AGE STRATIFIED HOSPITALIZATION CHARACTERISTICS OF CHRONIC KIDNEY DISEASE PATIENTS

By

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ABSTRACT

Background: Chronic Kidney disease is recognized as a significant health problem affecting about 14.8% of the US population. CKD is the ninth leading cause of death in the united states . CDC projected the prevalence of CKD for 65 and older to slightly increase to 37.8 %.[4] CKD not only accounts for more death than prostate and breast cancer put together but also contribute to other diseases which increase the probability of higher prevalence in heart disease and . In a study that focused on the future burden of CKD, they found that by 2030 adults of 30 years or older may increase from 14.8% to 16.7%.**Methods**: The data were obtained from the Nationwide Inpatient Sample (NIS) and were used to identify the relationship between length of stay, total charges, mortality and CKD. After merging the data, a total sample of 660,663 out of 30,931,761 discharge records of patients were diagnosed with chronic kidney disease. SAS Enterprise was used to perform descriptive and inferential analysis. **RESULTS**: The results showed that total charges, length of stay and mortality for CKD patients increases with the presence of comorbidities. Also, patients between the age of 0-19 and have hypertension their risk of developing CKD increases by 18x. Patients in their 20s and has hypertension are at a risk of developing CKD by almost 3 times when they reach 50 if they do not control their hypertension. Also, patients with complicated diabetes their risk increases by 8x where anemia at 4x. **Conclusion**: In this study comorbidities across all age groups such as diabetes, hypertension, obesity, anemia, and congestive heart disease increases the likelihood of developing CKD. Patients with these risk factors should follow guidelines to control their condition to avoid developing CKD.

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CHAPTER I

INTRODUCTION

1.1 Background of Chronic Kidney Disease

The kidneys are a bean - shaped organs located in each side of the body below the ribcage[1]. The kidneys funcion is to filter any waste product that is carried in the blood. According to the NIH, the kidneys filter nearly 120 to 150 quarters of blood to produce 1 to 2 quarters of urine[2]. CKD would in most cases be prevented but not cured. Therefore, watching for the common risk factors such as diabetes, hypertension and cardiovascular can prevent a person from developing kidney disease.

Chronic kidney disease (CKD) is when the kidney begins to suffer from a limited loss of function that might end in permanent damage over time. CKD is recognized as a significant health problem affecting about 14.8% of the US population. Its considered the ninth leading cause of death in the U.S. it's estimated that over 661,000 Americans suffer from kidney failure. Of these, 468,000 people are on dialysis and about 193,000 live with a kidney transplant . (Figure 1) Each year, kidney disease deaths account for more people than prostate and breast cancer with more than 47,000 deaths in 2013.[3]

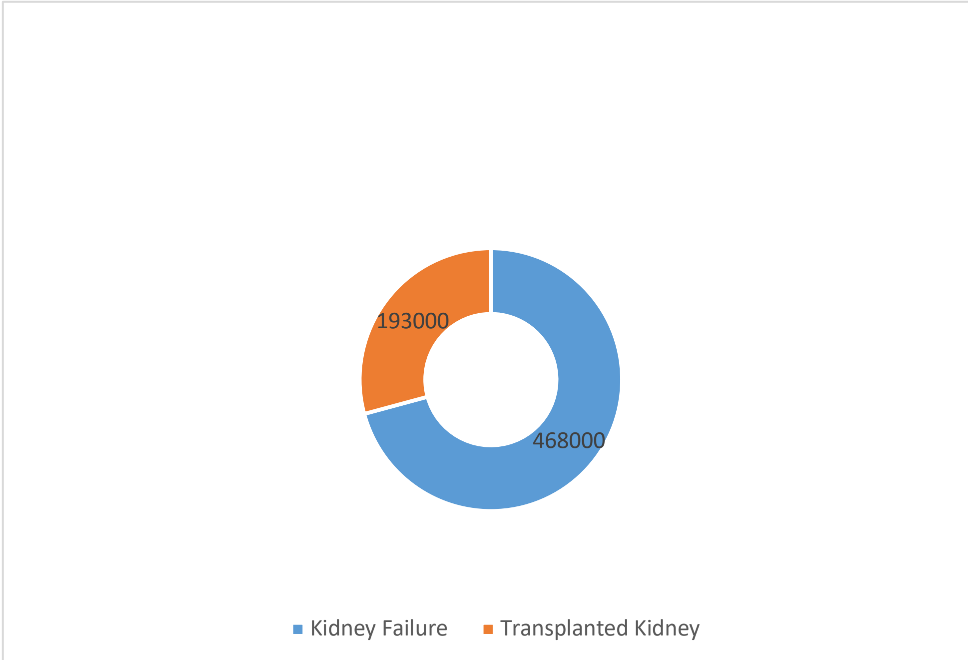

Figure 1: The percentage of transplanted and kidney failure

With the increase of hypertension, diabetes and cardiovascular diseases in the older population, the percentage may rise significantly. Thus, common risk factors include hypertension, diabetes, and age (>60). In the early stages, kidney disease often has no symptom; therefore, medical professionals referred to CKD as a silent disease.

The CKD prevalence in the general population of the United States is nearly14.8% an increase from 12 % in 2004. CDC estimates that more than 10% of adults in the United States may have CKD approximately more than 31 million people. Which means that 1 in every 10 adults will have chronic kidney disease. [4]

1.2 Chronic Kidney Disease prevalence from 1999 to 2014

The NHANES data from 1999 - 2014 in figure 2 shows that the older you are, the more prone you become to develop CKD. Participants aged 60+ from 1999-2002 had 36.9% compared to those 40-59 (10%). Same group age 60+ shown a decrease in 2011-2014 (32.6%) compared to those 40-59 (10.6%). For female it showed an increase from 2011-2014 (16.5%) from 1999-2002 (15.6%) while, the male also had an increase from 2011-2014 by 1% in 1999-2002. The white race showed an increase in 2011-2014 by 1.3% from 1999-2002 (13.9%) while other Hispanic 2011-2014 decreased by 1% (12.8%) compared to the same race in 1999-2002. The black race also showed an increase in 2011-2014 by (1.8%).

Risk factors such as diabetes, hypertension, obesity and cardiovascular disease were reported in figure 2. In 2011 -2014 Diabetes showed an increase of 0.4% from 2007-2010.Hypertension also increase by 1.5% in 2011-2014 (32.1%). For obese patients whose BMI>30 the percentage increase by 1.5% in 2011-2014 (17.6%). Lastly, cardiovascular disease showed a higher rate which is 42.6% in 2011-2014 compared to 2007-2010 (37.2%).[5]

	All CKD				eGFR <60 ml/min/1.73m^2				ACR ≥30 mg/g			
	1999-2002	2003-2006	2007-2010	2011-2014	1999-2002	2003-2006	2007-2010	2011-2014	1999-2002	2003-2006	2007-2010	2011-2014
Age												
20-39	6.0	5.9	5.4	6.6	0.4	0.1	0.3	0.3				
40-59	10.0	9.8	8.5	10.6	1.9	2.3	2.0	3.3	5.9	5.8	5.3	6.4
60+	36.9	37.1	33.6	32.6	24.0	25.8	22.9	22.6	8.6	8.2	7.0	8.5
Sex												
Male	12.0	12.6	11.7	13.0	4.8	5.7	5.2	6.4	9.1	8.9	8.4	8.8
Female	15.6	16.1	15.0	16.5	6.8	7.8	7.5	7.9	10.9	10.2	9.4	10.9
Race/Ethnicity												
Non-Hispanic White	13.9	14.3	13.8	15.2	6.6	7.9	7.5	8.5	9.3	8.5	8.4	9.0
Non-Hispanic Black/African American	15.1	15.8	14.8	16.9	5.3	5.2	5.8	6.2	12.7	13.0	11.2	13.5
Mexican American	11.6	11.6	11.8	12.5	1.4	1.6	2.3	2.5	10.4	10.9	10.5	11.2
Other Hispanic	13.8	15.5	11.4	12.8	3.6	3.5	3.3	4.3	11.7	13.3	9.5	10.5
Other Non-Hispanic	14.0	16.2	10.6	12.8	3.9	4.2	3.1	4.3	12.1	13.5	9.1	10.3
Risk Factor												
Diabetes	41.2	41.5	39.0	39.4	15.1	19.2	18.7	20.7	34.8	30.9	28.4	28.7
Self-reported diabetes	40.8	43.0	40.6	40.6	16.5	20.3	19.9	22.3	33.5	31.7	29.5	29.5
Hypertension	33.4	31.7	30.6	32.1	16.8	17.4	16.9	17.7	23.0	19.6	19.1	20.6
Self-reported hypertension	28.2	26.9	25.7	26.9	16.3	15.3	15.0	15.8	17.7	16.5	15.7	16.6
Self-reported cardiovascular disease	38.2	43.5	37.2	42.6	26.7	29.3	25.1	29.3	22.7	24.8	22.3	25.5
Obesity (BMI >30)	17.2	16.8	16.1	17.6	6.3	7.1	7.0	7.9	13.2	11.9	11.1	12.5
All	13.9	14.4	13.4	14.8	5.8	6.8	6.4	7.2	10.1	9.6	8.9	9.9

Figure 2: Prevalence of CKD in NHANES population within age, sex, race/ethnicity, & risk-factor categories, 1999-2014

1.3 Goals and objectives

The overall goals of this research are to identify the risk factors and costs associated with CKD patients in terms of mortality, length of stay and costs in different types of settings across the United States. The objectives are to determine the following

1. Whether types of comorbidities affect length of stay for CKD patients

2. Whether types of comorbidities affect total charges for CKD patients

3. Whether types of comorbidities affect mortality for CKD patients

4. Whether mortality, total charges, and length of stay differ with race, age, or socio-economic status for CKD patients

5. Whether there are differences in mortality, total charges, and length of stay across various regions for CKD patients

6. Whether there are differences in mortality, total charges, and length of stay among different hospital locations- rural or urban for CKD patients

7. Whether there are differences in length of stay, mortality, and cost with various types of health insurances Medicare, Medicaid, private insurance for CKD patients

1.3 Research Hypotheses

Hypothesis 1: Are there any statistical significant associations between race, gender, insurance, socioeconomics, types of comorbidities , hospital region and different age groups on total charges

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 2: Are there any statistical significant associations between race, gender, insurance, socioeconomics, types of comorbidities , hospital region and different age groups on length of stay

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 3: Are there any statistical significant associations between race, gender, insurance, socioeconomics, types of comorbidities , hospital region and different age groups on mortality

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 4: Are there any statistical significant associations between race, gender, insurance, socioeconomics, types of comorbidities , hospital region and different age group on developing CKD

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

1.5 Statement of the Problem

CKD is the ninth leading cause of death in the united states .it account for more than 14 % in the general population. CDC projected the prevalence of CKD for 65 and older to slightly increase to 37.8 %.[4] CKD not only accounts for more death than prostate and breast cancer put together but also contribute to other diseases which increase the probability of higher prevalence in heart disease and diabetes. In a study focusing on the future burden of CKD, they found that by 2030 adults aged 30 or older could rise to from 14.8% to 16.7%.[6]

1.6 Significance of the study

CKD is a public health problem that needs to be addressed, and yet the progress is slow. Therefore, the significance of this study is to contribute to the existing studies that warn about CKD becoming a significant cause of death in the US in the next 50 years. More than 31 million Americans are affected by CKD, and due to the increase of hospitals admissions, rigorous research is needed to shed light into the causes and ways to prevent people from developing CKD especially with this current generation. Many factors play a role in developing CKD, and yet half of the primary care doctors review CKD with their diabetics patients.[7]

1.7 Definition of Terms

Term	Definition
CKD	Chronic kidney disease
CKiD	Chronic kidney disease in children
KEEP	Kidney early evaluation program
Nephrons	A tiny filtering structure in the kidneys
EPO	A hormone produced by the kidney to stimulates the bone to make red blood cells
ACR (Albumin-to-creatinine ratio)	A method to detect elevated protein in the kidney
Creatinine	A test to estimates kidney filtration rate
GFR Glomerular Filtration Rate	A test to measure kidney functions
CVD	Cardiovascular disease
AV Graft	Direct connecting of the artery to a vein
AV fistula	Arteriovenous fistula is a procedures to connect the artery to a vein.
MDRD (Modification of Diet in Renal Disease)	A formula used to calculate kidney function by estimating the glomerular filtration rate (GFR) from creatinine serum obtained
KDOQI	Kidney Disease Outcomes Quality Initiative
CKD-EPI	Epidemiology Collaboration equation

Table 1: Definition of Terms

CHAPTER II

LITERATURE REVIEW

2.1 INTRODUCTION

The Kidneys play an essential role in the human body; it helps it get rid of any waste in the blood including excessive water to form the urine that later will pass to the bladder through the ureter. Each day the kidney filters about 120-150 quarts of blood. The filtering process occurs in a tiny unit called nephrons as shown in figure 3. Each kidney contains over a million nephrons. In the nephron, tiny blood vessels called capillaries intertwine with urine carrying tubes called tubules.[1]

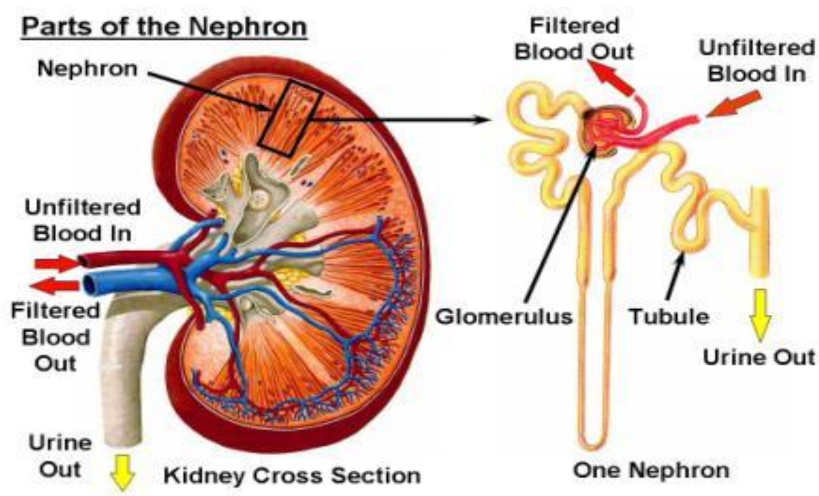

Figure 3 Illustration of Parts of the Nephrons
Source:http://unckidneycenter.org/images/kidney-health-library-pictures/parts-of-the-nephron/view

Also, as part of the kidney job is to release three important hormones the body needs. The first hormone is called erythropoietin(EPO) which stimulates the bone to make red blood cells. The second hormone is renin; it helps regulates blood pressure. The third hormone is calcitriol which is a form of vitamin D that helps to maintain calcium for the bones. CKD occurs when kidneys nephrons are attacked or damaged by poisoning or an injury. Chronic Kidney disease (CKD) is when the kidney is injured and is unable to filter blood as healthy kidney would. The blood waste then builds in the body and causes other problems such as pulmonary edema, hyperkalemia and heart attack.[8]

2.2 CKD in Children

Chronic kidney disease in children 0-19 has increased, between 2000 and 2008 it increased from 5.9 % to 15 % per million. Both children and adults share the same comorbid conditions such as cardiovascular and proteinuria. In the largest prospective cohort study in North America of 586 children between the age of 1 and 16 years old with an estimated eGFR between 30 and 90 ml/min/1.73 m2. The findings were, first the chronic kidney disease in children (CKiD) new formula to estimate eGFR from 15 to 75 ml/min/1.73 m2 eGFR = (ml/min/1.73 m2) =[0.413 * Height (cm)] / [SCr (mg/dl)]. Second, more than 30 % of the children had anemia based on KDOQI guidelines for pediatrics. Third, race and lower iGFR cause of CKD are individually related to the level of proteinuria.[9]

2.3 Classification of Stages for Chronic Kidney Disease

Chronic kidney disease is mainly identified by measuring GFR (Glomerular Filtration Rate) and ACR (Albumin to creatinine ratio). The condition can be identified through a blood or urine tests to measures the creatinine level. GFR is a blood test that measures how much blood does the kidney filter each minute. Results of GFR determine the stage of the disease with the most severe stages that shows a result of (GFR = 15-29 mL/min per 1.73 m2). Table 2 explains the KDOQI staging guidelines. The mean eGFR between 2003 and 2006 was 93.8 wherein 2007, and 2010 was 95 shown in figure 4.[10]

Stages	Description	Glomerular Filtration Rate(GFR)
1	Normal GFR and Protein in the Urine	(GFR > 90 mL/min per 1.73 m2)
2	Mild decrease in GFR	(GFR = 60-89 mL/min per 1.73 m2)
3a	Moderate decrease in GFR	(GFR = 45-59 mL/min per 1.73 m2)
3b	Moderately to severely decreased	(GFR = 30-44 mL/min per 1.73 m2)
4	Severely decreased	(GFR = 15-29 mL/min per 1.73 m2)
5	Kidney Failure (ESKD)	(GFR = <15 mL/min per 1.73 m2)

Table 2: Kidney Disease Outcomes and Quality Improvement (KDOQI) CKD Staging Guidelines

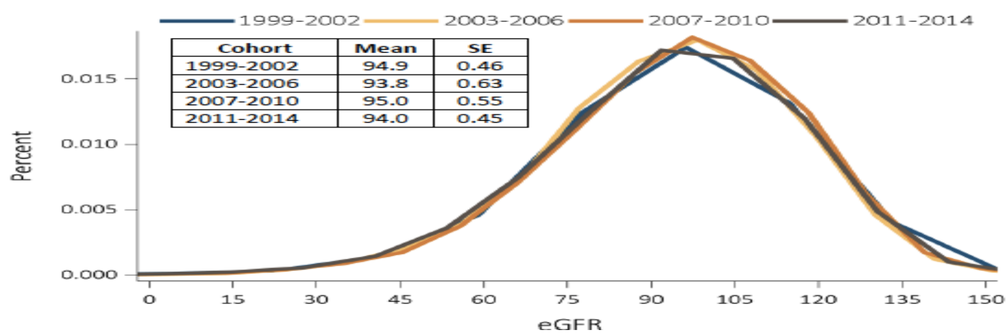

Figure 4: eGFR distribution among NHANES participants, 1999-2014

2.4 Signs and symptoms of CKD

Early stages of CKD	Late stages of CKD
weakness	skin appearance
changes in urination frequency	Wight loss
urine color	pulmonary-uremic lung
edema	muscle cramps
elevated blood pressure	anemia

Table 3: signs and symptoms

2.5 CKD Prevalence by Stage from 1999 2014

Figure 5 illustrates how CKD stages progressed over 15 years. Stage 1 data shows that in recent years it regressed to the initial level (1999-2002). Where stage 2 started to decrease beginning (2007-2010).Stage 3 showed an increase from 5.4% to 6.6% from 1999 to 2014. Stage 4 decreased from 0.5% to 0.4% and stage 5 from 0.1% to 0.2%.

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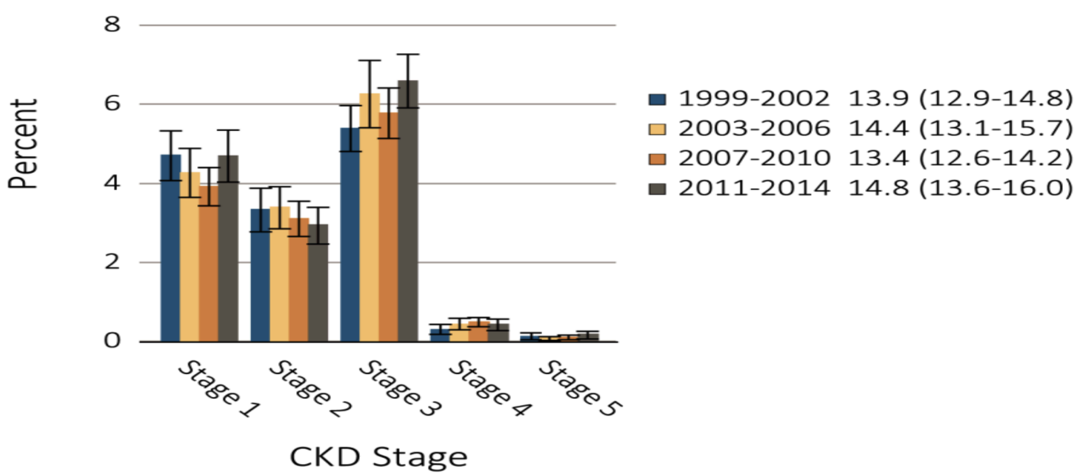


Figure 5: Chronic Kidney Disease Stages Data

2.6 Equations Used to estimate CKD in both Adult and children

The best equation for estimating GFR level in children is Bedside Schwartz equation.

