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DISCREPANCY IN HOSPITALIZATION CHARGES AND LENGTH OF STAY BETWEEN  
CHILDREN WITH AND WITHOUT OBESITY

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## ABSTRACT

Childhood obesity is an epidemic in the United States, affecting about 17% of children and adolescents (Ogden, Carroll, Kit, & Fleagal, 2012). This study's purpose is to examine whether previously observed associations of childhood obesity with higher hospitalization charges as well as longer length of stay (LOS) in the hospital have changed in recent years. The 2009 Kids' Inpatient Database is analyzed. T-tests are used to examine differences in hospitalization charges and LOS of obese and non-obese children, and regression analyses are used to estimate relationships controlling for confounding variables. As in previous research, analyses of 2009 data showed higher hospitalization charges and longer LOS for obese children compared to their non-obese counterparts with similar diagnoses. In three of the four primary diagnoses examined, the gap between obese and non-obese children's hospitalization charges widened; similarly, in three of the four primary diagnoses examined, the gap in LOS widened. The results of this study indicate that the impacts of obesity on health care use and expenses remain significant and have increased over time. Policymakers should evaluate the results of government policies and either make appropriate modifications or design new ones to effectively prevent the childhood obesity epidemic from becoming more severe and further impacting children's health and health care use.

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## **Chapter 1**

### **Introduction**

Childhood obesity in the United States is an epidemic with numerous impacts. To be considered obese, one needs to have a body-mass index, or BMI, over the 95<sup>th</sup> percentile of the particular population examined (Ogden & Fleagal, 2010). Recent data has indicated that 16.9 % of U.S. children and adolescents suffer from obesity, with a higher prevalence among boys (18.6%) than girls (15.0%) (Ogden, Carroll, Kit, & Fleagal, 2012). The obesity prevalence also varies among ethnic groups, with the non-Hispanic blacks having the highest rate, followed by Mexican Americans, then non-Hispanic whites (Caprio et al., 2008). Since the 1970s, the prevalence of obesity has increased drastically for children of various age groups. The rates of obesity among children aged 2 to 5 years and 6 to 11 years doubled, and the rate of obesity among children between the ages of 12 to 16 tripled (Wieting, 2008).

The various effects of childhood obesity are serious, and it is an issue that cannot be ignored. For example, children with obesity are more likely to develop various acute and chronic medical problems; furthermore, many of the problems eventually lead to higher mortality and morbidity (Wieting, 2008). A 2007 study found that 60% of obese children had at least one risk factor for cardiovascular diseases, and 25% had two or more (Freedman, Dietz, Srinivasan, & Berenson, 1999). Research has also shown that a relationship exists between childhood obesity and lower self-esteem (Strauss, 2000).

While the negative health consequences of childhood obesity are well known, comparatively less research has been conducted about the economic impacts of this epidemic.

This study analyzes data from the 2009 Kids' Inpatient Database, a nationally representative database containing hospital discharge data for children, to examine the relationship between childhood obesity and health care utilization as measured by hospitalization charges as well as the length of stay (LOS) at the hospital.

### **Motivation for this Study**

The childhood obesity epidemic has worsened for the most part in the past several decades. It is a serious issue that merits much attention from the society and the government. The fact that even infants and toddlers are experiencing obesity is disconcerting as childhood obesity is associated with increased risk medical problems like diabetes and stroke in adulthood (Reilly & Kelly, 2011).

Obesity-related comorbidities account for the rise in healthcare expenditures and hospitalization charges. Over the past 3 decades, \$100 billion dollars in excess health expenditures in the United States can be attributed to obesity (Finkelstein, Fiebelkorn, & Wang, 2003). From 1987 to 2001, the increase in the prevalence of obesity accounted for 12% of growth in healthcare related costs (Thorpe, Florence, Howard, & Joski, 2004). It is evident that obesity, besides the associated negative health consequences, has an impact on the economy as well.

Myriad external factors have resulted in the obesity epidemic in the United States. Changes in people's lifestyles and habits in the past several decades have led to the increased prevalence of obesity. Increased intake of calories and inactive lifestyles due to the development of new technology are just a few of the many factors that have contributed to the obesity



epidemic (Cutler, Glaeser, & Shapiro, 2003). For example, a recent study indicated that a fast food restaurant within 0.1 mile from a school is associated with an increase in obesity incidence of 5.2 percent for ninth graders (Currie, DellaVigna, Moretti, & Pathania, 2010).

