Hospital Charges and Comorbidities of Obese and Morbidly Obese Patients

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Citation


Abstract

To examine the variations in average hospital charges and to describe comorbidities between non-obese, obese, and morbidly obese, a retrospective analysis of 2005 inpatient data from the Florida Agency for Health Care Administration (AHCA) was performed. Of all hospitalizations (N=2,534,641) in Florida during 2005, 94.9%, 3.3%, and 1.8% belonged to non-obese, obese, and morbidly obese patients, respectively. Socio-demographic (e.g., race/ethnicity, health insurance) and hospital characteristics (e.g., length of stay or LOS) differed significantly in three groups. Also, case mix, age, sex, race/ethnicity, LOS, and health insurance-adjusted mean hospital charges (US $) were significantly different among non-obese (15,021), obese (19,550), and morbidly obese groups (22,192) (p < .01). The most common reason for hospitalization was coronary atherosclerosis among non-obese and obese patients while it was congestive heart failure among morbidly obese patients. Hospital charges increased as weight increased among Florida inpatients, thus, economic consequences of obesity should be further explored.

INTRODUCTION

Next to tobacco use, obesity is the second leading cause of preventable mortality and a major cause of morbidity and disability in the United States (US). The proportion of overweight/ obesity in the US has risen in the last two decades and recent national studies have reported that 64.5% and 30.5% of Americans are overweight, and obese, respectively. Rising obesity and its associated comorbidities result in deleterious effects on health status and a significant increase in health burdens. Excess cost attributable to overweight and obesity was reported to be approximately $92.6 billion dollars, comprising between 6 - 10% of the total health care expenditure of the US. Obese individuals had 36% higher annual health care costs than non-obese individuals.

While there were numerous national studies on obesity, reports on obesity in Florida had primarily been descriptive in nature and restricted to the non-hospitalized population. In 2005, about 37.9% of Florida adults were overweight and 22.8% were obese. Hospital resource use among obese patients of Florida has not been reported. The purposes of the study were (1) to compare the demographic and clinical characteristic differences including adjusted mean hospital length of stay (LOS) and charges between non-obese, obese, and morbidly obese patients and (2) to describe the frequencies of primary reasons for hospitalization (primary diagnosis) and comorbidities (secondary diagnosis) separately in these three groups.

METHOD

Inpatient data from the Florida Agency for Health Care Administration (AHCA) were obtained and retrospectively examined. The dataset contained demographic and clinical information of all patients admitted in Florida hospitals during 2005. Hospitals included all acute care and short-term psychiatric hospitals in Florida. Data contained no personal identifiers. The study was approved by the Institutional Review Board (IRB) at Florida International University.

Of all patients (N=2,534,641) hospitalized in 2005 in Florida, the sample was further categorized using the International Classification of Diseases, Ninth Edition (ICD-9) diagnosis codes. Those with a primary or secondary diagnosis of obese (ICD-9 code: 27800) and morbidly obese
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(ICD-9 code: 27801) were grouped. Due to the small sample size (< 1%), overweight (ICD-9 code: 27802) patients were combined with the remaining patients and labeled as non-obese.