Bedside Schwartz Equation

$$GFR\ (mL/min/1.73\ m^2) = (0.41 \times Height\ in\ cm) / Creatinine\ in\ mg/dL.$$

Modification of diet in renal disease (MDRD) is used to calculate GFR in the adult population, but due to the limited evaluation in the elderly population which they account for most of the CKD prevalence, a concern was raisd that this equation doesn't accurately reflect GFR in the elderly population.[11]

MDRD Equation

GFR (mL/min/1.73 m^2) = 175 × (Scr)-1.154 × (Age)-0.203 × (0.742 if female) × (1.212 if African American).

Epidemiology Collaboration equation (EPI)

The most widely-used equation is EPI. Race and sex use different creatinine serum (mg/dl) as shown in Figure 6.

CKD EPI Equation for Estimating GFR on the Natural Scale Expressed for Specified Race, Sex and Standardized Serum Creatinine (From Ann Intern Med 2009;150:604-612, used with permission)

Race	Sex	Serum Creatinine (mg/dL)	Equation
Black	Female	≤0.7	$GFR = 166 \times (Scr/0.7)^{-0.329} \times (0.993)^{Age}$
Black	Female	>0.7	$GFR = 166 \times (Scr/0.7)^{-1.209} \times (0.993)^{Age}$
Black	Male	≤ 0.9	$GFR = 163 \times (Scr/0.9)^{-0.411} \times (0.993)^{Age}$
Black	Male	>0.9	$GFR = 163 \times (Scr/0.9)^{-1.209} \times (0.993)^{Age}$
White or other	Female	≤0.7	$GFR = 144 \times (Scr/0.7)^{-0.329} \times (0.993)^{Age}$
White or other	Female	>0.7	$GFR = 144 \times (Scr/0.7)^{-1.209} \times (0.993)^{Age}$
White or other	Male	≤ 0.9	$GFR = 141 \times (Scr/0.9)^{-0.411} \times (0.993)^{Age}$
White or other	Male	>0.9	$GFR = 141 \times (Scr/0.9)^{-1.209} \times (0.993)^{Age}$

CKD-EPI equation expressed as a single equation: $GFR = 141 \times \min(Scr/\kappa, 1)^{\alpha} \times \max(Scr/\kappa, 1)^{-1.209} \times 0.993^{Age} \times 1.018$ [if female] $\times 1.159$ [if black] where Scr is standardized serum creatinine in mg/dL, κ is 0.7 for females and 0.9 for males, α is -0.329 for females and -0.411 for males, min indicates the minimum of Scr/κ or 1, and max indicates the maximum of Scr/κ or 1.

Figure 6: CKD-EPI Equation [12]

2.7 Albumin to Creatinine Ratio

ACR (Albumin to Creatinine Ratio) is a urine test that is used to measure a major protein commonly found in the blood called albumin. An indication of early kidney disease may be the presence of a small amount of albumin in the urine. Table 3 shows three categories of albumin in CKD to determine the severity of the urine albumin protein. The ACR is calculated by dividing the concentration of albumin into milligrams by grams of creatinine[13,14]

Albumin in CKD		
Category	**ACR (mg/g)**	**Terms**
A1	<30	Normal to mildly increased
A2	30-300	Moderately increased
A3	>300	Severely increased

Table 4: ACR in CKD

According to the national kidney foundation the cause of CKD is classified based on the incidence and the lacks of systematic disease and location within the kidney. For many patients with CKD, the cause of the disease is not expected to be known with certainty but may be either inferred or unknown.[15]

Type of Disease	systemic diseases affecting the kidney	primary kidney diseases (absence of systemic diseases affecting the kidney)
Glomerular diseases	Diabetes, systemic autoimmune diseases, systemic infections, drugs, neoplasia (including amyloidosis)	Diffuse, focal or crescentic proliferative glomerulonephritis; focal and segmental glomerulosclerosis; membranous nephropathy, minimal change disease
Tubulointerstitial diseases	Systemic infections, autoimmune, sarcoidosis, drugs, urate, environmental toxins (lead, aristolochic acid), neoplasia (myeloma)	Urinary-tract infections, stones, obstruction
Vascular diseases	Atherosclerosis, hypertension, ischemia, cholesterol emboli, systemic vasculitis, thrombotic microangiopathy, systemic sclerosis	ANCA-associated renal limited vasculitis; fibromuscular dysplasia
Cystic and congenital diseases	Polycystic kidney disease, Alport’s syndrome, Fabry’s disease	Renal dysplasia, medullary cystic disease, podocytopathies

Table 5: Causes of CKD

2.8 Chronic Kidney Disease Risk factors:

2.8.1 Diabetes

Diabetes is one of the leading causes of CKD. Its defined by hemoglobin (HgbA1c) ≥ 6.5 in a blood test. It occurs when the body is not making enough insulin or can't use the insulin it makes. Insulin is a hormone that controls the amount of sugar (glucose) in the blood. There are two types of diabetes; type1 and type 2. Type 1 is when the body does not make insulin at all. About 5 to 10 % of cases are type 1. 6 Type 2 is when the body is making insulin and cannot make good use of it. Over time high glucose levels can target the blood vassals in the kidney causing it to be narrowed and clogged. Without enough blood, the kidney becomes damaged allowing albumin (a type of protein) to pass with urine. About a third of people with diabetes might develop kidney failure.[16]

In a cross-sectional study of 15,675 participants to investigates the prevalence of diabetes in CKD using EPI and ACR formulas. By using EPI formula, they found that the participants with diabetes n=2279 and without diabetes n=13,396 prevalence of CKD was 25% versus 5.3% to the participants without diabetes. When ACR formula was used, the results were 16% versus 3.0% to the participants without diabetes. Also, the ACR for participants with ≥300mg/g was 4.6% versus 0.3%. the eGFR<60 ml/min per 1.73 m2 was 12% versus 2.5% and eGFR<30 ml/min per 1.73 m2 was 2.4% versus 0.4%.[16] Figure 7 shows the percentage of diabetes in CKD patients in the United States in 2014.[17]

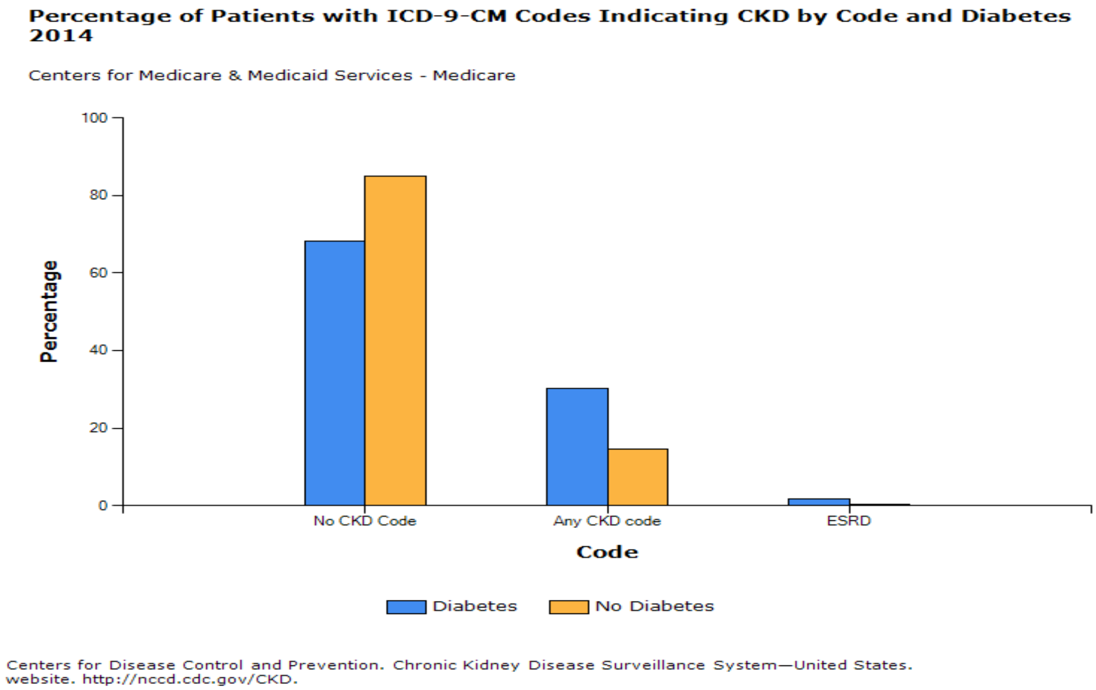


Figure 7: The ICD-9 of CKD patients with diabetes

2.8.2 Hypertension

CKD and hypertension have a unique relationship; they are the cause and the outcome of each other. High blood pressure is the second leading cause of CKD. It's reported that 85% to 95% of CKD patients has hypertension.[18] Hypertension occurs and develops early during CKD. Renal function worsening is one of the outcomes of hypertension. Although, many trials have shown a strong indicator that hypertension is a major risk factor that will lead to ESRD (End-stage renal disease). During a risk factor intervention trial, the BP for ESRD >20-fold higher for patients with stage 4 hypertension (SBP > 210 mmHg or DBP > 120 mmHg) than for patients with optimal BP levels (SBP < 120 mmHg and DBP < 80 mmHg). [19] For CKD patients keeping hypertension under controls is important to help prevent any adverse renal outcome. Figure 8 shows hypertension in patients by age race and ethnicity.

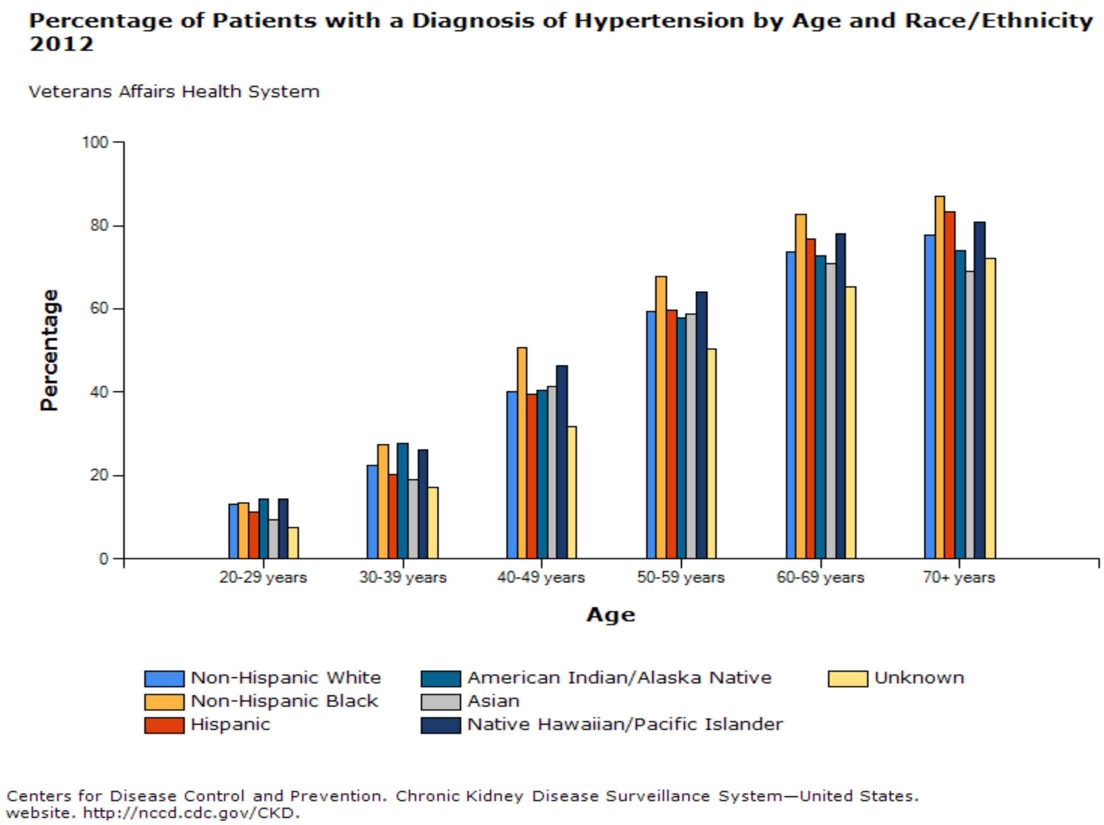


Figure 8: Hypertension by Age Race/Ethnicity [20]

2.8.3 Cardiovascular Disease

CKD significantly contribute to developing CVD (cardiovascular disease). As a result, patients with ESKD experience CVD due to the increase of albuminuria. A cohort study conducted on individuals aged between 45 to 64 and found that a decrease in GFR is an independent risk factor for recurrent and de novo CVD. [21]

Another study performed a comprehensive analysis of 37,153 persons with a median follows up of 16 months. The findings were persons with anemia, GFR of <60mL/min per 1.73 m2 and albuminuria were an independent risk factor for developing CVD. The survival rate was 93% of 30 months for persons with CVD and CKD compared to 98% for persons without CVD.[22]

2.8.4 Family History of Kidney Disease

Another risk factor is a family history of CKD. Approximately 24% of ESRD patients have a first-degree relative, an association that is much stronger in African Americans than whites. Freedman et al. study concluded that 20% of all dialysis patients treated in Georgia, North Carolina, and South Carolina had a family history of ESRD in a first and second-degree relative.[23] In another cohort study on 177,570 persons in northern California reported that a family history of kidney disease was related to de novo end-stage kidney disease. [24] in a study of 19,409 participants with CKD an 11.1% reported having a family history of CKD.[25]

2.8.5 Age

CKD is a prevalent clinical issue in elderly patients and its associated to the increase of morbidity and mortality. With the rise of life expectancy in the world, the prevalence of high rates of hypertension and diabetes in the elderly population has been a burden on CKD. Based on the Medicare population, patients 65 and older for part A, B, and D, the total cost has increased to 3.7 % between 2010 and 2013. CKD costs increased in 2013 by 20.88 %. Patients 65-69 in 2013 increased by 3.40%. Patients 70-74 decreased by 3.5 % and 75-79 a decrease of 3.45 %.80-84 A reduction of 5.19 %. [26]

2.8.6 Anemia

Anemia is a condition in which the body has less red blood cells than average. Red blood cells carry oxygen to the organs, and when anima is the presence the amount of oxygen transported to the tissues and organs is low, then the organs might not function as it should. Anemia occurs in CKD patients who have a total loss of kidney function or kidney failure. When the kidneys are damaged and don't make EPO. EPO (erythropoietin) is a hormone made by the kidney to signal the need to produce red blood cells. Low levels of Iron, Vitamin B12 and folic acid are a common deficiency in patients with kidney disease. Anemia like other causes has its complications for CKD patients such as irregular heartbeat, heart muscle enlargement, and heart failure. [27]

In a study of 12,077 adults with CKD from 2007 - 2010 to find out the prevalence of anima in CKD patients. They found that anima was counted for 15.4 % in patients with CKD a total of 4.8 million people in the United States with CKD. With stage 1 accounts for 8.4 % where stage 5 (ESKD) increased to 53.4 %. [28]

2.8.7 Obesity

Obesity like other risk factors that contributes to the progression of chronic kidney disease. It raises the blood pressure causing volume expansion in the renin system making the kidney to be compressed and distressed. In a cohort study of 11,104 healthy men to evaluate the association between obesity and CKD and after 14 years of follow up, they concluded that higher BMI was associated significantly with increased risk of developing CKD.[29]

2.8.8 Race

Although, race contribute to many diseases. It often due in part to diabetes and hypertension. The prevalence of CKD between 2011 to 2014 was 16.9 %. A study of 19,205 participants to find the differences between racial and ethnic among mortality of CKD patients in five groups were performed using KEEP data. The groups were African American, Asian, non-Hispanic white and American Indian/Alaskan native. The prevalence in African American (n=5237) were 27 %, white (n=10,560) were 55 %. Also, the Asian group of (n=951) were 5 %, and Hispanic were (n=1638) were 9 %. In American Indian/Alaskan native (n=813) was 4 %. Finally, race and ethnicity increase the chances of a higher mortality rate in CKD patients. [30]

2.8.9 Renal Failure

Renal failure is defined when the kidneys have less than 15% of its function or can't filter blood anymore. A blood sample result of the glomerular filtration rate <15 ml/min/ 1.73 m2 indicates ESKD. The fluids intake should be monitored because the kidneys are severely injured and can lead to heart complications. Blood that is not filtered through the kidneys are circulating back to the heart and causing the blood to carry more waste and then causing other organs to suffer such as the heart. As a result, the nephrologist will need to start hemodialysis to help the body get rid of harmful waste.[31]

Hemodialysis is a type of treatment that filters the blood through a machine. It removes harmful waste and extra fluids the body no longer needs. Also, hemodialysis helps control blood pressure, balance potassium, sodium, calcium, and bicarbonate. [32]

As a result of ESKD, a surgeon will need to create an access for the machine to start filtering. Vascular access is typically done at the patient's arm where high blood volume flows during a hemodialysis session. There are two types of vascular access that can last for a long time. AV fistula is by connecting an artery into a vein to allow enough blood to travel to the machine. The second type is the AV graph. The difference between the two is in AV graph surgeon will use a human-made tube to connect the artery and a vein. It mostly used if AV fistula can't be connected due to other reasons. [33]

When the dialysis starts the blood travels through a needle to the machine and inside the device, the blood goes through thin fibers that filter the waste and the extra fluid as the healthy kidney would. Hemodialysis can be used either at a center where a registered nurse helps with the process or at home and that can be hard for most patients in regards to insurance reimbursement. [33] Figure 9 illustrates how hemodialysis machine is connected to the patient arm.

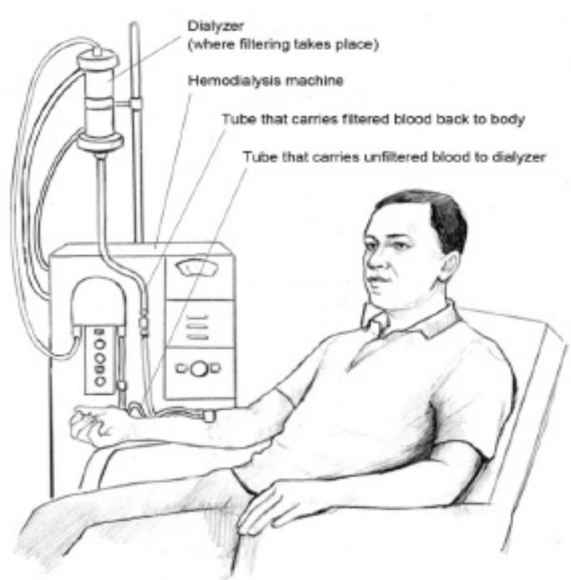


Figure 9: Hemodialysis machine

Peritoneal dialysis is another option for ESKD patients. It filters the blood through a machine to get rid of excess fluid and waste. This type of dialysis is performed at home and requires some level of knowledge.

A permanent catheter will be placed in the belly. Then every time a patient is starting a session of dialysis salty water (dialysis solution) needs to be emptied into the catheter. While the solution is in the belly, it soaks waste and fluids. After a few hours, the solution is drained. [33]

Two types of Peritoneal Dialysis

- Continuous ambulatory peritoneal dialysis

  This type does not require a machine and can be done using a salty solution for 4 to 6 hours and then is drained.

- Continuous cycler-assisted peritoneal dialysis

  This type requires a machine that fills and empty the belly three to five times during the night while asleep.