From 2003-2004 to 2011-2012, no significant changes were observed in the prevalence of childhood and adult obesity. This suggests that the country may be moving in the right direction in fighting obesity (Ogden, Carroll, Kit, & Fleagal, 2014). However, the overall rate of obesity remains high, and actions should be taken to address this issue.

Much research has been done to examine the economic impacts of adult obesity, which is more prevalent than childhood obesity. Not much has been done, however, to examine how childhood obesity impacts health care spending; given how much money the U.S. spends on health care compared to other developed nations without having better health outcomes, it is important to identify ways to change this situation. Previous studies have examined the relationship between childhood obesity and hospitalization charges, but the data analyzed were published in the years 2000 and 2003. The relationship may have changed since then, and it is useful to examine the relationship using newer data to see if the relationship has changed and whether childhood obesity is becoming a more serious issue in terms of economic impacts.

The purpose of this study is to examine how the relationship between childhood obesity and hospitalization charges and LOS has changed over time as well as to bring attention to obesity-related problems that are not well known. The previously mentioned health consequences of obesity are well known, but it is less common for the public to consider how childhood obesity is related to health care expenditures.

## **Prior Research on Obesity and Hospitalization**

More studies have been done in adults than children regarding obesity and hospitalizations. Analyses of data from 2005 suggested that adults with diabetes who were obese had hospitalization charges 6.1% higher than that of non-obese diabetic patients, and for the morbidly obese individuals, charges were 18.7% higher. Patients who are morbidly obese consume more hospital resources than those who are not, and this may create a burden for hospitals in terms of expenditures (Kim & Boye, 2009).

From 1999 to 2005, the number of obese children admitted to the hospital almost doubled from 21,743 to 42,429. This may indicate that obesity is gaining more attention; perhaps in the earlier years obesity was not yet recognized as a serious issue and was therefore under-coded as a diagnosis (Trasande, Lu, Fryer, & Weitzman, 2009). Because obese children may require additional and important inpatient services, training pediatric hospitalists on screening and identifying obesity in children is beneficial (Haemer et al., 2011).

Childhood obesity's impact on the economy has been noticeable for decades. During 1979 to 1981, the annual hospital costs associated with obesity were 34 million (in 2001 U.S. dollars); during 1997 to 1999, the number more than tripled to \$127 million (in 2001 U.S. dollars). In terms of the percentage of total hospital costs, the obesity-associated costs increased from 0.43% to 1.70% (Wang & Dietz, 2002). During those time periods, it was also found that the LOS appeared to be longer for obese children, with the gap widening as time progressed (Wang & Dietz, 2002). The study mentioned that obesity is generally not listed as a primary diagnosis since it is generally not a reimbursable diagnosis (Wang & Dietz, 2002).

Data from 2000 and 2003 led to findings showing that obesity in children between the ages of 2 and 19 was associated with higher hospitalization charges. In 2000, it was found that

for hospital discharge cases involving the top four primary diagnoses for children with obesity as a secondary diagnosis – appendicitis, asthma, mood disorders, and pneumonia – all exhibited higher hospitalization charges, with the largest discrepancy being children with appendicitis. In 2003, the findings were fairly consistent; however the gap between hospitalization charges of obese children and their non-obese counterparts has widened. Moreover, it was found for both years that the LOS for obese children was longer than non-obese children, with the gap also widening between from 2000 to 2003 (Woolford, Gebremariam, Clark, & Davis, 2007; Woolford, Gebremariam, Clark, & Davis, 2009).

### **Conceptual Framework and Hypotheses**

Based on research studies previously conducted, it is expected that obese children experienced higher hospitalization charges and longer LOS. However, the studies discussed above used data published in the years 2000 and 2003, so whether these patterns persist or have changed is not clear. For this paper, the 2009 Kids' Inpatient Database is used to obtain a more updated understanding of the relationship between obesity and hospitalization charges and LOS. More research has investigated the impacts of adult obesity, but more attention still needs to be brought to childhood obesity.

The conceptual framework depicted in Figure 1 shows the hypothesized relationships between various factors examined in this study. The main exposure of interest is obesity, and the presence of obesity is hypothesized to lead to higher hospitalization charges and longer LOS for children admitted to the hospital for four of the most common primary diagnoses among children age 2 to 18 – appendicitis, asthma, mood disorders, and pneumonia. Demographic factors – age,

race, gender, and household income – and external factors associated with the hospital are believed to be associated with childhood obesity (Woolford, Gebremariam, Clark, & Davis, 2007).