Socio-demographic information included in the analyses were age (years), sex, race/ethnicity, and insurance status. Age was treated as both continuous and dichotomous variables. Using the median age (55 years), it was dichotomized as < 55 and > 55 years of age. Sex (male and female) and race/ethnicity (whites, blacks, Hispanics, and others) were categorized. The original insurance variable was recoded into four groups as follows: 1) Commercial (Health Maintenance Organizations (HMO) and Preferred Provider Organizations (PPO)), 2) Federal or Medicare which included Medicare and other major federal carriers such as the Civilian Health and Medical Program of the Uniformed Services (CHAMPUS) and Veterans Administration (VA), 3) State/Medicaid which included Medicaid and other state payers such as Worker’s Compensation, and 4) Others included underinsured, charity, and uninsured. In addition, type of admission, discharge status, LOS (days), and hospital charges (US $) were examined. Hospital charges or total gross charges included the total bill of services rendered in the hospital and did not include professional (i.e., physician) fees. Patients who required immediate medical intervention were coded as an emergency admission while patients with non-life threatening conditions were coded as a non-emergency admission. Those admitted for obstetric reason (e.g., childbirth) were coded separately from emergency and non-emergency admission. Discharge status was grouped into four categories; 1) discharged home, 2) discharged to another facility (hospital, skilled nursing facility, home healthcare facility etc), 3) died in hospital, and 4) referred to hospice care. Due to the skewed distribution of LOS and hospital charges, the log-transformed scales were used in the model. The median LOS (3 days) and hospital charges (US $ 15,945) were used to categorize each variable into two or three groups (i.e., < 3, =3, and > 3 days or < 3 and > 3 days of LOS; < US $ 15,945 and > US $ 15,945 of hospital charges). The case mix index (CMI) for hospitals was also included in the obesity-hospital charges model. The AHCA calculated the CMI for all hospitals included in the 2005 database, as guided by the Ingenix Diagnosis Related Group (DRG) Expert. The CMI is defined as the average diagnosis-related group (DRG) weight for all of a hospital’s Medicare volume and it can be used to adjust the average cost per patient or per day for a given hospital relative to the adjusted average cost for other hospitals. The CMI was treated as a continuous variable in this study. In addition, we described the most common reasons for hospital admission (i.e., primary diagnosis) and the most frequently diagnosed secondary comorbidities for non-obese, obese, and morbidly obese patients.

The Statistical Analysis System (SAS®) for Windows, Release 9.1 (The SAS Institute, Cary, NC) was used for all analyses. The differences in frequencies of clinical and socio-demographic characteristics between three groups (non-obese, obese, and morbidly obese) were evaluated using chi-square (\(\chi^2\)) tests. Group comparisons of adjusted LOS and hospital charges were made using multiple regression models (PROC GLM) with multiple comparison tests. Because the log-scales of LOS and hospital charges were used in the models, their respective adjusted geometric means and the corresponding 95% confidence intervals (CI) were computed. Further, proportions of the most frequently diagnosed primary and secondary diagnoses were described and ranked between three groups.

RESULTS

Of 2,534,641 hospitalizations in Florida in 2005, 94.9%, 3.3% and 1.8% of records belonged to non-obese, obese, and morbidly obese patients, respectively (Table I). About 66% of patients were whites with approximately equal proportions of blacks and Hispanics. Most patients had Federal or Medicare (43.4%) as their primary payer. About 8.4% were either underinsured or uninsured.
There were more females than males in all three groups (non-obese, obese, and morbidly obese) (Table II). While most patients were whites in all groups, there were more blacks than Hispanics in both obese and morbidly obese groups. Over half of the patients were admitted for emergency reasons regardless of their weight status. All patients admitted for obstetric reasons (i.e., newborn delivery) belonged to the non-obese group (data not shown). While the majority was discharged home in all groups, the proportion of those discharged to another care facility was highest among the morbidly obese group. A higher proportion of morbidly obese (0.9%) patients died in hospitals compared with obese (0.5%) patients. About 8.4%, 8.5%, and 9.5% of non-obese, obese, and morbidly obese patients, respectively, were underinsured or uninsured.

Obese and morbidly obese patients were older than their non-obese counterparts. The mean and standard error (± SE) for age (years) was 50.2 ± 0.02 (non-obese), 55.4 ± 0.1 (obese), and 52.2 ± 0.1 (morbidly obese). The median age (years) for each group was 55.0 (non-obese), 56.0 (obese) and 53.0 (morbidly obese) (data not shown). The average unadjusted LOS (days) was significantly different between all three pairs: non-obese (3.3), obese (3.2), and morbidly obese (3.6) (Table III). Initially, four models were fitted to derive adjusted LOS controlling for (1) age alone; (2) age, and race/ethnicity; (3) age, race/ethnicity, and sex; and (4) age, race/ethnicity, sex, and health insurance. Likewise, seven models were fitted initially to derive adjusted hospital charges controlling for (1) case mix alone; (2) case mix, and age; (3) case mix, age, and race/ethnicity; (4) case mix, age, race/ethnicity, and sex; (5) case mix, age, race/ethnicity, sex, and insurance status; (6) case mix, age, race/ethnicity, sex, insurance status, and LOS; and (7) all variables in model 6 without the case mix. The best model for each outcome (LOS and hospital charges) was selected and presented in Table III. Age, race/ethnicity, sex, and insurance status-adjusted LOS were different significantly between non-obese (3.3), obese (3.1), and morbidly obese (3.6) patients (p < .01 between all three pairs). There was a positive relationship between weight-status and unadjusted mean hospital charges (US $). Similarly, when mean hospital charges were adjusted for case mix, age, race/ethnicity, sex, health insurance and LOS, the charges (US $) were the
lowest among non-obese (15,021) patients followed by obese (19,550) and morbidly obese (22,192) patients. All three pairs were significantly different at alpha < .01 level.