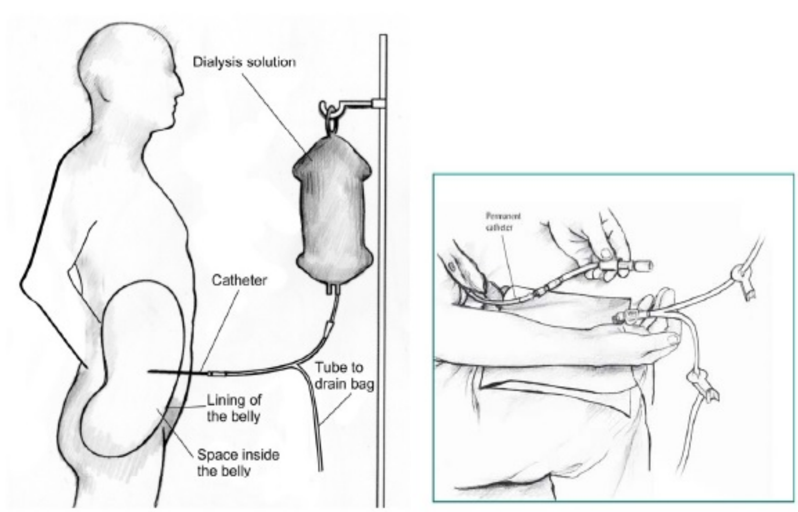


Figure 10: peritoneal dialysis

2.9 Treatments

The best treatment is through transplantation. Transplantation is a surgical operation which a healthy kidney is transsferd from either alive or a recently deceased donor. The human body may still reject the new kidney but with conservative diet and medication they body may adjust and accept it. A working transplanted kidney would keep an affected person healthier than dialysis.

2.10 Research Gap

The current literature has focused more on the factors associated with CKD as well as its etiology. Also, it contributed to finding CKD prevalence in the United States by using laboratory methods such as MDRD, EPI formula and population characteristics. This study will make a comprehensive review of the cofactors that are linked to the developing of CKD by looking at healthcare facilities discharge of inpatient profiles obtained from the NIH database. The outcome of this study will look for the effects of comorbidities on the length of stay, total charges, and mortality.

CHAPTER III

RESEARCH METHODS AND DESIGN

3.1 Research Questions and Hypotheses

Hypothesis 1: Are there any statistical significant association between race, gender, insurance, socioeconomics, types of comorbidities , hospital region in different age groups in terms of total charges

- **Null hypothesis: (H0 = H1)**: race, gender, insurance, socioeconomics, types of comorbidities , hospital region have no significant difference with total charges in CKD patients

- **Alternative hypothesis (H0 ≠ H1)**: race, gender, insurance, socioeconomics, types of comorbidities , hospital region have a significant difference with total charges in CKD patients

Hypothesis 2: Are there any statistical significant associations between race, gender, insurance, socioeconomics, types of comorbidities , hospital region in different age groups in terms of length of stay

- **Null hypothesis: (H0 = H1)**: race, gender, insurance, socioeconomics, types of comorbidities , hospital region have no significant difference with total charges in CKD patients

- **Alternative hypothesis (H0 ≠ H1)**: race, gender, insurance, socioeconomics, types of comorbidities , hospital region have a significant difference length of stay in CKD patients

Hypothesis 3: Are there any statistical significant associations between race, gender, insurance, socioeconomics, types of comorbidities , hospital region in different age groups in terms of mortality

- **Null hypothesis: (H0 = H1)**: race, gender, insurance, socioeconomics, types of comorbidities , hospital region have no significant difference with have no significant difference with mortality in CKD patients
- **Alternative hypothesis (H0 ≠ H1)**: race, gender, insurance, socioeconomics, types of comorbidities , hospital region have a significant difference with mortality in CKD patients

Hypothesis 4: Are there any statistical significant associations between race, gender, insurance, socioeconomics, types of comorbidities , hospital region and different age group on developing CKD

- **Null hypothesis: (H0 = H1):** race, gender, insurance, socioeconomics, types of comorbidities , hospital region have no significant difference in age group on developing CKD
- **Alternative hypothesis (H0 ≠ H1):** race, gender, insurance, socioeconomics, types of comorbidities , hospital region have a significant difference in age group on developing CKD

3.2 Nationwide Inpatient Sample Dataset

The national inpatient sample (NIS) database is used in this study. NIS is part of the Healthcare Cost and Utilization Project (HCUP). It's the most extensive database available to all-payer inpatient in the United States. It includes data from more than 7 million hospital stays each year. And an estimated more than 35 million hospitalization nationally. The database samples include patient's types, insured or not, including individuals covered by Medicare, Medicaid or privately insured. The NIS database is being used by researchers and policymakers to identify, and predict future trends in healthcare.[34]

3.3 Data and Methods

In this study, the dataset was obtained from the Nationwide Inpatient Sample (NIS). The NIS has more than 7 million hospital stays each year. Accounting from all discharge data of 1,050 hospitals located in 44 States, approximating a 20% stratified sample of U.S community hospitals. Also, the NIS contains more than one hundred clinical and nonclinical data elements for each hospital stay. These include the following:

- Primary and secondary diagnoses
- Primary and secondary procedures
- Admissions and discharge status
- Patient demographics (gender, age, race, the median income for zip code)
- Hospital settings such as teaching status or not
- Expected payment source
- Total charges
- Length of stay

3.4 Data population sample

The data variables used in this research was obtained from the NIS dataset for 2009-2012. HCUP appendix C clinical classification software included CKD ICD-9 code (158) and its cluster code that contains all CKD related ICD-9 codes, 585, 5851, 5852, 5853, 5854, 5855, 5856, 5859. After extracting chronic kidney disease dataset using ICD-9 code 158, table 6 shows all variables used.

NIS Variables	Definition	Value	Level of measurement
AGE	Age in years at admission	0-115 years old	Continuous
FEMALE	Indicator of sex	0=Male 1=Female	Nominal
RACE	Race	1=White 2=Black 3=Hispanic 4=Asian or Pacific Islander 5=Native American, 6=Other	Nominal
DIED	Mortality	0=did not die during hospitalization 1= Died during hospitalization	Nominal (binary)
DXn	Diagnoses	ICD-9 codes for diagnosis	Nominal
TOTCHG	Total Charges	Total charges for hospitalization	Nominal
LOS	Length of Stay	0-365 days	Continuous
PAY 1	Insurance type	1=Medicare, 2=Medicaid, 3=Private insurance 4=Self-pay 5=No charge 6=Other	Nominal

HOSP-LOCATION	HOSPITAL LOCATION	0=Rural 1=Urban	Nominal
Total DISC	Total hospital discharges	5(n)	Real number
NPR	number of procedures	number of procedures performed during hospitalization	Nominal
ZIPINC_QRTL	socioeconomic status	Median household income for patient's ZIP Code, 1-4 Less than $39,000 $39,000 - $47,999 $48,000 – 62,999 More than $63,000	Nominal
HOSP_REGION	Region of hospitals	1=Northeast 2=Midwest 3=South 4=West	Nominal
CM_DM	Diabetes, uncomplicated	0= not present 1= present	Nominal
CM_DMCX	Diabetes with chronic complications	0= not present 1= present	Nominal
CM_OBESE	Obesity	0= not present 1= present	Nominal
CM_AIDS	Acquired immune deficiency syndrome	0= not present 1= present	Nominal
CM_ANEMDEF	Deficiency anemias	0= not present 1= present	Nominal
CM_ARTH	Rheumatoid arthritis/collagen vascular diseases	0= not present 1= present	Nominal
CM_BLDLOSS	Chronic blood loss anemia	0= not present 1= present	Nominal
CM_CHF	Congestive heart failure	0= not present 1= present	Nominal

CM_CHRNLUNG	Chronic pulmonary disease	0= not present 1= present	Nominal
CM_COAG	Coagulopathy	0= not present 1= present	Nominal
CM_DEPRESS	Depression	0= not present 1= present	Nominal
CM_DRUG	Drug abuse	0= not present 1= present	Nominal
CM_HTN_C	Hypertension (combine uncomplicated and complicated)	0= not present 1= present	Nominal
CM_HYPOTHY	Hypothyroidism	0= not present 1= present	Nominal
CM_LIVER	Liver disease	0= not present 1= present	Nominal
CM_LYMP	Lymphoma	0= not present 1= present	Nominal
CM_LYTES	Fluid and electrolyte disorders	0= not present 1= present	Nominal
CM_METS	Metastatic cancer	0= not present 1= present	Nominal
CM_NEURO	Other neurological disorders	0= not present 1= present	Nominal
CM_PARA	Paralysis	0= not present 1= present	Nominal
CM_PERIVASC	Peripheral vascular disorders	0= not present 1= present	Nominal
CM_PSYCH	Psychoses	0= not present 1= present	Nominal
CM_PULMCIRC	Pulmonary circulation disorders	0= not present 1= present	Nominal
CM_RENLFAIL	Renal failure	0= not present 1= present	Nominal
CM_TUMOR	Solid tumor without metastasis	0= not present 1= present	Nominal
CM_ULCER	Peptic ulcer disease excluding bleeding	0= not present 1= present	Nominal
CM_VALVE	Valvular disease	0= not present 1= present	Nominal
CM_WGHTLOSS	Weight loss	0= not present 1= present	Nominal

Table 6: Description of all variables included in the national inpatient sample (NIS) data.

3.5 Study hypotheses and associated statistical tests

Four objectives were tested and analyzed to answer the research questions by using different inferential and descriptive statistical analysis as given in Table 7.

Research Question	Hypothesis	Independent Variables	Outcome Variables	Inferential Analyses
Do race, gender, insurance, socioeconomics, types of comorbidities , hospital region significantly affect total charges	Hypothesis1	race, gender, insurance, socioeconomics, types of comorbidities , hospital region	TOTCHG	Multi Linear Regression (TOTCHG) vs race, gender insurance, socioeconomics types of comorbidities hospital region
Do Type of race, gender, insurance, socioeconomics, types of comorbidities , hospital region significantly length of stay (LOS)	Hypothesis2	race, gender, insurance, socioeconomics, types of comorbidities , hospital region	LOS	Multi Linear Regression (LOS) vs race, gender insurance, socioeconomics types of comorbidities hospital region
Do Type of race, gender, insurance, socioeconomics, types of comorbidities , hospital region significantly affect mortality(DIED)	Hypothesis3	race, gender, insurance, socioeconomics, types of comorbidities , hospital region	DIED	Logistic Regression (DIED) vs race, gender insurance, socioeconomics types of comorbidities hospital region

is race, gender, insurance, socioeconomics, types of comorbidities , hospital region associated with developing CKD	Hypothesis4	race, gender, insurance socioeconomics types of comorbidities hospital region	CKD	Logistic Regression vs race, gender insurance, socioeconomics types of comorbidities hospital region

Table 7: Study Hypotheses and its Associated Statistical Tests

3.6 Patient characteristics and hospital Context

Variables	Attributes
Race	White
	Black
	Hispanic
	Asian or Pacific Islander
	Native American
	Other
Gender	Male
	Female
Age group	0-19
	20-64
	65-74
	75-84
	> 85
Comorbidities	Hypertension
	Diabetes
	Anemia
	Congestive heart disease
	Drug abuse
	Fluid and electrolytes disorder
	Obesity
Socioeconomics	< $39,000
	$39,000 - $47,999
	$48,000 – 62,999
	> $63,000
Insurance type	Medicare
	Medicaid
	Private insurance

	Self-pay
	other
Hospital Context Variables	Attributes
Hospital Location	Rural
	Urban
Hospital Region	Northeast
	Midwest
	South
	West

Table 8: Patient characteristics and hospital Context

CHAPTER IV

RESULTS OF THE DATA ANALYSIS

4. Sample Characteristics

Data were obtained from the NIS database between 2009 and 2012 and after merging the data, a total sample of 660,663 out of 30,931,761 discharge records of patients who were diagnosed with chronic kidney disease. SAS Enterprise was used to perform descriptive and inferential analysis.

4.1 The Outcomes of the descriptive Analysis

Age is one of the major risk factors in chronic kidney disease patients. The one-way frequency test showed that the average age was 63 years old and the percentile range was between 0 and 115 years old. A total of (n= 4809) patients were between the age of 0 to 19(0.79%). 20 to 64 years old patients were totaling (n=297,586) 49.05 %. 65 to74 years old were(n= 136,100) 22.43%. 75 to 84 years old (n=115,09) 19%. And 85 and older were (n=53,015) 8.73% and 55 were missing.

Age	Count	%age
0-19	4809	0.79%
20-64	297,586	49.05%
65-74	136,100	22.43%
75-84	115,098	19%
> 85	53,015	8.73%
missing	55	0.009
total	606,663	100%

Table 9: Age Distribution

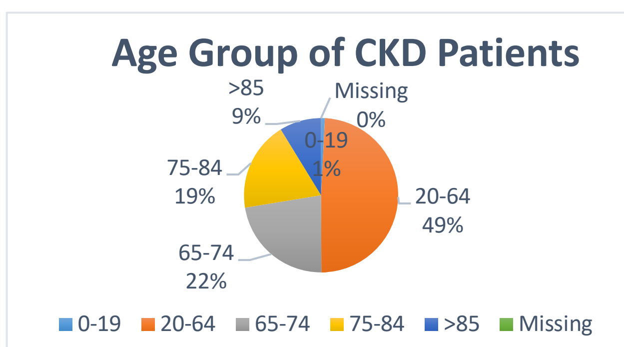


Figure 11: Age Percentage

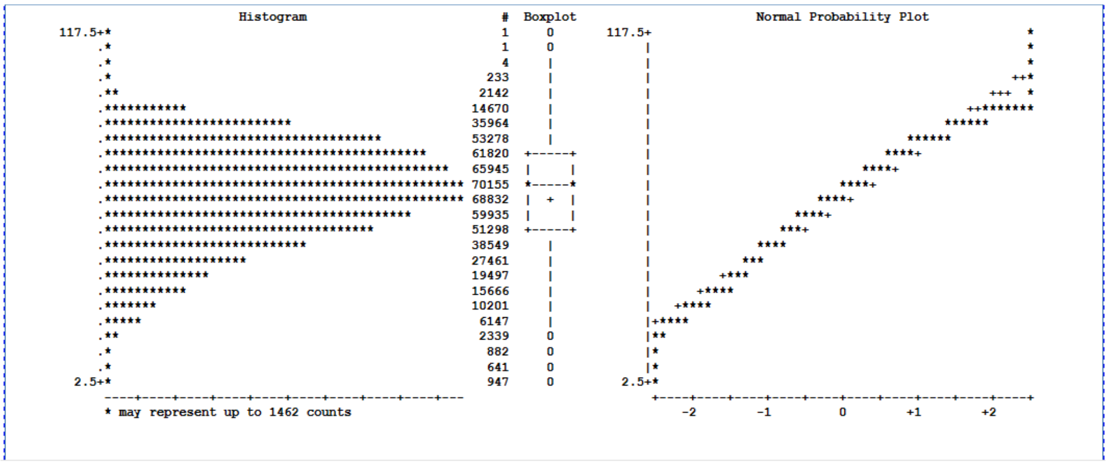


Figure 12: age at admission

4.1.2 Patient Gender

In CKD incidence, between 2009 to 2012 female patients were 51.76%, and male patients were 48.23%.

Gender	Count	%age
Male	313,990	51.76%
Female	292,619	48.23%
Missing	54	0.01%
Total	606,663	100%

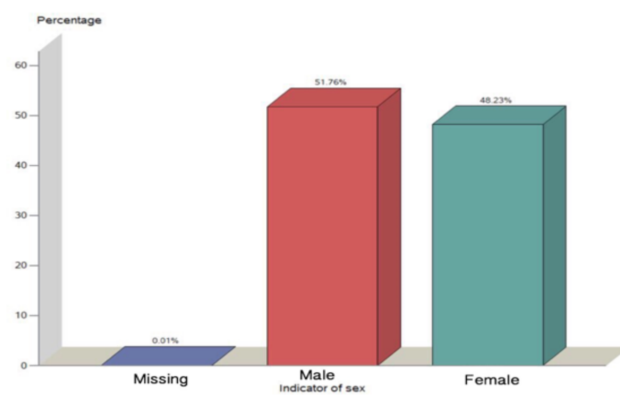


Table 10: Gender percentage

Figure 13: gender Frequency

4.1.3 Race

The study population showed 43.51% were white patients and 30.13% were black patients. Asian or Pacific Islander patients had 2.11%, and the Hispanic race had 11.30%. The Native Americans patients had the lowest %age among all race groups which is 0.89% as shown in figure 14 and table 11.

Race	Count	Percentage
White	263,936	43.51%
Black	182,807	30.13%
Hispanic	68,530	11.30%
Asian or Pacific Islander	12,780	2.11%
Native American	5,371	0.89%
Other	16,065	2.65%
Missing	57,172	9.42%

Table 11: Races percentages

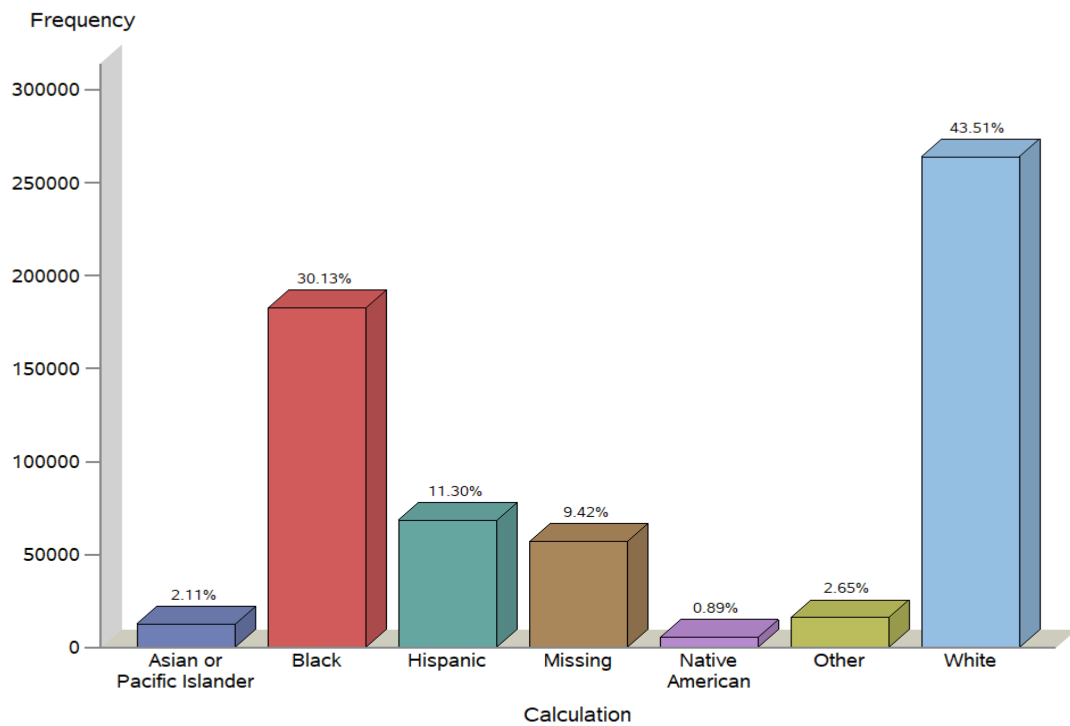


Figure 14: Races incidence among races

4.1.4 Insurance type

As shown in table 12 and figure 15 Medicare recipients were the heights among all groups 76%.private insurance patients had 11.8%, then Medicare recipients had 8.3%. Also, self-pay had 1.8%, and other insurance types had 1.50%.