Differences in demographics are hypothesized to influence the chance of acquiring one of the four primary diagnoses. Lastly, obesity, demographic factors and external factors are all thought to have a relationship with the two main outcomes of interest – hospitalization charges and LOS.

The hypotheses being tested are:

- 1) Obese children are likely to accrue more hospitalization charges than non-obese children with similar diagnoses
- 2) Obese children are likely to have a longer LOS than non-obese children with similar diagnoses

## **Chapter 2**

### **Methods**

#### **Data**

The data analyzed in this study comes from the 2009 Kids' Inpatient Database (KID 2009). It is a part of the Healthcare Cost and Utilization Project that is sponsored by the Agency for Healthcare Research and Quality. The KID is the largest all-payer inpatient care database that is available to the public. Its data comes from hospital discharge records of children below the age of 20 in participating hospitals. Information that can be found in the KID includes demographic characteristics of children in the database, hospital characteristics, primary and secondary diagnoses, procedures performed, and costs. Hospitals from 44 states are included in the 2009 KID, and a total of 4,121 hospitals supplied information for the database. Unweighted, a total of over 3 million pediatric discharges are included in the database.

The study sample consists of children between the ages of 2 and 18 admitted to the hospital for one of the top four pediatric primary diagnoses (see Table 2) that included obesity as a secondary diagnosis. There are a total of 286,730 children in the sample.

#### **Research Design**

This research study uses a cross-sectional design. For this research, the main exposure of interest is obesity. The outcome variables of interest are hospitalization charges and LOS. To

explore possible confounders to the two outcomes of interest, the analyses control for gender, race, household income level, expected primary payer, and hospital characteristics.

### **Variables included in the Analyses**

Multiple variables from KID 2009 were included in the analysis for the purpose of this study. To find the top four primary diagnoses and examine them, DXCCS1, the code accounting for the primary diagnosis when a child was admitted to the hospital, was used in the analysis. Obesity, the risk factor of interest, was coded as a binary categorical variable; 1 is obese and 0 is non-obese.

The gender variable was also a binary categorical variable, with 1 being female and 0 being male. Age, a continuous categorical variable, was a demographic variable that was included in the study to indicate the age of patients. Income, which is broken down into four quartiles (first, second, third, and fourth) was a demographic factor that represented the household income of a patient's family. Expected primary payer, whoever was expected for the charges accrued as a result of a hospitalization, was included, and the possible options were government (Medicare or Medicaid), private, and other (self-pay, no charge, and other). The hospital characteristics that were included in the analysis were hospital location, either rural or urban, and hospital region (Northeast, Midwest, South, or West).

The two outcomes of interest were LOS and hospitalization charges. LOS was the number of days a patient stayed in the hospital during the hospitalization and was a continuous categorical variable. Hospitalization charges was the amount of charges accrued as a result of a hospitalization.

KID 2009 used ICD-9, or the International Classification of Diseases, Ninth Revision, to code the diagnoses of children who were admitted to the hospital. Because sometimes many diagnoses account for the same broader diagnoses, the CCS, or Clinical Classifications Software, is used to combine diagnoses similar in nature into one diagnosis. To find the top four most common diagnoses for kids with a secondary diagnosis of obesity, the top four CCS codes were determined. For the secondary diagnosis of obesity, if any of the secondary diagnoses were ICD-9 codes 278.00, 278.01, or 278.02, the child was considered obese.

### **Analyses**

A t-test was used to determine the whether a difference in mean hospitalization charges and LOS for obese and non-obese children was present; obesity, the main exposure of interest, is a binary categorical variable, and the outcomes of interest are both quantitative and continuous. The results of this research can show whether the presence of obesity is associated hospitalization charges and LOS, but they cannot indicate any causal relationship since a longitudinal method of research is not used.

To test the degree of association between obesity and hospitalization charges and LOS, multiple regressions are used since confounding factors, may influence these outcomes.