**Table III:** Crude and adjusted hospital length of stay and charges by weight-status (N = 2,534,641)

Because primary diagnoses relating to obstetric reasons (e.g. childbirth) were found among the non-obese group only, these reasons were not included in the primary and secondary diagnosis results (Table IV). The most common primary diagnosis was coronary atherosclerosis in non-obese (9.5%) and obese (25.5%) groups while it was unspecified congestive heart failure in morbidly obese (23.8%) group (Table IV). The most common secondary diagnosis was unspecified essential hypertension in all three groups (Table V). About 23.6% (non-obese), 18.8% (obese), and 28.1% (morbidly obese) of patients had essential hypertension. The second most common diagnosis in the non-obese group was unspecified hyperlipidemia (8.3%). However, Type 2 diabetes mellitus was the second most common diagnosis in the obese (9.3%) and the morbidly obese (16.5%) groups. The third common diagnosis was Type 2 diabetes mellitus for non-obese patients and unspecified hyperlipidemia for obese and morbidly obese patients.

**Table IV:** The most common primary reasons for hospitalization by weight-status

**DISCUSSION**

Two salient findings from this study were related to the prevalence of obesity. During 1999-2004, the prevalence of obesity in the US increased. The reason was due to a significant increase of obesity among men while obesity among women leveled off during this period. According to the 2005 Behavioral Risk Factor Surveillance Survey (BRFSS) data, 37.9% of adults were overweight and 22.8% were obese in Florida. In the same year, among hospitalized patients of our study, the prevalence of overweight was extremely low (< 1%). This may be due to the facts that the ICD-9 code for overweight was recently added and physicians often underestimated the overweight status of their patients. It was shown that about a quarter of overweight patients were thought to be of normal weight by their doctors. The prevalence of obesity in our study was 3.3% while it was 22.8% among general population of Florida in 2005. The reason for the divergent proportions may be that the remainder obese populations in Florida did not need hospital care or received care in non-hospital settings or did not have access to medical care or were not diagnosed accurately due to the use of ICD-9 code.

In our study, most (66.4%) patients were whites with almost equal proportions of blacks (15.5%) and Hispanics (15.4%). Race/ethnic breakdown of Florida’s population in 2005 was 62.3% whites, 15.5% blacks, and 19.7% Hispanics. Therefore, the race/ethnic proportions of general and hospitalized populations in Florida were similar except that there were more whites and less Hispanics among the hospitalized population. This could be due to the reason that Hispanics were more likely to lack access to health care than persons of other race/ethnic groups.

The obesity prevalence among blacks in our study deserves discussion. Several studies in the US have reported that
increases in obesity prevalence and related health consequences disproportionately affect minority groups such as blacks and Hispanics. The National Center for Health Statistics (NCHS) indicated that approximately 45.0% of black and 36.8% of Hispanic adults were obese. In our study, while the majority was whites in all three weight-status groups, there were more blacks than Hispanics in both obese and morbidly obese groups. Our finding mirrored the US obesity prevalence which indicated blacks were disproportionately affected with 6% of black women compared to 2.8% of all US women were reported to be morbidly obese. Evidence suggested that the strikingly high obesity risk among blacks responded to social and cultural standards about diet, physical activity, sedentary behavior, and perception of body size. Additionally, analysis of the National Health and Nutrition Examination Survey (NHANES) III data indicated that blacks were characterized by relatively low levels of physical activity and high levels of inactivity during leisure time. Black women reported greater body satisfaction than Hispanic women and black women considered overweight bodies more attractive.