Health Insurance	Count	percentage
Medicare	461,459	76%
Medicate	50,184	8.3%
Private Insurance	71,365	11.8%
Self-pay	11,098	1.8%
No Charge	2,032	0.33%
Other	8,914	1.50%
Missing	1,403	0.23%

Table: 12 Insurance type ratio in CKD

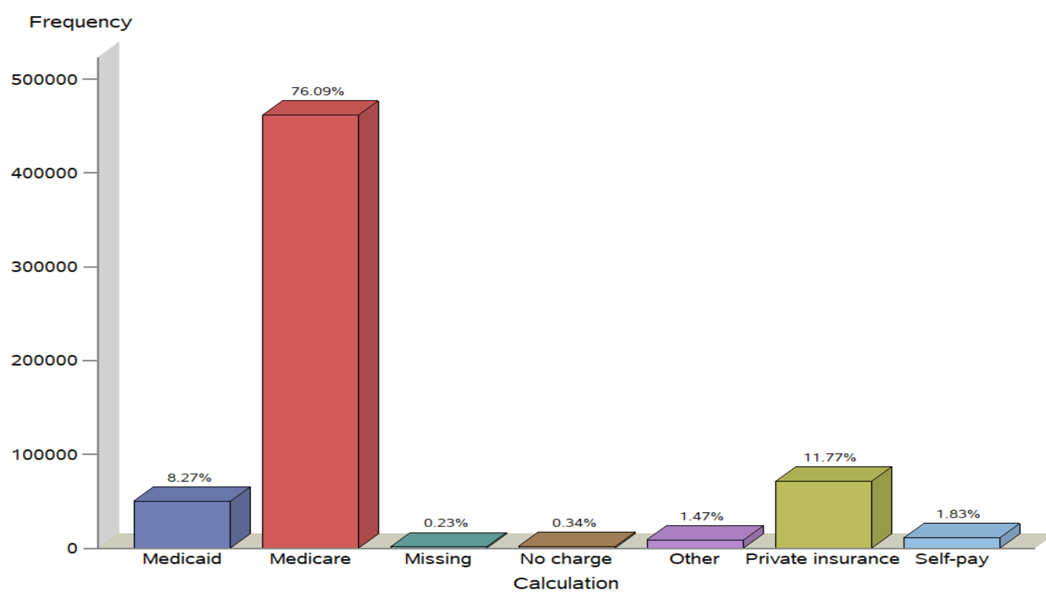


Figure 15: Health Insurance of CKD Sample

4.1.5 Distribution of comorbidities in CKD patients in NIS 2009-2012 as shown in figure 16

As an important part of the descriptive analysis we need to detail the comorbidities and find out the most significant risk factors associated with developing CKD. The overall sample is (n=**606,663**) and the first risk factor that contributes to developing CKD is hypertension **72.5%** diabetes mellitus (complicated **22.09%** and uncomplicated **29.41%**). Congestive heart disease **19.30%.** Anemia deficiency **22.09%**, obesity **10.50%** and as a result of the above risk factors CKD patients develop renal failure which account for (**534,468**) or **88.1%,** other major prevalence are fluid and electrolytes disorder **29.25%** and peptic ulcer disease **33.13%**.

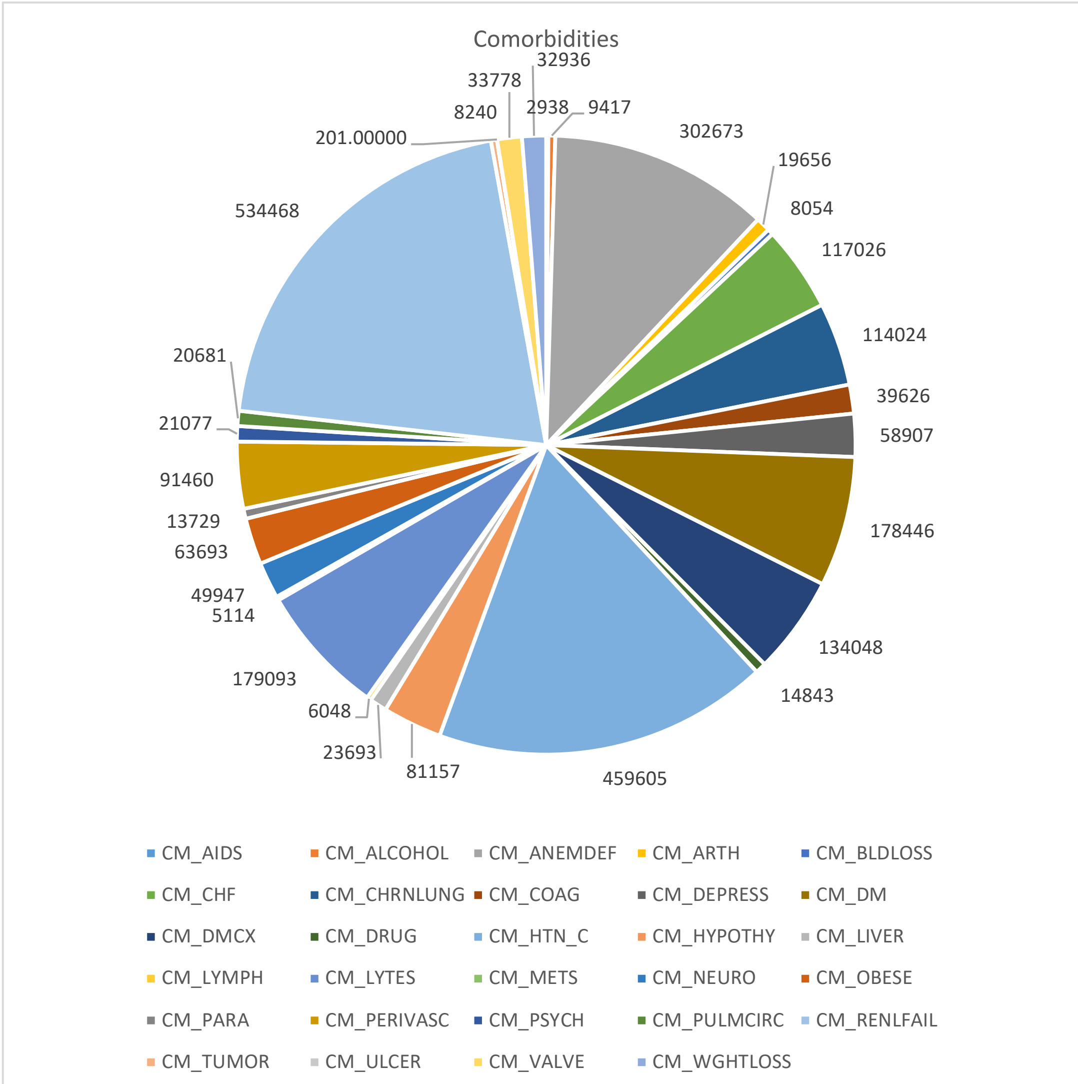


Figure 16: Distribution of comorbidities in CKD patients in NIS 2009-2012

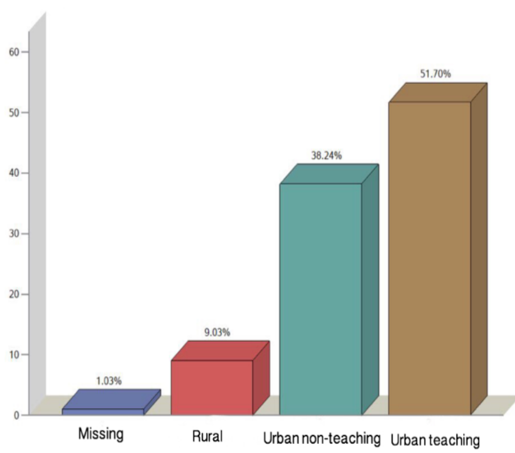
CM_AIDS*:** Acquired immune deficiency syndrome, ***CM_ALCOHOL*:** Alcohol abuse, ***CM_ANEMDEF*:** Deficiency anemias, ***CM_ARTH*:** Rheumatoid arthritis/collagen vascular diseases, ***CM_BLDLOSS*:** Chronic blood loss anemia, ***CM_CHF*:** Congestive heart failure, ***CM_CHRNLUNG*:** Chronic pulmonary disease, ***CM_COAG*:** Coagulopathy, ***CM_DEPRESS*:** Depression, ***CM_DM*:** Diabetes, uncomplicated, ***CM_DMCX*:** Diabetes with chronic complications, ***CM_DRUG*:** Drug abuse, ***CM_HTN_C*:** Hypertension (combine uncomplicated and complicated), ***CM_HYPOTHY*:** Hypothyroidism, ***CM_LIVER: Liver disease, ***CM_LYMPH*:** Lymphoma, ***CM_LYTES*:** Fluid and electrolyte disorders, ***CM_METS*:** Metastatic cancer, ***CM_NEURO*:** Other neurological disorders, ***CM_OBESE*:** Obesity, ***CM_PARA*:** Paralysis, ***CM_PERIVASC*:** Peripheral vascular disorders, ***CM_PSYCH*:** Psychosis**,** ***CM_PULMCIRC*:** Pulmonary circulation disease, ***CM_RENLFAIL*:** Renal Failure**,** ***CM_TUMOR*:** Solid tumor without metastasis**,** ***CM_ULCER*:** Peptic ulcer disease excluding bleeding**,** ***CM_VALVE*:** Valvular disease**,** ***CM_WGHTLOSS***: Wight lose.

4.1.6 Hospital type teaching or non-teaching

Urban teaching hospitals had a total of 313,671 patients from 2009 to 2012. Urban non-teaching hospitals had a total of 231,966 patients. Rural hospitals have 54,783 patients. Figure 17

4.1.7 Hospital Regions

The South region had (n=268,513) or 44.26% of the total patients. Midwest (n=137,704) or 22.7%Northeast had (n=117,823)or 19.42%. West region has the lowest ratio of 13.62%. Shown in Figure 18.



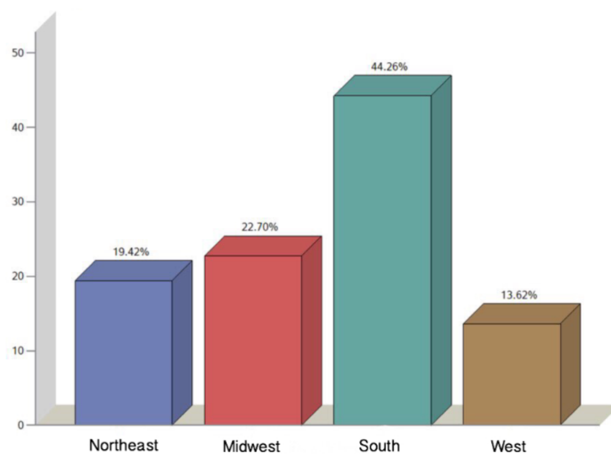


Figure 17: Hospital location and teaching status Figure18: Hospital regions and percentage of CKD

4.1.8 Mortality of CKD

Between 2009 and 2012 a total of 16,167 patients died during hospitalization as shown in figure19.

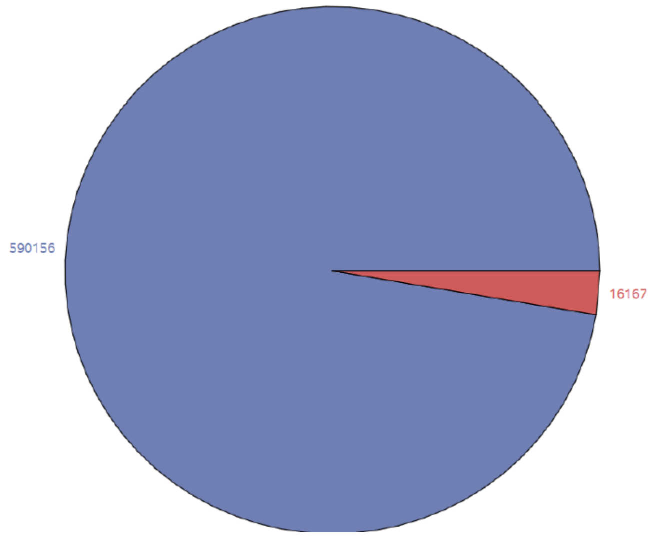


Figure 19: Frequency of mortality in CKD patients

4.1.9 Mean and median of length of stay of CKD patients 2009-2012 (LOS)

The mean of the length of stay of CKD patients between 2009 to 2012 was 5.4 days where the median was 4 days as shown in figure 20.

Analysis Variable : LOS Length of stay for each year						
Calendar year	N Obs	Mean	Std Dev	Std Error	N	Median
2009	138210	5.6249114	7.3204205	0.0196915	138202	4
2010	152359	5.4594353	7.1954752	0.0184356	152337	4
2011	173338	5.3771296	6.7425262	0.0161950	173333	4
2012	142756	5.2541525	6.6307232	0.0175501	142745	4

Analysis Variable : LOS Length of stay for years 2009-2012				
Mean	Std Dev	Std Error	N	Median
5.4252417	6.9685908	0.000199541	1219620791	4

Figure 20: Mean and median for 2009 to 2012 in length of stay

4.1.10 Average length of stay from 2009 to 2012

Figure 21 shows the average length of stay starting the year 2009 to 2012 of CKD patients in the United States.

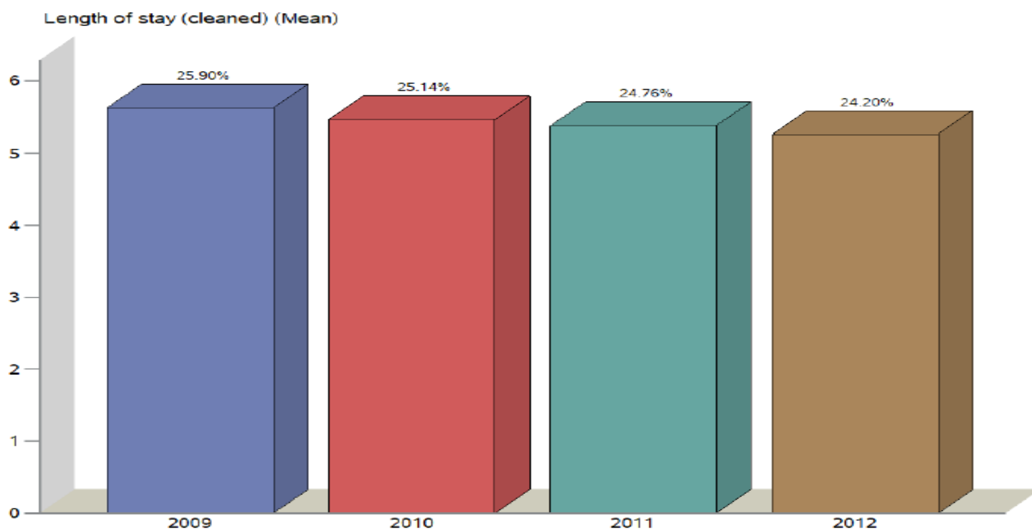


Figure 21: Average length of stay

4.1.11 Average of the total discharges by region

Figure 22 show the mean for each region included in the NIS and indicates that the West region had the highest total discharge when comparing to the other regions from 2009 to 2012.

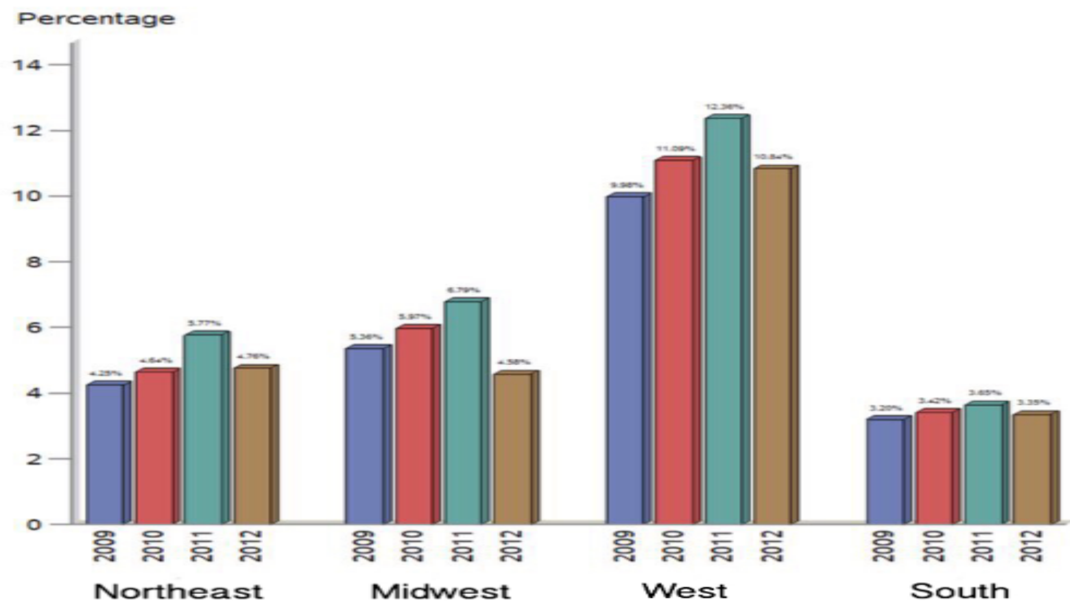


Figure 22: Average total discharges by region

4.1.13 Average Total charges

The average charges of 2009 were $40,695.42 and in 2010 increased to (0.88%). In 2011 it rose to (1.7%) wherein 2012 it increased by (0.6%).

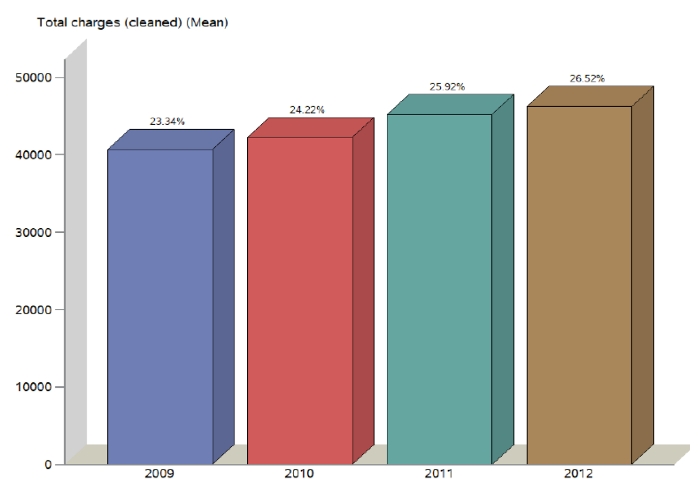


Figure 23: Mean of Total charges

4.2 Evaluation of hypothesis 1: race, gender, insurance, socioeconomics, types of comorbidities , hospital region , hospital location in different age groups and total charges

4.2.1 linear regression -Age group 0-19 vs total charges

linear regression was used to examine the age group 0-19 years old. Total charges was the dependent variable and after adjusting for the other variables in the model (table 13) CKD patients total charges decreased by $1,763 over patients with other illnesses. the total charges for African American increased by $2,646 over White(reference). Hispanic were charged $1,227 more than White. Although, Asian or pacific Islander were charged less than White (reference) by $173.67. Native Americans charges increased by $1,891 more than White(reference). Other races were charged $3,045 more than the reference. The model is statistically significant (<.0001).

Female patients were charged less than male by $2,409 . Patients total charges for Medicaid insurance showed that it increased by $9,553 more than Medicare(reference). For private insurance the total charges increased by $8,146 more than Medicare. Self-pay were charged $3,694 more than Medicare. No Charges increased by $9,978 more than Medicare. Other forms of payments were charged more than Medicare by $16,409.

For the socioeconomic status, patients who made less than <$39.999 was used as a reference to compare the other category too. So the model showed that patients who earned between $39,000 to $47,999 were charged $815.9 less than the reference. For patients with an income of $48,000 to 62,999, they were charged $984 less than the reference. Lastly, for patients whose income is more than $63,000 were charged $1392 less than the reference.

Patients with Hypertension showed an increase in total charges by $58,167 over patients without hypertension. For obese patients their charges were more than patients who are not obese by $2,463 For those with and congestive heart failure their total charges were $151,734 more than patients without CHF. patients with uncomplicated diabetes were charged $6178 more than patients without diabetes. Moreover, patients with complicated diabetes total charges increase by $29,339 more than patients without diabetes complications. Drug abuse chegres were $8902 more than patients without drug abuse. Patients with electrolytes disorder were charged $48,068 more than patients without . patients with anemia total charges were $22,371 more than patients without.