## Chapter 3

### Results

Table 1 shows the frequencies of study variables in the sample of children admitted with the four primary diagnoses identified (shown in Table 2 below). Overall, 3.79% of the children in the sample were obese. Compared to children in the non-obese group, children in the obese group are less likely to be male and more likely to be female, less likely to be white and more likely to be black, more likely to have family income in the first quartile and less likely to be in the fourth quartile, more likely to use government and less likely to use private insurance as the expected primary payer, less likely to have been admitted to a rural hospital in the South and more likely to have been admitted to an urban hospital in the Midwest.

**Table 1. Frequencies of Study Variables (n=286,730)**

<u>Variable</u>	<u>All</u>	<u>Obese</u>	<u>Non-obese</u>
Total Sample	100	3.79	96.21
Gender			
Male	54.65	45.37	55.02
Female	45.35	54.63	44.98
Race			
White	50.91	46.54	51.08
Black	18.85	23.40	18.68
Hispanic	21.46	21.36	21.46
Other	8.78	8.70	8.78
Income Quartile			
First	31.60	35.86	31.44
Second	25.42	26.82	25.37
Third	22.69	22.68	22.69
Fourth	20.29	14.64	20.51
Expected Primary Payer			
Government	45.68	54.47	45.34



Private	46.57	37.63	46.92
Other	7.75	7.90	7.74
Hospital Location			
Rural	11.43	8.37	11.55
Urban	88.57	91.63	88.45
Hospital Region			
Northeast	20.87	20.24	20.89
Midwest	24.18	28.24	24.02
South	34.61	32.35	34.70
West	20.34	19.17	20.39

Table 2 shows the top four primary diagnoses for children between the ages of 2 to 18 who have a secondary diagnosis of obesity. Mood disorders, asthma, appendicitis, and pneumonia are four most common primary diagnoses that involve obesity as a secondary diagnosis. Of the four diagnoses, mood disorders had the highest percentage of obese children at 7.75%.

**Table 2. Top Four Primary Diagnoses with a Secondary Diagnosis of Obesity**

<u>Primary Diagnosis</u>	<u>Number of non-Obese Children</u>	<u>Number of Obese Children</u>	<u>Percentage of Obese Children</u>
Appendicitis	60,203	1,463	2.37%
Asthma	73,663	2,395	3.15%
Mood Disorders	71,021	5,963	7.75%
Pneumonia	70,978	1,044	1.45%

Table 3 compares the hospitalization charges and LOS of kids with and without obesity of each of the top four primary diagnoses that include obesity as a secondary diagnosis. It can be seen that the charges for kids with obesity are greater than those without it for all four primary diagnoses, and the same is true for the LOS. Of the four diagnoses, the discrepancy for charges was widest for pneumonia patients (\$12,543.3), followed by asthma (\$5976.5), appendicitis (\$5,142.4), and mood disorders (\$1,144.3) for charges. For LOS, discrepancy was also widest for

pneumonia at 1.29 day, followed by mood disorders at 0.87 day, asthma at 0.77 day, then and appendicitis at 0.4 day.

**Table 3. Hospitalization Charges and Length of Stay based on Obesity**

<u>Diagnosis</u>	<u>Obese</u>	<u>Charges</u>	<u>Difference</u>	<u>t</u>	<u>p</u>	<u>LOS</u>	<u>Difference</u>	<u>t</u>	<u>p</u>
Appendicitis	Y	31,063.2	5,142.4	8.76	<.0001	3.1162	0.3975	4.95	<.0001
	N	25,920.8				2.7187			
Asthma	Y	17,718.3	5,976.5	17.33	<.0001	2.9344	0.77	21.48	<.0001
	N	11,741.8				2.1644			
Mood Disorders	Y	16,250.1	1,144.3	4.37	<.0001	8.2318	0.8687	5.40	<.0001
	N	15,105.8				7.3642			
Pneumonia	Y	31,002.3	12,543.3	9.84	<.0001	4.6370	1.2895	9.25	<.0001
	N	18,459.0				3.3475			

\* All charges are expressed in 2009 U.S. dollars and LOS is measured in number of days.