Other interesting findings about hospitalized patients of Florida were linked to differences in the characteristics, mean hospital charges and comorbidities between groups. However, it should be noted that these findings are discussed based on the overall result (i.e., global p value) of the general association between obesity and related characteristic. First, as indicated in the general association between obesity and discharge status result (p < .01), a higher proportion of morbidly obese (0.9%) patients died in hospitals compared with obese (0.5%) patients. Similarly, previous studies indicated that obesity was associated with more complicated care, reduced life expectancy and higher mortality rates. A dose-response relationship between high body mass index (BMI as a measure of obesity) and increased poor health outcomes and mortality had also been described. Second, morbidly obese patients in our sample were likely to be either underinsured or uninsured, and were more likely to be discharged to other care facilities compared with other groups. Runge (2007) indicated that while a lack of economic opportunity increased the chance of becoming obese, obesity also hindered an individual’s economic opportunity. Previous studies demonstrated that uninsured adults faced severe negative health consequences due to lack of preventive and treatment services for chronic diseases. Additionally, unemployed and underprivileged individuals were more likely to be obese and diabetic, thus, their health care cost tended to be higher compared with their employed and privileged counterparts. Third, a positive association was found between adjusted mean hospital charges and weight status; hospital charges increased with increased level of obesity. This association was found after adjusting for individual (e.g. age, insurance status, severity of disease as defined by length of stay), and hospital (e.g. case mix index) level characteristics. Previous studies showed a strong association between BMI and higher health care costs with a 25%, 50% and 100% increase in costs for patient with a BMI of 30 to 35, 35 to 40, and over 40, respectively. Evidence suggested that a higher obesity-related health care cost was a function of significantly higher use of health care resources, medical care and prescription drugs. Medical conditions linked to obesity were more frequent among severely obese individuals than moderately obese individuals. Increment of charges and utilization rates were a result of treating important obesity associated comorbidities such as hypertension, hyperlipidemia, Type 2 diabetes mellitus, coronary artery disease, and stroke which accounted for almost 85% of the economic burden of obesity.

Fourth, findings from our study showed that the most common primary diagnosis was coronary atherosclerosis among non-obese and obese patients while it was unspecified congestive heart failure (CHF) among morbidly obese patients. Correspondingly, national data from the American Heart Association (AHA) recognized atherosclerotic coronary disease as a major source of morbidity and the leading cause of death in the US. Numerous studies indicated that obesity associated health problems were more frequent among morbidly obese than obese individuals. Consequences of obesity included cardiovascular disease, disability and death in several studies. Also, morbid obesity proved to be a known risk factor for CHF.

The Framingham Study data showed an increased risk form men (5%) and women (7%) to develop CHF with each unit increment of BMI. The most common secondary diagnosis in our study was unspecified essential hypertension in all three groups. While the second most common comorbidity was unspecified hyperlipidemia in non-obese patients, it was Type 2 diabetes mellitus in both obese and morbidly obese patients. Likewise, previous studies indicated that hypertension was the chief medical problem linked to obesity.
in weight, the prevalence of diabetes increased by 9%. Moreover, among people diagnosed with Type 2 diabetes, 67% were overweight (BMI ≥27) and 46% were obese (BMI ≥30).

The limitations associated with our study are outlined below. The Florida AHCA dataset used for this study was specifically collected for administrative purposes. Consequently, a number of important indicators useful for clinical (e.g. chronicity of obese and morbidly obese status) and epidemiologic (e.g. continuous measures of patients’ weight, height, and BMI) studies were not available. Because unique patient identifiers (e.g. social security number) of records were not released for public use, the sample size in our study corresponded to the number of records. Also, those patients hospitalized outside of Florida and those who died while outside of Florida were not included in the data.

CONCLUSION

The study revealed important information about the characteristic differences between hospitalized patients who were non-obese, obese, and morbidly obese in Florida. The adjusted length of stay (LOS) between non-obese, obese, and morbidly obese patients was significantly but not substantially (0.1 to 0.5 day) different. When multiple factors including LOS were adjusted, hospital charges were significantly and substantially different among the three groups with the highest charges among the morbidly obese. Thus, the study further emphasized the high burden of obesity in Florida with a higher use of hospital resources related to higher degrees of obesity. With a high prevalence and severity of obesity among populations across the US, Florida health care providers should be prepared to deliver appropriate preventive programs and health care services for obese individuals. Obesity prevention/treatment and outcome research involving racial/ethnic minorities and socio-economically disadvantaged groups of Florida are also needed. The study underscored the need for obesity prevention initiatives in Florida.

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