Urban hospitals charged CKD patients more than rural hospitals by $11,825. The total charges for patients in the Midwest region were $5,225 less than the reference (Northeast). Patients in the South region were charged $4,557 less than the reference (Northeast). Where in the West region patients were charges $1,541 more than the reference(Northeast). The model was statistically significant (<000.1)

Parameter	Estimate	Standard Error	t Value	Pr > |t|	95% Confidence Limits	
Intercept	20451.9944	789.416718	25.91	<.0001	18904.7655	21999.2234
CKD	-1763.3716	774.059556	-2.28	0.0227	-3280.5010	-246.2421
Black	2646.4450	105.527331	25.08	<.0001	2439.6152	2853.2748
Hispanic	1227.1263	94.577851	12.97	<.0001	1041.7571	1412.4956
Asian or Pacific Islanders	-173.6640	184.126790	-0.94	0.3456	-534.5460	187.2180
Native Americans	1890.9776	367.408407	5.15	<.0001	1170.8701	2611.0851
Other	3044.9899	157.101958	19.38	<.0001	2737.0756	3352.9042
Female	-2409.0826	69.241668	-34.79	<.0001	-2544.7938	-2273.3714
Medicaid	9553.1046	737.197303	12.96	<.0001	8108.2239	10997.9853
Private Insurance	8146.3051	737.697312	11.04	<.0001	6700.4444	9592.1658

Self-Pay	3694.3047	757.470902	4.88	<.0001	2209.6885	5178.9210
No Charges	9978.5544	1001.890046	9.96	<.0001	8014.8852	11942.2235
Other	16408.8017	760.562848	21.57	<.0001	14918.1254	17899.4781
$39,000 - $47,999	-815.8995	96.424193	-8.46	<.0001	-1004.8875	-626.9115
$48,000 - 62,999	-984.5554	99.902704	-9.86	<.0001	-1180.3611	-788.7496
> $63,000	-1392.3330	108.170424	-12.87	<.0001	-1604.3432	-1180.3227
Hypertension	58167.1095	434.191608	133.97	<.0001	57316.1093	59018.1098
Obesity	2462.7178	380.173262	6.48	<.0001	1717.5916	3207.8440
Congestive Heart Failure	151783.9574	1147.934406	132.22	<.0001	149534.0465	154033.8684
Diabetes Without Complications	6177.6783	631.232033	9.79	<.0001	4940.4857	7414.8708
Diabetes With Complications	29399.5285	1817.532798	16.18	<.0001	25837.2283	32961.8287
Drug Abuse	8902.0747	344.755785	25.82	<.0001	8226.3656	9577.7839
Electrolytes Disorder	48068.5057	162.100255	296.54	<.0001	47750.7949	48386.2165
Anemia	22371.0022	254.166640	88.02	<.0001	22869.1599	21872.8446
Urban	11824.7308	119.900245	98.62	<.0001	11589.7305	12059.7310
Midwest	-5225.4594	121.700854	-42.94	<.0001	-5463.9888	-4986.9300
South	-4556.6317	98.852424	-46.10	<.0001	-4750.3790	-4362.8844
West	1540.7636	110.952734	13.89	<.0001	1323.3001	1758.2270

Table 13: Total charges with regards to race, type of comorbidities

4.2.2 linear regression -Age group 20-64 vs total charges

linear regression was used to study the age group 20-64 years old. Total charges was the dependent variable and after adjusting for the other variables in the model (table14) .CKD patients total charges increased by $3,483 over patients with other illnesses. The total charges for African American decreased by $1,661 less than the White(reference). Hispanic were charged $55 more than White. Although, Asian or pacific Islander were charged less than White (reference) by $1,140. Native Americans charges increased by $4,365 less than White(reference). Other races were charged $1,201 less than the reference. The model was statistically significant (<.0001).

Female patients were charged less than male by $10,543 . Patients total charges for Medicaid insurance showed a decrease by $3,966 than Medicare(reference). For private insurance the total charges decreased by $359 than Medicare. Self-pay were charged $6,686 less than Medicare. No Charges increased by $5,273 more than Medicare. Other forms of payments were charged more than Medicare by $335.

For the socioeconomic status, patients who made less than <$39.999 was used as a reference to compare the other category too. So the model showed that patients who earned between $39,000 to $47,999 were charged $720 less than the reference. For patients with an income of $48,000 to 62,999, they were charged $446 less than the reference. Lastly, for patients whose income is more than $63,000 were charged $624 less than the reference.

Patients with Hypertension showed an increase in total charges by $4,982 over patients without hypertension. For obese patients their charges were more than patients who are not obese by $4,479 For those with congestive heart failure their total charges were $14,805 more than patients without CHF.

patients with uncomplicated diabetes were charged $2,439 more than patients without diabetes. Moreover, patients with complicated diabetes total charges increase by $4,511 more than patients without diabetes complications. Drug abuse charged were $3,972 less than patients with other illnesses. Patients with electrolytes disorder were charged $20,972 more than patients without . CKD patients with anemia total charges were $12,299 more than patients without.

Urban hospitals charged CKD patients more than rural hospitals by $14,960. The total charges for patients in the Midwest region were $8,523 less than the reference (Northeast). Patients in the South region were charged $4,942 less than the reference

(Northeast). Where in the West region patients were charges $7,494 more than the reference(Northeast). The model was statistically significant (<000.1).

Parameter	Estimate	Standard Error	t Value	Pr > |t|	95% Confidence Limits	
Intercept	35707.34557	110.4527042	323.28	<.0001	35490.86222	35923.82892
CKD	3483.58608	87.1327530	39.98	<.0001	3312.80900	3654.36316
Black	-1661.03006	53.4752590	-31.06	<.0001	-1765.83965	-1556.22046
Hispanic	54.90869	60.3996526	0.91	0.3633	-63.47247	173.28985
Asian or Pacific Islanders	1140.29249	124.9914808	9.12	<.0001	895.31366	1385.27133
Native Americans	-4365.20505	225.4892767	-19.36	<.0001	-4807.15597	-3923.25413
Other	1200.91880	107.4458326	11.18	<.0001	990.32881	1411.50879
Female	-10542.61591	40.6727355	-259.21	<.0001	-10622.33302	-10462.89880
Medicaid	-3966.45379	65.2345079	-60.80	<.0001	-4094.31109	-3838.59648
Private Insurance	-359.18447	60.1233252	-5.97	<.0001	-477.02404	-241.34491
Self-Pay	-6686.59567	81.3917154	-82.15	<.0001	-6846.12052	-6527.07082
No Charges	-5273.20596	198.4944071	-26.57	<.0001	-5662.24790	-4884.16402
Other	335.44714	99.3937071	3.37	0.0007	140.63903	530.25525
$39,000 - $47,999	-720.16115	52.3114768	-13.77	<.0001	-822.68977	-617.63252
$48,000 - 62,999	-445.94086	54.3649652	-8.20	<.0001	-552.49425	-339.38748
> $63,000	-624.20506	58.8202106	-10.61	<.0001	-739.49057	-508.91955
Hypertension	4982.04695	44.6593118	111.56	<.0001	4894.51630	5069.57761
Obesity	4478.62006	61.4067041	72.93	<.0001	4358.26512	4598.97501
Congestive Heart Failure	14804.63618	110.0024921	134.58	<.0001	14589.03523	15020.23713
Diabetes Without Complications	2439.00172	59.5754600	40.94	<.0001	2322.23595	2555.76749
Diabetes With Complications	4510.62851	114.2541975	39.48	<.0001	4286.69437	4734.56265
Drug Abuse	-3972.57341	80.4466938	-49.38	<.0001	-4130.24605	-3814.90076
Electrolytes Disorder	20972.41367	53.5202582	391.86	<.0001	20867.51588	21077.31147
Anemia	12299.63982	59.8328192	205.57	<.0001	12416.91000	12182.36963
Urban	14960.19405	65.6866496	227.75	<.0001	14831.45056	15088.93753
Midwest	-8523.02407	61.7532332	-138.02	<.0001	-8644.05820	-8401.98994
South	-4941.90911	51.3264350	-96.28	<.0001	-5042.50708	-4841.31113
West	7493.80449	60.3463779	124.18	<.0001	7375.52775	7612.08124

Table 14: Total charges with regards to race, type of comorbidities 20-64

4.2.3 linear regression -Age group 65-74 vs total charges

linear regression was used to study the age group 65-74 years old. Total charges was the dependent variable and after adjusting for the other variables in the model (in table 15) CKD patients total charges decreased by $165 over patients with other illnesses. The total charges for African American increased by $230 less than the White(reference). Hispanic were charged $6,209 more than the White. Although, Asian or pacific Islander were charged less than White (reference) by $9,149. Native Americans charges decreased by $3,962 less than White(reference). Other races were charged $6,632 less than the reference. The model was statistically significant (<.0001).

Female patients were charged less than male by $5,610 . Patients total charges for Medicaid insurance showed a decreased by $640 than Medicare(reference). For private insurance the total charges increased by $824 than Medicare. Self-pay were charged $5,766 less than Medicare. No Charges decreased by $7,172 than Medicare. Other forms of payments were charged less than Medicare by $171.

For the socioeconomic status, patients who made less than <$39.999 was used as a reference to compare the other category to. So the model showed that patients who earned between $39,000 to $47,999 were charged $801 less than the reference. For patients with an income of $48,000 to 62,999, they were charged $298 less than the reference. Lastly, for patients whose income is more than $63,000 were charged $807 more than the reference.

Patients with Hypertension showed a decrease in total charges by $1,185 over patients with other illnesses. For obese patients their charges were more than patients who are not obese by $5,053 For those with and congestive heart failure their total charges were $9,398 more than patients without CHF.

patients with uncomplicated diabetes were charged $1,844 less than patients with other illnesses. Moreover, patients with complicated diabetes total charges increased by $ 1,451more than patients without diabetes complications. Drug abuse charged were $3,752 less than patients with other illnesses. Patients with electrolytes disorder were charged $ 3753 more than patients without .patients with anemia total charges were $ 9,440 more than patients without.

Urban hospitals charged CKD patients more than rural hospitals by $21,323. The total charges for patients in the Midwest region were $ 9,296 less than the reference (Northeast). Patients in the South region were charged $ 3612 less than the reference (Northeast). Where in the West region patients were charges $14,424 more than the reference(Northeast). The model was statistically significant (<000.1)

Parameter	Estimate	Standard Error	t Value	Pr > |t|	95% Confidence Limits	
Intercept	33238.18469	204.497099	162.54	<.0001	32837.37754	33638.99184
CKD	-165.12847	125.951005	-1.31	0.1898	-411.98803	81.73109
Black	229.75246	134.610783	1.71	0.0879	-34.07996	493.58487
Hispanic	6209.39043	165.614855	37.49	<.0001	5884.79112	6533.98975
Asian or Pacific Islanders	9149.24024	313.057514	29.23	<.0001	8535.65848	9762.82200
Native Americans	-3962.28849	567.677035	-6.98	<.0001	-5074.91559	-2849.66139
Other	6632.31587	264.172603	25.11	<.0001	6114.54682	7150.08492
Female	-5610.07454	83.900074	-66.87	<.0001	-5774.51574	-5445.63333
Medicaid	-639.68821	294.068199	-2.18	0.0296	-1216.05158	-63.32485
Private Insurance	824.09466	125.824696	6.55	<.0001	577.48267	1070.70666
Self-Pay	-5766.14091	498.166501	-11.57	<.0001	-6742.52980	-4789.75202
No Charges	-7171.99270	1387.049488	-5.17	<.0001	-9890.56111	-4453.42430
Other	-171.11964	398.716652	-0.43	0.6678	-952.59031	610.35103

$39,000 - $47,999	-801.24813	115.665478	-6.93	<.0001	-1027.94842	-574.54785
$48,000 - 62,999	-297.90107	120.711532	-2.47	0.0136	-534.49145	-61.31070
> $63,000	806.69076	128.693665	6.27	<.0001	554.45569	1058.92584
Hypertension	-1185.22795	89.975422	-13.17	<.0001	-1361.57662	-1008.87927
Obesity	5053.28782	129.336549	39.07	<.0001	4799.79272	5306.78293
Congestive Heart Failure	9397.91423	139.483868	67.38	<.0001	9124.53073	9671.29772
Diabetes Without Complications	-1843.93558	96.678488	-19.07	<.0001	-2033.42203	-1654.44913
Diabetes With Complications	1451.42842	183.732398	7.90	<.0001	1091.31936	1811.53749
Drug Abuse	-3752.57682	445.671680	-8.42	<.0001	-4626.07770	-2879.07594
Electrolytes Disorder	17095.93486	98.770207	173.09	<.0001	16902.34871	17289.52101
Anemia	9440.39561	110.191545	85.67	<.0001	9656.36718	9224.42405
Urban	21322.96548	132.909617	160.43	<.0001	21062.46728	21583.46367
Midwest	-9296.60966	135.138336	-68.79	<.0001	-9561.47606	-9031.74325
South	-3611.96442	113.159855	-31.92	<.0001	-3833.75377	-3390.17507
West	14424.21697	136.687334	105.53	<.0001	14156.31458	14692.11935

Table 15: Total charges with regards to race, type of comorbidities 65-74

4.2.4 linear regression -Age group 75-84 vs total charges

linear regression was used to study the age group 75-84 years old. Total charges was the dependent variable and after adjusting for the other variables in the model (table16) CKD patients total charges decreased by $942 over patients with other illnesses. The total charges for African American increased by $2,537 more than the White(reference). Hispanic were charged $8,578 more than the White. Although, Asian or pacific Islander were charged more than White (reference) by $11,726. Native Americans charges decreased by $3,3102 less than White(reference). Other races were charged $8,289 more than the reference. The model was statistically significant (<.0001).

Female patients were charged less than male by $5,774 . Patients total charges for Medicaid insurance showed an increase by $2,238 than Medicare(reference). For private insurance the total charges increased by $434 than Medicare. Self-pay were charged $3,707 less than Medicare. No Charges decreased by $5,235 than Medicare. Other forms of payments were charged less than Medicare by $4,605.

For the socioeconomic status, patients who made less than <$39.999 was used as a reference to compare the other category to. So the model showed that patients who earned between $39,000 to $47,999 were charged $953 less than the reference. For patients with an income of $48,000 to 62,999, they were charged $348 less than the reference. Lastly, for patients whose income is more than $63,000 were charged $697 more than the reference.

Patients with Hypertension showed a decrease in total charges by $664 over patients with other illnesses. For obese patients their charges were more than patients who are not obese by $6,745 For those with and congestive heart failure their total charges were $8,115 more than patients without CHF.

patients with uncomplicated diabetes were charged $1,221 less than patients with other illnesses. Moreover, patients with complicated diabetes total charges increased by $ 3,104 more than patients without diabetes complications. Drug abuse charged were $2,790 less than patients with other illnesses. Patients with electrolytes disorder were charged $ 13,164 more than patients without .patients with anemia total charges were $ 7,519 more than patients without.

Urban hospitals charged CKD patients more than rural hospitals by $19,140. The total charges for patients in the Midwest region were $ 9,445 less than the reference (Northeast). Patients in the South region were charged $ 3,686 less than the reference

(Northeast). Where in the West region patients were charges $13,813 more than the reference(Northeast). The model was statistically significant (<000.1)

Parameter	Estimate	Standard Error	t Value	Pr > |t|	95% Confidence Limits	
Intercept	29803.35404	175.148483	170.16	<.0001	29460.06915	30146.63893
CKD	-942.56977	99.493191	-9.47	<.0001	-1137.57294	-747.56660
Black	2537.06510	132.931540	19.09	<.0001	2276.52394	2797.60626
Hispanic	8578.02820	152.100536	56.40	<.0001	8279.91648	8876.13993
Asian or Pacific Islanders	11726.25844	270.908721	43.28	<.0001	11195.28684	12257.23005
Native Americans	-3102.42118	541.548992	-5.73	<.0001	-4163.83824	-2041.00412
Other	8288.93286	246.193572	33.67	<.0001	7806.40208	8771.46364
Female	-5774.27913	74.935986	-77.06	<.0001	-5921.15104	-5627.40723
Medicaid	2237.89461	335.730347	6.67	<.0001	1579.87489	2895.91434
Private Insurance	434.83655	150.868141	2.88	0.0039	139.14027	730.53282
Self-Pay	-3707.21837	555.882074	-6.67	<.0001	-4796.72777	-2617.70897
No Charges	-5235.29966	1502.328633	-3.48	0.0005	-8179.81118	-2290.78815
Other	-4604.75036	422.323205	-10.90	<.0001	-5432.48905	-3777.01166
$39,000 - $47,999	-952.61078	104.742543	-9.09	<.0001	-1157.90249	-747.31906
$48,000 - 62,999	-348.99591	108.982680	-3.20	0.0014	-562.59814	-135.39367
> $63,000	698.33915	114.446965	6.10	<.0001	474.02711	922.65119
Hypertension	-664.06722	80.820901	-8.22	<.0001	-822.47335	-505.66108
Obesity	6745.37138	149.796858	45.03	<.0001	6451.77479	7038.96798
Congestive Heart Failure	8115.57893	105.613373	76.84	<.0001	7908.58042	8322.57745
Diabetes Without Complications	-1221.30616	86.249794	-14.16	<.0001	-1390.35274	-1052.25958
Diabetes With Complications	3103.78299	172.508498	17.99	<.0001	2765.67238	3441.89361
Drug Abuse	-2790.27578	677.743365	-4.12	<.0001	-4118.62904	-1461.92251
Electrolytes Disorder	13164.51671	83.078657	158.46	<.0001	13001.68545	13327.34797
Anemia	7519.91232	90.855959	82.77	<.0001	7697.98682	7341.83782
Urban	19139.88490	114.855471	166.64	<.0001	18914.77219	19364.99760
Midwest	-9444.83641	115.954831	-81.45	<.0001	-9672.10382	-9217.56900
South	-3686.40731	98.939580	-37.26	<.0001	-3880.32542	-3492.48920
West	13813.49506	120.184315	114.94	<.0001	13577.93801	14049.05211

Table 16: Total charges with regards to race, type of comorbidities 75-84

4.2.5 linear regression -Age group >85 vs total charges

linear regression was used to study the age group >85 years old. Total charges was the dependent variable and after adjusting for the other variables in the model (table17) CKD patients total charges decreased by $1,319 over patients with other illnesses. The total charges for African American increased by $4,223 more than the White(reference). Hispanic were charged $10,327 more than the White. Although, Asian or pacific Islander were charged more than White (reference) by $14,555. Native Americans charges decreased by $1,649 less than White(reference). Other races were charged $7,401 more than the reference. The model was statistically significant (<.0001).

Female patients were charged less than male by $4,449 . Patients total charges for Medicaid insurance showed an increase by $4,436 than Medicare(reference). For private insurance the total charges decreased by $1,294 than Medicare. Self-pay were charged $3,817 less than Medicare. No Charges decreased by $1,735 than Medicare. Other forms of payments were charged less than Medicare by $6,931.

For the socioeconomic status, patients who made less than <$39.999 was used as a reference to compare the other category to. So the model showed that patients who earned between $39,000 to $47,999 were charged $779 less than the reference. For patients with an income of $48,000 to 62,999, they were charged $79 more than the reference. Lastly, for patients whose income is more than $63,000 were charged $1,524 more than the reference.

Patients with Hypertension showed an increase in total charges by $327 over patients without hypertension. For obese patients their charges were more than patients who are not obese by $8,118 For those with and congestive heart failure their total charges were $7,571 more than patients without CHF.

Patients with uncomplicated diabetes were charged $843 more than patients without diabetes. Moreover, patients with complicated diabetes total charges increased by $ 5,124 more than patients without diabetes complications. Drug abuse charged were $772 more than patients without drug abuse. Patients with electrolytes disorder were charged $8,631 more than patients without .patients with anemia total charges were $ 6363 more than patients without.