Table 4 presents results of multiple regression analyses with hospitalization charges as the outcome of interest. Obese children, after controlling for demographic factors and hospital characteristics, were found to have significantly higher average hospitalization charges than non-obese children. Obese children had average charges that were \$1333.66 higher than their non-obese counterparts. There were also other results of statistical significance from the regression analyses of hospitalization charges. With each year of increase in age, there was an increase of \$391.85 in hospitalization charges. Female children had costs that were \$288.23 lower than those of male children. In comparison to white children, all other groups except for black children experienced higher hospitalization charges; Hispanic children by \$4,400.95 and Other by

\$1,428.02. Children belonging to families in the fourth income quartile had higher charges than those of the first quartile by \$1,133.18. Compared to children using government insurance, children with private insurance accrued higher hospitalization charges by \$1,512.01. Children at hospitals in urban regions were charged \$6,567.63 more than children at rural hospitals. Lastly, when the hospital is located in the Midwest or the South as opposed to the Northeast, children accrued lower charges (\$4,003.37, \$2,344.69); in the West, however, they accrued higher charges (\$4,993.27).

**Table 4. Linear Regressions of Hospitalization Charges**

<u>Variable</u>	<u>Parameter Estimate</u>	<u>Standard Error</u>	<u>t</u>	<u>p</u>
Obesity	1333.65652	304.28113	4.38	<.0001
Age	391.85205	10.90299	35.94	<.0001
Gender				
Male				
Female	-288.22510	113.86236	2.53	0.0114
Race				
White				
Black	-141.78945	163.24691	0.87	0.3851
Hispanic	4400.95266	158.60311	27.75	<.0001
Other	1428.01864	211.69180	6.75	<.0001
Income Quartile				
First				
Second	108.83828	154.78779	0.70	0.4820
Third	38.51280	165.09669	0.23	0.8155
Fourth	1133.17862	177.39559	6.39	<.0001
Expected Primary Payer				
Government				
Private	1512.00874	220.06276	6.87	<.0001
Other	-5.71961	221.03007	0.03	0.9794
Hospital Location				
Rural				
Urban	6567.63197	191.88332	34.23	<.0001
Hospital Region				
Northeast				
Midwest	-4003.36843	170.59960	23.47	<.0001
South	-2344.68935	149.55377	15.68	<.0001
West	4993.26557	172.32839	28.98	<.0001

Table 5 contains information from multiple regression analyses related to the other outcome of interest, LOS. When obesity was present, children stayed in the hospital for a significantly longer period (1.19 days) on average; older age also was associated with longer stays, with each one year of increase in age associating with an increase of 0.18 days in LOS. Females had longer LOS than males by 0.24 days, Blacks and Hispanics had shorter stays than whites by 0.54 and 0.58 days respectively, and children of families in the third and fourth income quartiles had shorter stays than those in the first quartile families by 0.19 and 0.28 days respectively. Children using private insurance LOS 0.7 day longer and those with other payers had LOS 0.4 day shorter when compared to children using government insurance. Children in urban hospitals had longer LOS than those in rural hospitals by 1.2 day. Compared to children hospitalized in the Northeast, children in the Midwest stayed 0.15 day shorter those in the South stayed 0.18 days longer, and those in the West stayed 0.5 day shorter.

**Table 5. Linear Regressions of Length of Stay**

<u>Variable</u>	<u>Parameter Estimate</u>	<u>Standard Error</u>	<u>t</u>	<u>p</u>
Obesity	1.19404	0.07740	15.43	<.0001
Age	0.18303	0.00279	65.56	<.0001
Gender				
Male				
Female	0.24389	0.02916	8.36	<.0001
Race				
White				
Black	-0.54145	0.04184	12.94	<.0001
Hispanic	-0.58440	0.04049	14.43	<.0001
Other	-0.00691	0.05415	0.13	0.08985
Income Quartile				
First				
Second	-0.08400	0.03972	2.11	0.0345
Third	-0.18538	0.04231	4.38	<.0001
Fourth	-0.27986	0.04541	6.16	<.0001
Expected Primary Payer				
Government				
Private	0.70148	0.05657	12.40	<.0001

Other	-0.39893	0.05674	7.03	<.0001
Hospital Location				
Rural				
Urban	1.17008	0.04933	23.72	<.0001
Hospital Region				
Northeast				
Midwest	-0.14709	0.04389	3.35	0.0008
South	0.17503	0.03848	4.55	<.0001
West	-0.49352	0.04377	11.27	<.0001

## Chapter 4

### Discussion and Conclusions

Based on 2009 data, obese children continue to experience higher hospitalization charges and longer hospital stays when admitted to the hospital for appendicitis, asthma, mood disorders, or pneumonia than non-obese children. According to Woolford, Gebremariam, Clark and Davis (2007), in 2000, similar relationships existed. Additionally, 2003 data showed similar findings as well (Woolford et al., 2009). The discrepancy in both outcomes of interest widened from 2000 to 2003, and from 2003 to 2009, indicating an increased need for attention to the economic impacts of childhood obesity. Even though childhood obesity did not become more prevalent during this time period, its impact on hospitalization charges and LOS became more serious.

