. The relationship between either co-morbidities or life factors, and at least one of the individual health factors of interest (obesity and diabetes) to African American, female inpatients between the ages of 21 and 55 in the United States from 2008 to 2010 can be generalized.

Conclusions

Health-care providers may set up the interventions such as diabetic patient counseling, pharmaceutical care, or disease management to delay the progression of co-morbidities or complications that diabetic patients may possibly have in hospitalization. Studies show that obesity impacts both medical-care and lost-productivity outcomes, but we have little data to show that weight loss has an impact on these outcome, in the African American community with diabetes. For short-term and smaller studies, it would be practical to collect pharmaceutical and laboratory cost measures. Inpatient and outpatient use and costs may require larger studies.

Furthermore, it is strongly recommended that lost-productivity outcomes and costs be collected because they are relatively easy to collect and the impact of obesity is well documented. This study is significant

because it demonstrates the validity for use of a single-gender and culturally responsive model of prevention that is critical to health promotion and disease prevention for African American woman. Future directions include the need to further establish and refine community collaboration building and partnership development activities with local organizations and agencies to support health promotion and disease prevention targeted to African American women.

Present research has acknowledged the need to ensure physicians have the necessary medical and cultural information required to provide exceptional care to all. Measure of central tendency for LOS, cost, age, NumProc, and NumChron, patients had on average two procedures and three chronic conditions on average with medical cost of 256,000. This supports that there are substantial variations existing in inpatient treatment patterns, among patients with obesity and or diabetes. Further research on the determinants of the resource utilization could be helpful in predicting and alleviating these costs and improving patient care in African American women.

Conflicts of interest

There are no conflicts of interest. At the time of developing this manuscript, Terris Moss was employed at Rutgers University School of Health Professions as an Instructor in Clinical Research. Resignation from Rutgers School of Health Professions was on June 30, 2018. Terris Moss currently is employed as a Medical Communications Specialist Contractor at Strongbridge Biopharma, 900 Northbrook Drive, Trevoise, PA, and a CEO of Moss Consulting, LLC.

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