Urban hospitals charged CKD patients more than rural hospitals by $14,264. The total charges for patients in the Midwest region were $ 8,530 less than the reference (Northeast). Patients in the South region were charged $ 3,418 less than the reference (Northeast). Where in the West region patients were charges $12,134 more than the reference(Northeast). The model was statistically significant (<000.1)

Parameter	Estimate	Standard Error	t Value	Pr > |t|	95% Confidence Limits	
Intercept	24134.90136	157.036763	153.69	<.0001	23827.11473	24442.68799
CKD	-1319.49365	85.106299	-15.50	<.0001	-1486.29906	-1152.68825
Black	4223.07538	132.610616	31.85	<.0001	3963.16316	4482.98761
Hispanic	10327.39144	155.987149	66.21	<.0001	10021.66201	10633.12086
Asian or Pacific Islanders	14555.45116	257.869762	56.44	<.0001	14050.03534	15060.86699
Native Americans	-1648.60951	564.189349	-2.92	0.0035	-2754.40115	-542.81788
Other	7401.12674	241.036032	30.71	<.0001	6928.70444	7873.54903
Female	-4449.64428	71.884473	-61.90	<.0001	-4590.53537	-4308.75320
Medicaid	4436.53830	359.958045	12.33	<.0001	3731.03297	5142.04363
Private Insurance	-1294.52008	159.717501	-8.11	<.0001	-1607.56087	-981.47930

Self-Pay	-3816.84915	596.288929	-6.40	<.0001	-4985.55485	-2648.14345
No Charges	-1734.87644	1665.629914	-1.04	0.2976	-4999.45352	1529.70065
Other	-6931.40331	383.485359	-18.07	<.0001	-7683.02136	-6179.78526
$39,000 - $47,999	-779.12337	98.688336	-7.89	<.0001	-972.54910	-585.69764
$48,000 - 62,999	79.19697	102.605188	0.77	0.4402	-121.90565	280.29960
> $63,000	1523.76808	105.316649	14.47	<.0001	1317.35108	1730.18507
Hypertension	327.09045	73.672706	4.44	<.0001	182.69449	471.48641
Obesity	8117.98619	224.225956	36.20	<.0001	7678.51106	8557.46132
Congestive Heart Failure	7570.88652	84.749155	89.33	<.0001	7404.78111	7736.99194
Diabetes Without Complications	842.60092	86.808862	9.71	<.0001	672.45855	1012.74329
Diabetes With Complications	5123.96282	200.548564	25.55	<.0001	4730.89456	5517.03108
Drug Abuse	772.49536	924.369503	0.84	0.4033	-1039.23693	2584.22764
Electrolytes Disorder	8691.51605	72.190874	120.40	<.0001	8550.02444	8833.00767
Anemia	6362.71573	78.557126	80.99	<.0001	6516.68498	6208.74647
Urban	14264.57632	103.430577	137.91	<.0001	14061.85596	14467.29667
Midwest	-8530.64273	103.049654	-82.78	<.0001	-8732.61649	-8328.66897
South	-3418.86307	89.550341	-38.18	<.0001	-3594.37864	-3243.34749
West	12134.96470	107.400393	112.99	<.0001	11924.46365	12345.46576

Table 17: Total charges with regards to race, type of comorbidities >85

4.3 Evaluation of hypothesis 2: race, gender, insurance, socioeconomics, types of comorbidities , hospital region , location in different age groups on length of stay

4.3.1 linear regression -Age group 0-19 vs length of stay

linear regression was used to study the age group 0-19 years old. Length of stay was the dependent variable and after adjusting for the other variables in the model (table18) .CKD patients stayed 1.29 days shorter than patients with other illnesses represented in the model. The length of stay for African Americans were 0.39 days longer than White(reference). Hispanics stayed 0.27 shorter than White. Although, Asian or pacific Islander stayed a little longer than white by 0.0023). Native Americans stayed 0.28 longer than White (reference). Other races stayed 0.30 longer than the reference. The model was statistically significant (<.0001).Female patients stayed shorter than male by 0.29 days . Medicaid Patients stayed 1.06 days longer than Medicare patients (reference). For patients with private insurance that stayed longer than Medicare patients by 0.70. Self-pay patients stays 0.02 longer than the reference. No Charges patients stayed 0.53 longer days than Medicare. Other patients stays 10.5 days longer than the reference(Medicare)

For the socioeconomic status, patients who made less than <$39.999 was used as a reference to compare the other category to. So the model showed that patients who earned between $39,000 to $47,999 stayed 0.11 shorter than the reference. For patients with an income of $48,000 to 62,999, they stayed shorter 0.14 than the reference. Lastly, for patients whose income is more than $63,000 stayed shorter by 0.19 than the reference.

Patients with Hypertension stayed 6.2 days longer than patients without hypertension. For obese patients they stayed 0.06 days longer than patients who are not obese. For those with congestive heart failure they stayed 15.82 days longer than patients without CHF. patients with uncomplicated diabetes stayed 0.52 days longer than patients without diabetes. Moreover, patients with complicated diabetes stayed 4.75 days longer than patients without diabetes complications. Drug abuse stayed 1.96 days longer than patients without drug abuse. Patients with electrolytes disorder stayed 5.6 days longer than patients without .patients with anemia stayed 1.84 days shorter than patients without.

The length of stay for Urban hospitals were 1.5 days longer than rural hospitals. Patients in the Midwest region stayed 0.31 days shorter than the reference (Northeast). Patients in the South region stayed 0.20 days shorter than the reference (Northeast). Where in the West region patients stayed 0.32 days longer than the reference(Northeast). The model was statistically significant (<000.1).

Parameter	Estimate	Standard Error	t Value	Pr > |t|	95% Confidence Limits	
Intercept	3.41758708	0.10840058	31.53	<.0001	3.20512578	3.63004838
CKD	-1.29145189	0.10164317	-12.71	<.0001	-1.49066892	-1.09223487
Black	0.38891917	0.01367392	28.44	<.0001	0.36211877	0.41571957
Hispanic	-0.27046052	0.01218553	-22.20	<.0001	-0.29434372	-0.24657731
Asian or Pacific Islanders	0.00239403	0.02347618	0.10	0.9188	-0.04361844	0.04840651
Native Americans	0.27678601	0.04799130	5.77	<.0001	0.18272475	0.37084727
Other	0.30550390	0.02032531	15.03	<.0001	0.26566701	0.34534079
Female	-0.29597636	0.00895854	-33.04	<.0001	-0.31353477	-0.27841794
Medicaid	1.05698214	0.10216257	10.35	<.0001	0.85674711	1.25721717
Private Insurance	0.70855837	0.10223849	6.93	<.0001	0.50817454	0.90894220
Self-Pay	0.02109877	0.10465370	0.20	0.8402	-0.18401878	0.22621632
No Charges	0.53008232	0.13576280	3.90	<.0001	0.26399203	0.79617261
Other	1.51144508	0.10506049	14.39	<.0001	1.30553022	1.71735994
$39,000 - $47,999	-0.11022953	0.01253249	-8.80	<.0001	-0.13479278	-0.08566628
$48,000 - 62,999	-0.14037921	0.01294718	-10.84	<.0001	-0.16575522	-0.11500321
> $63,000	-0.19561892	0.01398830	-13.98	<.0001	-0.22303550	-0.16820234
Hypertension	6.21064996	0.05750855	108.00	<.0001	6.09793523	6.32336470
Obesity	0.06329266	0.04901383	1.29	0.1966	-0.03277272	0.15935804
Congestive Heart Failure	15.82525460	0.14852180	106.55	<.0001	15.53415712	16.11635208
Diabetes Without Complications	0.52997475	0.08375174	6.33	<.0001	0.36582430	0.69412520
Diabetes With Complications	4.75101049	0.23742447	20.01	<.0001	4.28566691	5.21635407
Drug Abuse	1.96023892	0.04483609	43.72	<.0001	1.87236176	2.04811607
Electrolytes Disorder	5.62278256	0.02108127	266.72	<.0001	5.58146401	5.66410110
Anemia	1.84593443	0.03296334	56.00	<.0001	1.91054140	1.78132745
Urban	1.52105803	0.01564204	97.24	<.0001	1.49040018	1.55171589
Midwest	-0.31854777	0.01593300	-19.99	<.0001	-0.34977589	-0.28731965
South	-0.20843716	0.01292566	-16.13	<.0001	-0.23377099	-0.18310333
West	-0.32441998	0.01426055	-22.75	<.0001	-0.35237017	-0.29646980

Table 18: Length of stay with regards to race, type of comorbidities 0-19

4.3.2 linear regression -Age group 20-64 vs length of stay

linear regression was used to study the age group 20-64 years old. Length of stay was the dependent variable and after adjusting for the other variables in the model (table19) .CKD patients stayed 0.03 days shorter than patients with other illnesses. The length of stay for African Americans were 0.04 days longer than White(reference). Hispanics stayed 0.29 shorter than White. Although, Asian or pacific Islander stayed longer than white by 0.18 . Native Americans stayed 0.04 longer than White (reference). Other races stayed 0.16 longer than the reference. The model was statistically significant (<.0001). Female patients stayed shorter than male by 0.08 days . Medicaid Patients stayed 0.5 days shorter than Medicare patients (reference). For patients with private insurance that stayed l shorter than Medicare patients by 1.17 days. Self-pay patients stays 1.32 days shorter than the reference. No Charges patients stayed 0.82 days shorter days than Medicare. Other patients stays 0.9 days shorter than the reference(Medicare)

For the socioeconomic status, patients who made less than <$39.999 was used as a reference to compare the other category to. So the model showed that patients who earned between $39,000 to $47,999 stayed 0.13 shorter than the reference. For patients with an income of $48,000 to 62,999, they stayed 0.17 shorter than the reference. Lastly, for patients whose income is more than $63,000 stayed shorter by 0.16 than the reference.

Patients with Hypertension stayed 0.07 days longer than patients without hypertension. For obese patients they stayed 0.3 days longer than patients who are not obese. For those with congestive heart failure they stayed 1.9 days longer than patients without CHF. patients with uncomplicated diabetes stayed 0.19 day longer than patients without diabetes. Moreover, patients with complicated diabetes stayed 1 day longer than patients without diabetes complications. Drug abuse stayed 0.69 days longer than patients without drug abuse. Patients with electrolytes disorder stayed 2.3 days longer than patients without .patients with anemia stayed 1.6 days longer than patients without.

The length of stay for Urban hospitals were 0.89 days longer than rural hospitals. patients in the Midwest region stayed 0.7 days shorter than the reference (Northeast). Patients in the South region stayed 0.5 days shorter than the reference (Northeast). Where in the West region patients stayed 0.6 days shorter than the reference(Northeast). The model was statistically significant (<000.1).

Parameter	Estimate	Standard Error	t Value	Pr > |t|	95% Confidence Limits	
Intercept	6.278503008	0.01198689	523.78	<.0001	6.255009127	6.301996889
CKD	-0.029501988	0.00942852	-3.13	0.0018	-0.047981550	-0.011022425
Black	0.045535110	0.00579345	7.86	<.0001	0.034180152	0.056890067
Hispanic	-0.292384478	0.00649373	-45.03	<.0001	-0.305111955	-0.279657001
Asian or Pacific Islanders	0.183143128	0.01324362	13.83	<.0001	0.157186097	0.209100159
Native Americans	0.047503270	0.02450069	1.94	0.0525	-0.000517205	0.095523746
Other	0.163387017	0.01168586	13.98	<.0001	0.140483154	0.186290880
Female	-0.808356927	0.00440520	-183.50	<.0001	-0.816990959	-0.799722894
Medicaid	-0.549636797	0.00708685	-77.56	<.0001	-0.563526775	-0.535746819
Private Insurance	-1.177586607	0.00651690	-180.70	<.0001	-1.190359494	-1.164813721
Self-Pay	-1.327541344	0.00885053	-150.00	<.0001	-1.344888063	-1.310194625
No Charges	-0.816643126	0.02164628	-37.73	<.0001	-0.859069061	-0.774217190
Other	-0.913776087	0.01082157	-84.44	<.0001	-0.934985971	-0.892566203
$39,000 - $47,999	-0.132584134	0.00567979	-23.34	<.0001	-0.143716310	-0.121451958
$48,000 - 62,999	-0.171860781	0.00589298	-29.16	<.0001	-0.183410806	-0.160310756
> $63,000	-0.168999395	0.00636335	-26.56	<.0001	-0.181471336	-0.156527455
Hypertension	0.073936672	0.00483721	15.28	<.0001	0.064455916	0.083417428
Obesity	0.340530801	0.00660378	51.57	<.0001	0.327587636	0.353473966
Congestive Heart Failure	1.951257046	0.01191248	163.80	<.0001	1.927909002	1.974605090
Diabetes Without Complications	0.199583413	0.00646675	30.86	<.0001	0.186908820	0.212258006

Diabetes With Complications	1.010478692	0.01219913	82.83	<.0001	0.986568835	1.034388549
Drug Abuse	0.688620355	0.00872085	78.96	<.0001	0.671527795	0.705712915
Electrolytes Disorder	2.328296403	0.00580354	401.19	<.0001	2.316921665	2.339671140
Anemia	1.614686360	0.00645794	250.03	<.0001	1.627343683	1.602029037
Urban	0.869595565	0.00715503	121.54	<.0001	0.855571967	0.883619163
Midwest	-0.724721779	0.00673807	-107.56	<.0001	-0.737928147	-0.711515410
South	-0.502019803	0.00559808	-89.68	<.0001	-0.512991840	-0.491047766
West	-0.638758410	0.00645671	-98.93	<.0001	-0.651413323	-0.626103496

Table 19: Length of stay with regards to race, type of comorbidities 20-64

4.3.3 linear regression -Age group 65-74 vs length of stay

linear regression was used to study the age group 65-74 years old. Length of stay was the dependent variable and after adjusting for the other variables in the model (table20) .CKD patients stayed 0.12 days longer than patients with other illnesses. The length of stay for African Americans were 0.41 days longer than White(reference). Hispanics stayed 0.08 shorter than White. Although, Asian or pacific Islander stayed longer than white by 0.30 days. Native Americans stayed 0.001 shorter than White (reference). Other races stayed 0.60 days longer than the reference. The model was statistically significant (<.0001). Female patients stayed shorter than male by 0.19 days . Medicaid Patients stayed 1 day longer than Medicare patients (reference). For patients with private insurance that stayed shorter than Medicare patients by 0.17 days. Self-pay patients stays 0.01 days longer than the reference. No Charges patients stayed 0.45 longer days than Medicare. Other patients stays 0.08 days shorter than the reference(Medicare)

For the socioeconomic status, patients who made less than <$39.999 was used as a reference to compare the other category to. So the model showed that patients who earned between $39,000 to $47,999 stayed 0.24 shorter than the reference. For patients with an income of $48,000 to 62,999, they stayed 0.34 shorter than the reference. Lastly, for patients whose income is more than $63,000 stayed shorter by 0.4 than the reference.

Patients with Hypertension stayed 0.43 days shorter than patients with other illnesses. For obese patients they stayed 0.29 days longer than patients who are not obese. For those with congestive heart failure they stayed 2.03 days longer than patients without CHF. patients with uncomplicated diabetes stayed 0.1 day shorter patients with other illnesses. Moreover, patients with complicated diabetes stayed 0.70 days longer than patients without diabetes complications. Drug abuse stayed 0.76 days longer than patients without drug abuse. Patients with electrolytes disorder stayed 2.38 days longer than patients without .patients with anemia stayed 1.55 days longer than patients without.

The length of stay for Urban hospitals were 0.95 days longer than rural hospitals. patients in the Midwest region stayed 0.78 days shorter than the reference (Northeast). Patients in the South region stayed 0.47 days shorter than the reference (Northeast). Where in the West region patients stayed 0.8 days shorter than the reference(Northeast). The model was statistically significant (<000.1).

Parameter	Estimate	Standard Error	t Value	Pr > |t|	95% Confidence Limits	
Intercept	5.877631211	0.02065355	284.58	<.0001	5.837150969	5.918111453
CKD	0.120008179	0.01264286	9.49	<.0001	0.095228625	0.144787733
Black	0.411766415	0.01354368	30.40	<.0001	0.385221270	0.438311559
Hispanic	0.085561978	0.01654809	5.17	<.0001	0.053128307	0.117995649
Asian or Pacific Islanders	0.301549774	0.03074982	9.81	<.0001	0.241281209	0.361818340
Native Americans	-0.001884018	0.05722062	-0.03	0.9737	-0.114034436	0.110266399
Other	0.605355113	0.02674070	22.64	<.0001	0.552944281	0.657765945
Female	-0.195048473	0.00844474	-23.10	<.0001	-0.211599861	-0.178497086
Medicaid	1.010299865	0.02973086	33.98	<.0001	0.952028419	1.068571310

Private Insurance	-0.175581406	0.01265910	-13.87	<.0001	-0.200392793	-0.150770020
Self-Pay	0.016400954	0.05044934	0.33	0.7451	-0.082477990	0.115279897
No Charges	0.453761175	0.14050173	3.23	0.0012	0.178382707	0.729139643
Other	-0.088168658	0.04041629	-2.18	0.0291	-0.167383172	-0.008954144
$39,000 - $47,999	-0.241808180	0.01168850	-20.69	<.0001	-0.264717239	-0.218899120
$48,000 - 62,999	-0.346501020	0.01217389	-28.46	<.0001	-0.370361419	-0.322640621
> $63,000	-0.408191292	0.01294541	-31.53	<.0001	-0.433563851	-0.382818733
Hypertension	-0.436579182	0.00906189	-48.18	<.0001	-0.454340172	-0.418818191
Obesity	0.287847825	0.01294605	22.23	<.0001	0.262474023	0.313221627
Congestive Heart Failure	2.032895486	0.01402785	144.92	<.0001	2.005401387	2.060389585
Diabetes Without Complications	-0.105586918	0.00976449	-10.81	<.0001	-0.124724969	-0.086448867
Diabetes With Complications	0.705013676	0.01807775	39.00	<.0001	0.669581918	0.740445434
Drug Abuse	0.758069213	0.04475774	16.94	<.0001	0.670345619	0.845792807
Electrolytes Disorder	2.388447307	0.00994916	240.07	<.0001	2.368947308	2.407947306
Anemia	1.548324085	0.01107592	139.79	<.0001	1.570032505	1.526615666
Urban	0.948825560	0.01347380	70.42	<.0001	0.922417376	0.975233745
Midwest	-0.773386637	0.01372161	-56.36	<.0001	-0.800280513	-0.746492761
South	-0.469911105	0.01148322	-40.92	<.0001	-0.492417805	-0.447404405
West	-0.809653304	0.01353803	-59.81	<.0001	-0.836187369	-0.783119239

Table 20: Length of stay with regards to race, type of comorbidities 65-74

4.3.4 linear regression -Age group 75-84 vs length of stay

linear regression was used to study the age group 75-84 years old. Length of stay was the dependent variable and after adjusting for the other variables in the model (table21) .CKD patients stayed 0.03 days shorter compared to patients with other conditions represented in the model. The length of stay for African Americans were 0.52 days longer than White(reference). Hispanics stayed 0.18 longer than White. Although, Asian or pacific Islander stayed longer than white by 0.46 days. Native Americans stayed 0.03 longer than White (reference). Other races stayed 0.75 days longer than the reference. The model was statistically significant (<.0001). Female patients stayed shorter than male by 0.22 days . Medicaid Patients stayed 1.33 days longer than Medicare patients (reference). For patients with private insurance that stayed shorter than Medicare patients by 0.02 days. Self-pay patients stays 0.65 days longer than the reference. No Charges patients stayed 0.59 longer days than Medicare. Other patients stays 0.21 days shorter than the reference(Medicare)

For the socioeconomic status, patients who made less than <$39.999 was used as a reference to compare the other category to. So the model showed that patients who earned between $39,000 to $47,999 stayed 0.2 shorter than the reference. For patients with an income of $48,000 to 62,999, they stayed 0.28 shorter than the reference. Lastly, for patients whose income is more than $63,000 stayed shorter by 0.3 than the reference.

Patients with Hypertension stayed 0.47 days shorter than patients with other illnesses. For obese patients they stayed 0.41 days longer than patients who are not obese. For those with congestive heart failure they stayed 1.82 days longer than patients without CHF. patients with uncomplicated diabetes stayed 0.09 day shorter patients with other illnesses. Moreover, patients with complicated diabetes stayed 0.68 days longer than patients without diabetes complications. Drug abuse stayed 0.72 days longer than patients without drug abuse. Patients with electrolytes disorder stayed 1.96 days longer than patients without .patients with anemia stayed 1.23 days longer than patients without.

The length of stay for Urban hospitals were 0.77 days longer than rural hospitals. Patients in the Midwest region stayed 0.79 days shorter than the reference (Northeast). Patients in the South region stayed 0.44 days shorter than the reference (Northeast). Where in the West region patients stayed 0.91days shorter than the reference(Northeast). The model was statistically significant (<000.1).