In 2000, the hospitalization charges for obese children with the either appendicitis, asthma, mood disorders, and pneumonia were all higher than and were statistically significantly different ( $p < .05$ ) from the charges accrued by their non-obese counterparts. Using 2009 US dollars, for appendicitis, the mean charges were \$3843 higher, \$2147 higher for asthma, \$652 higher for mood disorders, and \$3164 for pneumonia. In 2003 the discrepancy widened for all four diagnoses; \$4229 for appendicitis, \$2501 for asthma, \$1543 for mood disorders, and \$3953 for pneumonia. It is noteworthy to mention that the additional charges for obese children with mood disorders more than doubled.

With 2009 data, it was found that children with obesity still experienced higher hospitalization charges than non-obese children for all four primary diagnoses examined and the

discrepancies widened for three diagnoses. Obese children were charged an additional \$5,142 for appendicitis, \$5,976 for asthma, \$1,144 for mood disorders, and \$12,543 for pneumonia. While the discrepancy for mood disorders narrowed from 2003 to 2009, the discrepancy for pneumonia grew by over \$8,000.

It appears that the economic impact of obesity continued to grow and this should be an alarming fact for policy-makers. Childhood obesity is a problem that needs to be addressed, considering the preventable nature of obesity. It is important to note that of the top four diagnoses that include obesity as a secondary diagnosis, the diagnosis with the highest percentage of children suffering from obesity was mood disorders. It has been mentioned in the past that obesity and depression have shared symptoms, such as sedentary behavior and sleep problems, and this perhaps is an indication that the two health problems have similar pathophysiological pathways (Reeves, Postolache, & Snitker, 2008). For people between the ages of 18 and 64, obesity has also been found to be associated with a higher likelihood of having depressive mood (Heo, Pietrobelli, Fontaine, Sirey, & Faith, 2006). Moreover, for school-age children, the ones who are overweight or obese are more likely to be victims and perpetrators of bullying, possibly hindering their social and psychological development (Janssen, Craig, Boyce, & Pickett, 2004).

Due to the presence of multiple predictors for the outcomes of interest, multiple regression analysis was used to examine whether obesity is associated with hospitalization charges and LOS, controlling for those other factors. Result of the linear regression show that when a child is obese, regardless of which of the four primary diagnoses the child has, he or she accrued a hospitalization charge that is \$1,333.66 dollars higher than a non-obese counterpart. For LOS, an obese child experienced an additional length of 1.2 days. These findings were both

statistically significant after controlling for demographics and hospital characteristics, so the relationships' significance is independent of all other variables in the analyses.

After analyzing the 2009 KID data, it was found that childhood obesity continues to be a problem in terms of its economic impacts. Higher hospitalization charges were accrued by obese children compared to their non-obese counterparts. The health effects of obesity have been well known for a long period of time due to the amount of research done to explore and examine them, but its economic impacts are sometimes overlooked; therefore, research is necessary to show its significance. Besides the direct costs of childhood obesity, which are more obvious, this epidemic potentially has other costs. Obese children have been found to exhibit poorer school attendance rates, and this may have an implication on educational attainment, leading to a loss of human capital in the long run (Hammond & Levine, 2010). Such indirect costs are difficult to quantify, so research studies on direct costs is of great importance since they are one of the only means of determining the economic impacts of childhood obesity.

### **Limitations**

One limitation of the study is that hospitalization charges were examined instead of hospitalization costs. These two concepts may bear little similarity because charges are subject to reimbursement agreements with insurers, whereas costs reflect the money spent on the resources used for the care of a particular patient. For charges, hospitals can determine to change the amount of money it hopes to bill its patients on an individual and arbitrary basis. Given the possibility that charges are not systematically accrued, they are not the most appropriate way to analyze childhood obesity's economic impact.