Parameter	Estimate	Standard Error	t Value	Pr > |t|	95% Confidence Limits	
Intercept	5.924141394	0.01931141	306.77	<.0001	5.886291712	5.961991076
CKD	-0.033657315	0.01090177	-3.09	0.0020	-0.055024393	-0.012290238
Black	0.521774448	0.01459801	35.74	<.0001	0.493162866	0.550386030
Hispanic	0.176994013	0.01660346	10.66	<.0001	0.144451805	0.209536222
Asian or Pacific Islanders	0.464958132	0.02920860	15.92	<.0001	0.407710292	0.522205973
Native Americans	0.034979131	0.05973033	0.59	0.5581	-0.082090220	0.152048481
Other	0.746273808	0.02722653	27.41	<.0001	0.692910767	0.799636849
Female	-0.224129198	0.00823534	-27.22	<.0001	-0.240270182	-0.207988214
Medicaid	1.334278413	0.03707256	35.99	<.0001	1.261617492	1.406939333
Private Insurance	-0.020301842	0.01659186	-1.22	0.2211	-0.052821303	0.012217619
Self-Pay	0.654976133	0.06143165	10.66	<.0001	0.534572253	0.775380013
No Charges	0.588591093	0.16635223	3.54	0.0004	0.262546551	0.914635636
Other	-0.211087701	0.04679847	-4.51	<.0001	-0.302811071	-0.119364331
$39,000 - $47,999	-0.208539353	0.01155626	-18.05	<.0001	-0.231189227	-0.185889480
$48,000 - 62,999	-0.283263279	0.01200234	-23.60	<.0001	-0.306787450	-0.259739108
> $63,000	-0.300242323	0.01257661	-23.87	<.0001	-0.324892031	-0.275592615
Hypertension	-0.406478712	0.00889302	-45.71	<.0001	-0.423908719	-0.389048704
Obesity	0.411323075	0.01634120	25.17	<.0001	0.379294898	0.443351251
Congestive Heart Failure	1.829538068	0.01159663	157.76	<.0001	1.806809076	1.852267061
Diabetes Without Complications	-0.090302874	0.00951884	-9.49	<.0001	-0.108959471	-0.071646277
Diabetes With Complications	0.685681728	0.01842117	37.22	<.0001	0.649576876	0.721786580
Drug Abuse	0.717852884	0.07425083	9.67	<.0001	0.572323852	0.863381916
Electrolytes Disorder	1.963955464	0.00913592	214.97	<.0001	1.946049389	1.981861539
Anemia	1.238037092	0.00997179	124.15	<.0001	1.257581444	1.218492740
Urban	0.774189907	0.01270886	60.92	<.0001	0.749280981	0.799098833
Midwest	-0.784507900	0.01285596	-61.02	<.0001	-0.809705131	-0.759310668
South	-0.438849636	0.01096165	-40.04	<.0001	-0.460334084	-0.417365188
West	-0.912756047	0.01296946	-70.38	<.0001	-0.938175742	-0.887336352

Table 21: Length of stay with regards to race, type of comorbidities 75-84

4.3.5 linear regression -Age group >85 vs length of stay

linear regression was used to study the age group >85 years old. Length of stay was the dependent variable and after adjusting for the other variables in the model (table22) .CKD patients stayed 0.19 days shorter than patients with other illnesses. The length of stay for African Americans were 0.54 days longer than White(reference). Hispanics stayed 0.27 longer than White. Although, Asian or pacific Islander stayed longer than white by 0.62 days. Native Americans stayed 0.16 longer than White (reference). Other races stayed 0.61 days longer than the reference. The model was statistically significant (<.0001). Female patients stayed shorter than male by 0.20 days . Medicaid Patients stayed 3.07 days longer than Medicare patients (reference). For patients with private insurance that stayed shorter than Medicare patients by 0.04 days. Self-pay patients stays 1.6 days longer than the reference. No Charges patients stayed 0.39 longer days than Medicare. Other patients stays 0.34 days shorter than the reference(Medicare)

For the socioeconomic status, patients who made less than <$39.999 was used as a reference to compare the other category to. So the model showed that patients who earned between $39,000 to $47,999 stayed 0.25 shorter than the reference. For patients with an income of $48,000 to 62,999, they stayed 0.28 shorter than the reference. Lastly, for patients whose income is more than $63,000 stayed shorter by 0.24 than the reference.

Patients with Hypertension stayed 0.25 days shorter than patients with other illnesses. For obese patients they stayed 0.69 days longer than patients who are not obese. For those with congestive heart failure they stayed 1.43 days longer than patients without CHF. patients with uncomplicated diabetes stayed 0.71 days longer than patients without diabetes. Moreover, patients with complicated diabetes stayed 0.71 days longer than patients without diabetes complications. Drug abuse stayed 0.78 days longer than patients without drug abuse. Patients with electrolytes disorder stayed 1.31 days longer than patients without .patients with anemia stayed 0.97 days longer than patients without.

The length of stay for Urban hospitals were 0.37 days longer than rural hospitals. patients in the Midwest region stayed 0.71 days shorter than the reference (Northeast). Patients in the South region stayed 0.41 days shorter than the reference (Northeast). Where in the West region patients stayed 0.74 days shorter than the reference(Northeast). The model was statistically significant (<000.1)

Parameter	Estimate	Standard Error	t Value	Pr > |t|	95% Confidence Limits	
Intercept	5.926349286	0.02192956	270.24	<.0001	5.883368105	5.969330466
CKD	-0.186423754	0.01182405	-15.77	<.0001	-0.209598490	-0.163249018
Black	0.544331888	0.01846460	29.48	<.0001	0.508141914	0.580521862
Hispanic	0.273996075	0.02162322	12.67	<.0001	0.231615318	0.316376831
Asian or Pacific Islanders	0.624274505	0.03541374	17.63	<.0001	0.554864795	0.693684215
Native Americans	0.166692650	0.07878214	2.12	0.0344	0.012282374	0.321102925
Other	0.608611104	0.03376527	18.02	<.0001	0.542432340	0.674789868
Female	-0.203961715	0.01000844	-20.38	<.0001	-0.223577903	-0.184345528
Medicaid	3.076549022	0.05031651	61.14	<.0001	2.977930401	3.175167643
Private Insurance	-0.046393094	0.02224100	-2.09	0.0370	-0.089984693	-0.002801495
Self-Pay	1.599783618	0.08341299	19.18	<.0001	1.436297034	1.763270203
No Charges	0.389365260	0.23270327	1.67	0.0943	-0.066725107	0.845455628
Other	-0.377596126	0.05382728	-7.01	<.0001	-0.483095732	-0.272096521
$39,000 - $47,999	-0.254699206	0.01379778	-18.46	<.0001	-0.281742377	-0.227656036
$48,000 - 62,999	-0.284583823	0.01432153	-19.87	<.0001	-0.312653517	-0.256514129
> $63,000	-0.239242283	0.01467978	-16.30	<.0001	-0.268014144	-0.210470422
Hypertension	-0.250283914	0.01027282	-24.36	<.0001	-0.270418289	-0.230149539
Obesity	0.693887467	0.03093440	22.43	<.0001	0.633257111	0.754517823
Congestive Heart Failure	1.429268017	0.01179842	121.14	<.0001	1.406143520	1.452392514

Diabetes Without Complications	0.045686145	0.01214232	3.76	0.0002	0.021887614	0.069484675
Diabetes With Complications	0.712544860	0.02701624	26.37	<.0001	0.659593965	0.765495756
Drug Abuse	0.783120479	0.12835226	6.10	<.0001	0.531554479	1.034686479
Electrolytes Disorder	1.316857087	0.01005804	130.93	<.0001	1.297143681	1.336570494
Anemia	0.970028475	0.01093168	88.74	<.0001	0.991454191	0.948602758
Urban	0.368709209	0.01448803	25.45	<.0001	0.340313180	0.397105238
Midwest	-0.716106259	0.01446639	-49.50	<.0001	-0.744459891	-0.687752627
South	-0.409674214	0.01256340	-32.61	<.0001	-0.434298035	-0.385050392
West	-0.746137609	0.01469588	-50.77	<.0001	-0.774941018	-0.717334200

Table 22: Length of stay with regards to race, type of comorbidities >85

4.4 Evaluation of hypothesis 3: race, gender, insurance, socioeconomics, types of comorbidities , hospital region , location in different age groups on mortality

4.4.1 Logistic regression -Age group 0-19 vs Mortality

A multivariable logistic regression analysis was conducted to examine independent variables of mortality for the age group of 0-19 years. Variables included (race, gender, insurance, socioeconomics, comorbidities, hospital region and hospital location). The model was significant (χ^2= 9428.1374, df= 27, p < .0001) and all the variables were independent predictors of mortality (Figure 24). Patients with Chronic Kidney Disease (CKD) (OR= 1.777, p < .0001, CI: 1.367, 2.311) are at a high risk to of mortality than patients without CKD.

Hispanic (OR= 1.100, p < .0001, CI: 1.044 ,1.159), are associated with higher odds of morality than White Americans. Female patients (OR= 1.348, p < .0001, CI: 1.299, 1.399) are at higher risk of mortality than male. Patients with Medicaid insurance (OR= 1.063, p < .0001, CI: 0.772 ,1.462), private insurance (OR= 1.190, p < .0001, CI: 0.864, 1.639) are at higher risk of mortality than patients with Medicare insurance**.**

Patients earning between 40,000 and 49,999 (OR= 1.077, p = 0.0048, CI: 1.025, 1.132), between 50,000 and 65,999 (OR= 1.126, p = 0.8782, CI: 1.070, 1.185), and patients who earn >66,000 (OR= 1.339, p < .0001, CI: 1.263, 1.420) are at higher risk of mortality than patients earning less than 39,999 .

Patients with obesity (OR= 2.465, p < .0001, CI:1. 1.916 ,3.172),drugs abuse (OR= 1.750, p < .0001, CI: 1.426 ,2.149), anemia (OR= 1.074, p=0.0033, CI: 0.968 ,1.192) are at higher risk of mortality than those without.

Model Fit Statistics		
Criterion	Intercept Only	Intercept and Covariates
AIC	154137.20	144763.06
SC	154150.20	145127.29
-2 Log L	154135.20	144707.06

Testing Global Null Hypothesis: BETA=0			
Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	9428.1374	27	<.0001
Score	21184.1456	27	<.0001
Wald	13233.5135	27	<.0001

Analysis of Maximum Likelihood Estimates						
Parameter		DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept		1	3.7503	0.1584	560.3685	<.0001
CKD	1	1	0.2876	0.0669	18.4537	<.0001
RACE	2	1	-0.2878	0.0257	125.5767	<.0001
RACE	3	1	0.2712	0.0262	107.4747	<.0001
RACE	4	1	0.1745	0.0464	14.1595	0.0002
RACE	5	1	-0.1046	0.0791	1.7469	0.1863
RACE	6	1	-0.2291	0.0344	44.2345	<.0001
FEMALE	1	1	0.1493	0.00945	249.5138	<.0001
PAY1	2	1	0.2517	0.0393	41.0249	<.0001
PAY1	3	1	0.3651	0.0403	82.0819	<.0001
PAY1	4	1	-0.4603	0.0475	94.0698	<.0001
PAY1	5	1	-0.1399	0.1250	1.2544	0.2627
PAY1	6	1	-0.2076	0.0506	16.8032	<.0001
ZIPINC_QRTL	2	1	-0.0467	0.0166	7.9564	0.0048
ZIPINC_QRTL	3	1	-0.00255	0.0166	0.0235	0.8782
ZIPINC_QRTL	4	1	0.1706	0.0193	77.8470	<.0001
CM_HTN_C	1	1	-0.5031	0.0276	332.4502	<.0001
CM_OBESE	1	1	0.4512	0.0643	49.2031	<.0001
CM_CHF	1	1	-1.2795	0.0341	1409.6530	<.0001
CM_DM	1	1	-0.1231	0.0587	4.3914	0.0361
CM_DMCX	1	1	-0.5462	0.1058	26.6521	<.0001
CM_DRUG	1	1	0.2799	0.0523	28.6042	<.0001
CM_LYTES	1	1	-0.9269	0.0111	6944.9325	<.0001
CM_ANEMDEF	1	1	0.0359	0.0265	1.8364	0.1754
HOSP_LOCATION	1	1	-0.5292	0.0244	471.4491	<.0001
HOSP_REGION	2	1	0.0130	0.0205	0.4007	0.5267
HOSP_REGION	3	1	0.00241	0.0146	0.0274	0.8684
HOSP_REGION	4	1	-0.0742	0.0176	17.8345	<.0001

Odds Ratio Estimates			
Effect	Point Estimate	95% Wald Confidence Limits	
CKD 1 vs 0	1.777	1.367	2.311
RACE 2 vs 1	0.629	0.599	0.661
RACE 3 vs 1	1.100	1.044	1.159
RACE 4 vs 1	0.999	0.900	1.109
RACE 5 vs 1	0.756	0.627	0.910
RACE 6 vs 1	0.667	0.620	0.718
FEMALE 1 vs 0	1.348	1.299	1.399
PAY1 2 vs 1	1.063	0.772	1.462
PAY1 3 vs 1	1.190	0.864	1.639
PAY1 4 vs 1	0.521	0.376	0.722
PAY1 5 vs 1	0.718	0.469	1.101
PAY1 6 vs 1	0.671	0.484	0.932
ZIPINC_QRTL 2 vs 1	1.077	1.025	1.132
ZIPINC_QRTL 3 vs 1	1.126	1.070	1.185
ZIPINC_QRTL 4 vs 1	1.339	1.263	1.420
CM_HTN_C 1 vs 0	0.366	0.328	0.407
CM_OBESE 1 vs 0	2.465	1.916	3.172
CM_CHF 1 vs 0	0.077	0.068	0.088
CM_DM 1 vs 0	0.782	0.621	0.984
CM_DMCX 1 vs 0	0.335	0.222	0.508
CM_DRUG 1 vs 0	1.750	1.426	2.149
CM_LYTES 1 vs 0	0.157	0.150	0.164
CM_ANEMDEF 1 vs 0	1.074	0.968	1.192
HOSP_LOCATION 1 vs 0	0.347	0.315	0.382
HOSP_REGION 2 vs 1	0.955	0.893	1.021
HOSP_REGION 3 vs 1	0.945	0.895	0.998
HOSP_REGION 4 vs 1	0.875	0.824	0.930

Figure 24: Mortality with regards to race, type of comorbidities 0-19

4.4.2 Logistic regression -Age group 20-64 vs Mortality

A multivariable logistic regression analysis was conducted to examine independent predictors of mortality for the age group of 20-64 years old. Variables included (race, gender, insurance, socioeconomics, comorbidities, hospital region and hospital location). The model was significant ($\chi 2$= 98831.5549, df= 27, p < .0001) and all the predictors were independent predictors of mortality (Figure 25)

Patients with Chronic Kidney Disease (CKD) (OR= 0.779 0.812, *p* < .0001, CI: 0.779 0.812) are at a lower risk to die than patients without CKD. Being African American (OR= 1.115, *p* < .0001, CI: 1.095, 1.134), Hispanic (OR= 1.231, *p* < .0001, CI: 1.204, 1.258), Native American (OR= 1.148, *p*= 0.0114, CI: 1.060 ,1.243) are associated with higher odds of morality than White Americans, while being Asian or pacific Islander (OR= 0.867, *p* < .0001, CI: 0.831, 0.903) is associated with lower odds of mortality than White Americans.

Female patients (OR= 1.778, *p* < .0001, CI: 1.755, 1.802) are at higher risk of mortality than males. Patients with Medicaid insurance (OR= 1.189, *p*= 0.0002, CI: 1.166 ,1.213), private insurance (OR= 1.345, *p* < .0001, CI: 1.321, 1.369), self-pay insurance (OR= 1.157, *p* < .0001, CI: 1.129, 1.186), no charge (OR= 1.626, *p* < .0001, CI: 1.513, 1.748), other forms of payments (OR= 1.150, *p* < .0001, CI: 1.115 ,1.187) are at higher risk of mortality than patients with Medicare insurance**.** Patients earning between 40,000 and 49,999 annually (OR= 1.095, *p* < .0001, CI: 1.076, 1.114), between 50,000 and 65,999 (OR= 1.172, *p* < .0001, CI: 1.150, 1.193), and between >63,000 (OR= 1.238, *p* < .0001, CI: 1.214 ,1.264) are at higher risk of mortality than patients earning less than 39,999.

Patients with hypertension (OR= 1.156, $p < .0001$, CI: 1.140, 1.173) ,obesity (OR= 1.288, $p < .0001$, CI: 1.261, 1.316) , diabetes with chronic complications (OR= 1.277, $p < .0001$, CI: 1.238 ,1.317) , drug abuse (OR= 1.443, $p < .0001$, CI: 1.402 ,1.485) are at higher risk of mortality than those without. Patients with electrolytes (OR= 0.188, $p < .0001$, CI: 0.185 ,0.191), and anemia (OR= 0.870, $p < .0001$, CI: 0.855 ,0.884) are at less risk of mortality than those without. Patients of the Midwest region (OR= 1.170, $p <.0001$, CI: 1.144, 1.196) are associated with higher mortality rate then the northeast(reference).

Model Fit Statistics		
Criterion	Intercept Only	Intercept and Covariates
AIC	1070995.4	972217.84
SC	1071009.4	972611.05
-2 Log L	1070993.4	972161.84

Testing Global Null Hypothesis: BETA=0			
Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	98831.5549	27	<.0001
Score	142012.904	27	<.0001
Wald	109061.850	27	<.0001

Analysis of Maximum Likelihood Estimates						
Parameter		DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept		1	4.2121	0.0164	66203.7434	<.0001
CKD	1	1	-0.1146	0.00530	468.0786	<.0001
RACE	2	1	0.0569	0.0106	28.7332	<.0001
RACE	3	1	0.1562	0.0118	174.8722	<.0001
RACE	4	1	-0.1948	0.0190	105.6417	<.0001
RACE	5	1	0.0861	0.0340	6.4091	0.0114
RACE	6	1	-0.0527	0.0174	9.1340	0.0025
FEMALE	1	1	0.2878	0.00340	7177.7055	<.0001
PAY1	2	1	-0.0337	0.00907	13.7821	0.0002
PAY1	3	1	0.0892	0.00844	111.7330	<.0001
PAY1	4	1	-0.0611	0.0108	32.1297	<.0001
PAY1	5	1	0.2793	0.0302	85.6629	<.0001
PAY1	6	1	-0.0668	0.0137	23.8857	<.0001
ZIPINC_QRTL	2	1	-0.0250	0.00576	18.7837	<.0001
ZIPINC_QRTL	3	1	0.0426	0.00595	51.2474	<.0001
ZIPINC_QRTL	4	1	0.0981	0.00670	214.5683	<.0001
CM_HTN_C	1	1	0.0726	0.00362	401.8297	<.0001
CM_OBESE	1	1	0.1267	0.00540	550.2306	<.0001
CM_CHF	1	1	-0.4888	0.00532	8439.9776	<.0001
CM_DM	1	1	-0.0549	0.00451	148.2753	<.0001
CM_DMCX	1	1	0.1221	0.00790	238.8195	<.0001
CM_DRUG	1	1	0.1833	0.00729	632.8019	<.0001
CM_LYTES	1	1	-0.8422	0.00345	59603.0057	<.0001
CM_ANEMDEF	1	1	-0.0798	0.00420	361.7683	<.0001
HOSP_LOCATION	1	1	-0.1480	0.00613	582.4270	<.0001
HOSP_REGION	2	1	0.1247	0.00696	320.4396	<.0001
HOSP_REGION	3	1	-0.0326	0.00510	40.8807	<.0001
HOSP_REGION	4	1	-0.0600	0.00641	87.5797	<.0001

Odds Ratio Estimates			
Effect	Point Estimate	95% Wald Confidence Limits	
CKD 1 vs 0	0.795	0.779	0.812
RACE 2 vs 1	1.115	1.095	1.134
RACE 3 vs 1	1.231	1.204	1.258
RACE 4 vs 1	0.867	0.831	0.903
RACE 5 vs 1	1.148	1.060	1.243
RACE 6 vs 1	0.999	0.962	1.037
FEMALE 1 vs 0	1.778	1.755	1.802
PAY1 2 vs 1	1.189	1.166	1.213
PAY1 3 vs 1	1.345	1.321	1.369
PAY1 4 vs 1	1.157	1.129	1.186
PAY1 5 vs 1	1.626	1.513	1.748
PAY1 6 vs 1	1.150	1.115	1.187
ZIPINC_QRTL 2 vs 1	1.095	1.076	1.114
ZIPINC_QRTL 3 vs 1	1.172	1.150	1.193
ZIPINC_QRTL 4 vs 1	1.238	1.214	1.264
CM_HTN_C 1 vs 0	1.156	1.140	1.173
CM_OBESE 1 vs 0	1.288	1.261	1.316
CM_CHF 1 vs 0	0.376	0.368	0.384
CM_DM 1 vs 0	0.896	0.880	0.912
CM_DMCX 1 vs 0	1.277	1.238	1.317
CM_DRUG 1 vs 0	1.443	1.402	1.485
CM_LYTES 1 vs 0	0.186	0.183	0.188
CM_ANEMDEF 1 vs 0	0.852	0.839	0.867
HOSP_LOCATION 1 vs 0	0.744	0.726	0.762
HOSP_REGION 2 vs 1	1.170	1.144	1.196
HOSP_REGION 3 vs 1	0.999	0.982	1.017
HOSP_REGION 4 vs 1	0.972	0.953	0.993

Figure 25: Mortality with regards to race, type of comorbidities 20-64

4.4.3 Logistic regression -Age group 65-74 vs Mortality

A multivariable logistic regression analysis was conducted to examine independent predictors of mortality the age group 65-74 years old. Variables included (race, gender, insurance, socioeconomics, comorbidities, hospital region and hospital location The model was significant (χ^2= 35796.1203, df= 27, $p < .0001$) and all the predictors were independent predictors of mortality (Figure 26).