Since the 2009 KID data contains up to a total of 25 diagnoses for one case of hospitalization, and this study considers anyone with a secondary diagnosis of obesity as obese, it is possible that besides the primary diagnoses examined, there are other diagnoses that significantly affected the amount of hospitalization charges. Also, obesity was not recognized by the American Medical Association as a disease until 2013, so back in 2009, it was not a reimbursable diagnosis, potentially leading to under-coding of the health issue because hospitals were not going to be reimbursed for identifying obesity in their patients (Pollack, 2013).

A graphical analysis, using normal probability graphs, of the association between LOS and hospitalization charges showed a non-linear relationship. However, because a regression analysis was robust enough, despite the non-linear nature of the relationship, the results and analysis were acceptable.

### **Contribution and Policy Implications**

Not much research has been conducted to examine the impacts of childhood obesity in the United States on the economy, in particular its impacts on the LOS, and subsequently, hospitalization charges. While previous studies have examined the same issue, the last study utilized 2003 data, and this study used a more updated set of data from 2009. By doing so, any changes in the relationship between childhood obesity and LOS and hospitalization can be examined, possibly helping to assess the effectiveness of past policies to combat this epidemic that is affecting approximately 17% of US children and adolescents.

Consistent with 2003 findings, the hospitalization charges were statistically significantly higher and the LOS was statistically significantly longer for children who were obese compared

to their non-obese counterparts. Despite efforts by the government to combat childhood obesity in recent years, it continues to have an effect on the economy. The fact that three of the top four pediatric primary diagnoses that included obesity as a secondary diagnosis showed an widening gap between the hospitalization charges for children with and without obesity indicates that childhood obesity continues to be an important problem and that the US should make a bigger effort to address it. For pneumonia, the discrepancy in the hospitalization charges more than tripled from 2003 to 2009. Regardless of who the primary payer is, a significant increase like this has no doubt affected the economy. With over 45% of the study sample population having the government as the primary payer of their hospital stays and over 50% of the obese children examined using Medicaid or other government benefits to cover their hospitalization charges, it appears that the government has been greatly impacted by the childhood obesity epidemic.

Given the impact of childhood obesity on government spending on healthcare, it is extremely important for policy-makers to continue developing more and modifying existing policies designed to reduce the rate of childhood obesity. Stronger school-based and community-based education programs about ways to prevent obesity, such as better nutrition and proper exercising, need to be implemented so children have a lower likelihood of developing obesity.

## Appendix A

### Conceptual Framework

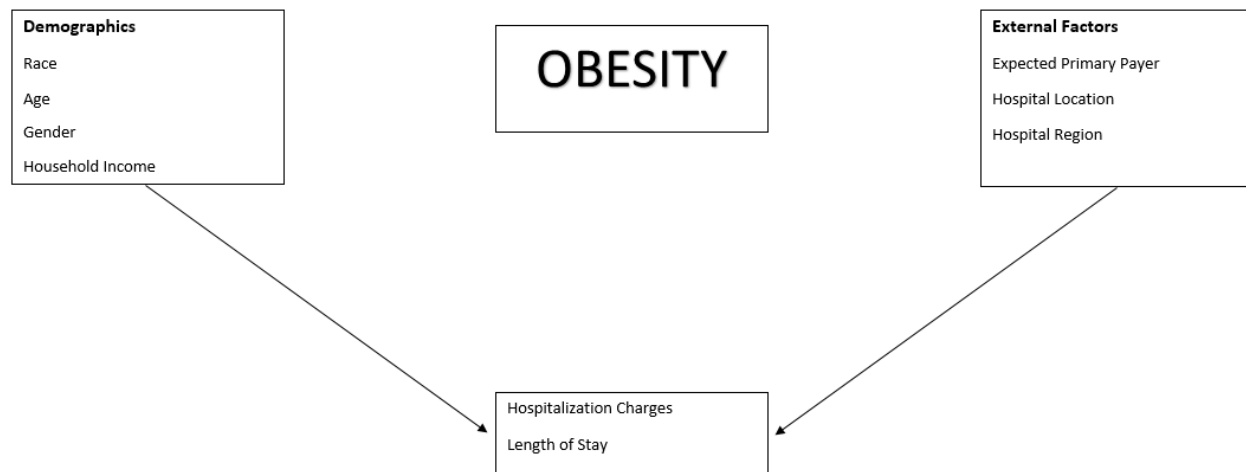


Figure 1. Conceptual Framework

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### **Education**

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### **Work Experience**

#### **American Red Cross – Centre Communities Chapter**

##### *Blood Services Intern*

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