Being Hispanic (OR= 1.015, $p < .0001$, CI: 0.984 ,1.047), are associated with higher odds of morality than White Americans, while being Asian or pacific islander (OR= 0.822, $p < .0001$, CI: 0.780, 0.866), African American (OR= 0.936, *p* 0.1766, CI: 0.913 ,0.959), Native American (OR= 0.903, p= 0.7095, CI: 0.815, 1.001), and other ethnicities (OR= 0.848, p= 0.0003, CI: 0.809 ,0.889) are associated with lower odds of mortality than White Americans.

Female patients (OR= 1.288, $p < .0001$, CI: 1.268 ,1.309) are at higher risk of mortality than male. Patients earning between 40,000 and 49,999 (OR= 1.059, $p = 0.0203$, CI: 1.037 ,1.082), between 50,000 and 65,999 (OR= 1.104, $p = 0.0004$, CI: 1.079, 1.129), and patients who earn >66,000 (OR= 1.148, $p < .0001$, CI: 1.121 ,1.176) are at higher risk of mortality than patients earning less than 39,999.

Patients with hypertension (OR= 1.654, $p < .0001$, CI: 1.627, 1.680) , obesity (OR= 1.390, $p < .0001$, CI: 1.353, 1.429) uncomplicated Diabetes (DM) (OR= 1.088, $p <.0001$, CI: 1.068, 1.108) ,diabetic patients with chronic complications (OR= 1.245, $p < .0001$, CI: 1.205, 1.286) are associated with higher risk of mortality than those without.

Patients of the Midwest region (OR= 1.184, *p* <.0001, CI: 1.154 ,1.216), South region (OR= 1.063, *p* = 0.2647, CI: 1.041, 1.086) , West region (OR= 1.044, *p* = 0.0016, CI: 1.018 ,1.071) are associated with higher mortality rate then the northeast(reference).

Model Fit Statistics		
Criterion	Intercept Only	Intercept and Covariates
AIC	606606.44	570864.32
SC	606619.15	571220.34
-2 Log L	606604.44	570808.32

Testing Global Null Hypothesis: BETA=0			
Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	35796.1203	27	<.0001
Score	41831.3593	27	<.0001
Wald	37707.6072	27	<.0001

Analysis of Maximum Likelihood Estimates						
Parameter		DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept		1	3.1383	0.0331	8971.1205	<.0001
CKD	1	1	-0.1050	0.00535	386.1141	<.0001
RACE	2	1	0.0193	0.0143	1.8258	0.1766
RACE	3	1	0.1004	0.0162	38.2944	<.0001
RACE	4	1	-0.1102	0.0239	21.3156	<.0001
RACE	5	1	-0.0164	0.0440	0.1388	0.7095
RACE	6	1	-0.0789	0.0220	12.9073	0.0003
FEMALE	1	1	0.1266	0.00404	983.9159	<.0001
PAY1	2	1	0.2940	0.0279	111.0844	<.0001
PAY1	3	1	0.2769	0.0202	187.4033	<.0001
PAY1	4	1	-0.1518	0.0355	18.2391	<.0001
PAY1	5	1	-0.3030	0.0790	14.7228	0.0001
PAY1	6	1	-0.5169	0.0280	340.8853	<.0001
ZIPINC_QRTL	2	1	-0.0162	0.00697	5.3881	0.0203
ZIPINC_QRTL	3	1	0.0251	0.00715	12.3420	0.0004
ZIPINC_QRTL	4	1	0.0646	0.00775	69.5528	<.0001
CM_HTN_C	1	1	0.2514	0.00408	3789.4513	<.0001
CM_OBESE	1	1	0.1647	0.00698	557.0226	<.0001
CM_CHF	1	1	-0.3886	0.00506	5902.6763	<.0001
CM_DM	1	1	0.0422	0.00473	79.6166	<.0001
CM_DMCX	1	1	0.1095	0.00834	172.6414	<.0001
CM_DRUG	1	1	0.2139	0.0240	79.5588	<.0001
CM_LYTES	1	1	-0.5667	0.00410	19096.7133	<.0001
CM_ANEMDEF	1	1	-0.00615	0.00488	1.5873	0.2077
HOSP_LOCATION	1	1	-0.0696	0.00658	111.7230	<.0001
HOSP_REGION	2	1	0.1007	0.00836	144.9618	<.0001
HOSP_REGION	3	1	-0.00695	0.00623	1.2439	0.2647
HOSP_REGION	4	1	-0.0253	0.00800	10.0077	0.0016

Odds Ratio Estimates			
Effect	Point Estimate	95% Wald Confidence Limits	
CKD 1 vs 0	0.811	0.794	0.828
RACE 2 vs 1	0.936	0.913	0.959
RACE 3 vs 1	1.015	0.984	1.047
RACE 4 vs 1	0.822	0.780	0.866
RACE 5 vs 1	0.903	0.815	1.001
RACE 6 vs 1	0.848	0.809	0.889
FEMALE 1 vs 0	1.288	1.268	1.309
PAY1 2 vs 1	0.899	0.853	0.947
PAY1 3 vs 1	0.884	0.863	0.904
PAY1 4 vs 1	0.576	0.534	0.620
PAY1 5 vs 1	0.495	0.411	0.595
PAY1 6 vs 1	0.399	0.379	0.421
ZIPINC_QRTL 2 vs 1	1.059	1.037	1.082
ZIPINC_QRTL 3 vs 1	1.104	1.079	1.129
ZIPINC_QRTL 4 vs 1	1.148	1.121	1.176
CM_HTN_C 1 vs 0	1.654	1.627	1.680
CM_OBESE 1 vs 0	1.390	1.353	1.429
CM_CHF 1 vs 0	0.460	0.451	0.469
CM_DM 1 vs 0	1.088	1.068	1.108
CM_DMCX 1 vs 0	1.245	1.205	1.286
CM_DRUG 1 vs 0	1.534	1.396	1.685
CM_LYTES 1 vs 0	0.322	0.317	0.327
CM_ANEMDEF 1 vs 0	0.988	0.969	1.007
HOSP_LOCATION 1 vs 0	0.870	0.848	0.893
HOSP_REGION 2 vs 1	1.184	1.154	1.216
HOSP_REGION 3 vs 1	1.063	1.041	1.086
HOSP_REGION 4 vs 1	1.044	1.018	1.071

Figure 26: Mortality with regards to race, type of comorbidities 65-74

4.4.4 Logistic regression -Age group 75-84 vs Mortality

A multivariable logistic regression analysis was conducted to examine independent predictors of mortality of the age group 74-85. Variables included (race, gender, insurance, socioeconomics, comorbidities, hospital region and hospital location). The model was significant (χ^2= 38863.3966, df= 27, p < .0001) and all the predictors were independent predictors of mortality (Figure 27)

Hispanic (OR= 1.028, p < .0001, CI: 1.000, 1.057), Native American (OR= 1.078, p= 0.0038, CI: 0.972 ,1.195) are associated with higher odds of morality than White Americans. Female patients (OR= 1.308, p < .0001, CI: 1.290 ,1.325) are at higher risk of mortality than male.

Patients earning between 40,000 and 49,999 (OR= 1.079, p = 0.2283, CI: 1.059, 1.099), between 50,000 and 65,999 (OR= 1.112, p<*.0001*, CI: 1.090, 1.134), and patients who earn >66,000 (OR= 1.097, p = 0.0001, CI: 1.075 ,1.120) are at higher risk of mortality than patients earning less than 39,999.

Patients with hypertension (OR= 1.626, p < .0001, CI: 1.604, 1.649) ,obesity (OR= 1.352, p < .0001, CI: 1.312, 1.394) , uncomplicated diabetes (OR= 1.059, p < .0001, CI: 1.042 ,1.076) ,diabetic patient with chronic complications (OR= 1.159, p < .0001, CI: 1.125, 1.195), drugs abuse (OR= 1.768, p < .0001, CI: 1.515 ,2.063) ,Patients with anemia (OR= 1.077, p < .0001, CI: 1.060 ,1.094) are at higher risk of mortality than those without.

Patients of the Midwest region (OR= 1.172, p <.0001, CI: 1.147, 1.197), South region (OR= 1.067, p = 0.2944, CI: 1.048 ,1.086), West region (OR= 1.060, p = 0.0819, CI: 1.038 ,1.083) are associated with higher mortality rate then the northeast(reference).

Model Fit Statistics		
Criterion	Intercept Only	Intercept and Covariates
AIC	777051.87	738242.47
SC	777064.57	738598.03
-2 Log L	777049.87	738186.47

Testing Global Null Hypothesis: BETA=0			
Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	38863.3966	27	<.0001
Score	44251.5303	27	<.0001
Wald	40742.0480	27	<.0001

Analysis of Maximum Likelihood Estimates						
Parameter		DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept		1	2.7581	0.0455	3670.4639	<.0001
CKD	1	1	-0.0669	0.00427	245.1096	<.0001
RACE	2	1	0.0284	0.0140	4.1173	0.0424
RACE	3	1	0.0805	0.0151	28.5103	<.0001
RACE	4	1	-0.1947	0.0205	89.8559	<.0001
RACE	5	1	0.1276	0.0440	8.4002	0.0038
RACE	6	1	-0.0944	0.0202	21.8923	<.0001
FEMALE	1	1	0.1341	0.00344	1515.5252	<.0001
PAY1	2	1	0.4824	0.0299	259.5014	<.0001
PAY1	3	1	0.2036	0.0203	100.7548	<.0001
PAY1	4	1	-0.2099	0.0352	35.4421	<.0001
PAY1	5	1	-0.3960	0.0782	25.6607	<.0001
PAY1	6	1	-0.6927	0.0262	699.3245	<.0001
ZIPINC_QRTL	2	1	0.00722	0.00599	1.4515	0.2283
ZIPINC_QRTL	3	1	0.0372	0.00608	37.5724	<.0001
ZIPINC_QRTL	4	1	0.0241	0.00636	14.4250	0.0001
CM_HTN_C	1	1	0.2431	0.00350	4828.8696	<.0001
CM_OBESE	1	1	0.1509	0.00780	374.4654	<.0001
CM_CHF	1	1	-0.3646	0.00396	8486.5353	<.0001
CM_DM	1	1	0.0286	0.00405	49.8194	<.0001
CM_DMCX	1	1	0.0739	0.00765	93.4294	<.0001
CM_DRUG	1	1	0.2849	0.0394	52.2044	<.0001
CM_LYTES	1	1	-0.4473	0.00348	16513.5309	<.0001
CM_ANEMDEF	1	1	0.0370	0.00408	82.2181	<.0001
HOSP_LOCATION	1	1	-0.0460	0.00543	71.9813	<.0001
HOSP_REGION	2	1	0.0880	0.00699	158.5417	<.0001
HOSP_REGION	3	1	-0.00566	0.00540	1.0996	0.2944
HOSP_REGION	4	1	-0.0120	0.00690	3.0258	0.0819

Odds Ratio Estimates			
Effect	Point Estimate	95% Wald Confidence Limits	
CKD 1 vs 0	0.875	0.860	0.890
RACE 2 vs 1	0.976	0.953	0.999
RACE 3 vs 1	1.028	1.000	1.057
RACE 4 vs 1	0.781	0.748	0.815
RACE 5 vs 1	1.078	0.972	1.195
RACE 6 vs 1	0.863	0.828	0.900
FEMALE 1 vs 0	1.308	1.290	1.325
PAY1 2 vs 1	0.878	0.828	0.931
PAY1 3 vs 1	0.664	0.649	0.680
PAY1 4 vs 1	0.439	0.408	0.473
PAY1 5 vs 1	0.365	0.304	0.438
PAY1 6 vs 1	0.271	0.259	0.284
ZIPINC_QRTL 2 vs 1	1.079	1.059	1.099
ZIPINC_QRTL 3 vs 1	1.112	1.090	1.134
ZIPINC_QRTL 4 vs 1	1.097	1.075	1.120
CM_HTN_C 1 vs 0	1.626	1.604	1.649
CM_OBESE 1 vs 0	1.352	1.312	1.394
CM_CHF 1 vs 0	0.482	0.475	0.490
CM_DM 1 vs 0	1.059	1.042	1.076
CM_DMCX 1 vs 0	1.159	1.125	1.195
CM_DRUG 1 vs 0	1.768	1.515	2.063
CM_LYTES 1 vs 0	0.409	0.403	0.414
CM_ANEMDEF 1 vs 0	1.077	1.060	1.094
HOSP_LOCATION 1 vs 0	0.912	0.893	0.932
HOSP_REGION 2 vs 1	1.172	1.147	1.197
HOSP_REGION 3 vs 1	1.067	1.048	1.086
HOSP_REGION 4 vs 1	1.060	1.038	1.083

Figure 27: Mortality with regards to race, type of comorbidities 75-84

4.4.5 Logistic regression -Age group >85 vs Mortality

A multivariable logistic regression analysis was conducted to examine independent predictors of mortality of the age group >85 years old. Variables included (race, gender, insurance, socioeconomics, comorbidities, hospital region and hospital location). The model was significant (χ^2= 27400.4417, df= 27, p < .0001) and all the predictors were independent predictors of mortality (Figure 28).

Female patients (OR= 1.242, p < .0001, CI: 1.225 ,1.259) are at higher risk of mortality than male. Patients earning between 40,000 and 49,999 (OR= 1.048, p = 0.0018, CI: 1 1.027 ,1.068), between 50,000 and 65,999 (OR= 1.052, p<*.0001*, CI: 1.031, 1.074), and patients who earn >66,000 (OR= 1.013, p= 0.0186, CI: 0.993 ,1.034) are at higher risk of mortality than patients earning less than 39,999.

Patients with hypertension (OR= 1.494, p < .0001, CI: 1.474, 1.515),obesity (OR= 1.286, p < .0001, CI: 1.225, 1.350), diabetic patient with chronic complications (OR= 1.159, p < .0001, CI: 1.114 ,1.206) , drugs abuse (OR= 2.193, p < .0001, CI: 1.700 ,2.828) , anemia (OR= 1.187, p<.0001, CI: 1.168 ,1.206) are at higher risk of mortality than those with without.

Urban hospitals (OR= 1.051, p <.0001, CI: 1.030 ,1.073) are associated with higher rate of mortality than rural hospitals. Patients of the Midwest region (OR= 1.219, p <.0001, CI: 1.194 ,1.246), South region (OR= 1.085, p = 0.4188, CI: 1.066 ,1.105) West region (OR= 1.067, p = 0.4543, CI: 1.045,1.089) are associated with higher mortality rate then the northeast(reference).

Model Fit Statistics		
Criterion	Intercept Only	Intercept and Covariates
AIC	717276.54	689930.09
SC	717288.85	690274.92
-2 Log L	717274.54	689874.09

Testing Global Null Hypothesis: BETA=0			
Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	27400.4417	27	<.0001
Score	31187.9860	27	<.0001
Wald	28792.6012	27	<.0001

Analysis of Maximum Likelihood Estimates						
Parameter		DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept		1	2.2729	0.0702	1047.2862	<.0001
CKD	1	1	-0.0231	0.00415	30.8542	<.0001
RACE	2	1	0.0501	0.0151	11.0147	0.0009
RACE	3	1	0.0642	0.0163	15.5329	<.0001
RACE	4	1	-0.2172	0.0211	106.2423	<.0001
RACE	5	1	0.0398	0.0464	0.7362	0.3909
RACE	6	1	-0.0561	0.0215	6.8027	0.0091
FEMALE	1	1	0.1084	0.00353	942.1578	<.0001
PAY1	2	1	0.5358	0.0329	265.1146	<.0001
PAY1	3	1	0.2025	0.0223	82.7168	<.0001
PAY1	4	1	-0.2839	0.0385	54.4569	<.0001
PAY1	5	1	-0.5353	0.0868	38.0619	<.0001
PAY1	6	1	-0.7229	0.0270	716.4203	<.0001
ZIPINC_QRTL	2	1	0.0189	0.00604	9.7526	0.0018
ZIPINC_QRTL	3	1	0.0233	0.00607	14.6880	0.0001
ZIPINC_QRTL	4	1	-0.0145	0.00615	5.5408	0.0186
CM_HTN_C	1	1	0.2008	0.00351	3268.4071	<.0001
CM_OBESE	1	1	0.1258	0.0125	101.5191	<.0001
CM_CHF	1	1	-0.3136	0.00373	7054.6118	<.0001
CM_DM	1	1	-0.00176	0.00439	0.1600	0.6891
CM_DMCX	1	1	0.0738	0.0101	53.9255	<.0001
CM_DRUG	1	1	0.3926	0.0649	36.5734	<.0001
CM_LYTES	1	1	-0.3140	0.00346	8234.5217	<.0001
CM_ANEMDEF	1	1	0.0857	0.00401	456.0385	<.0001
HOSP_LOCATION	1	1	0.0250	0.00520	23.1877	<.0001
HOSP_REGION	2	1	0.1121	0.00693	261.7205	<.0001
HOSP_REGION	3	1	-0.00439	0.00551	0.6346	0.4257
HOSP_REGION	4	1	-0.0214	0.00683	9.8001	0.0017

Odds Ratio Estimates			
Effect	Point Estimate	95% Wald Confidence Limits	
CKD 1 vs 0	0.955	0.939	0.971
RACE 2 vs 1	0.933	0.909	0.958
RACE 3 vs 1	0.946	0.918	0.975
RACE 4 vs 1	0.714	0.684	0.746
RACE 5 vs 1	0.924	0.829	1.029
RACE 6 vs 1	0.839	0.802	0.878
FEMALE 1 vs 0	1.242	1.225	1.259
PAY1 2 vs 1	0.765	0.718	0.815
PAY1 3 vs 1	0.548	0.534	0.562
PAY1 4 vs 1	0.337	0.311	0.365
PAY1 5 vs 1	0.262	0.214	0.321
PAY1 6 vs 1	0.217	0.208	0.227
ZIPINC_QRTL 2 vs 1	1.048	1.027	1.068
ZIPINC_QRTL 3 vs 1	1.052	1.031	1.074
ZIPINC_QRTL 4 vs 1	1.013	0.993	1.034
CM_HTN_C 1 vs 0	1.494	1.474	1.515
CM_OBESE 1 vs 0	1.286	1.225	1.350
CM_CHF 1 vs 0	0.534	0.526	0.542
CM_DM 1 vs 0	0.996	0.979	1.014
CM_DMCX 1 vs 0	1.159	1.114	1.206
CM_DRUG 1 vs 0	2.193	1.700	2.828
CM_LYTES 1 vs 0	0.534	0.526	0.541
CM_ANEMDEF 1 vs 0	1.187	1.168	1.206
HOSP_LOCATION 1 vs 0	1.051	1.030	1.073
HOSP_REGION 2 vs 1	1.219	1.194	1.246
HOSP_REGION 3 vs 1	1.085	1.066	1.105
HOSP_REGION 4 vs 1	1.067	1.045	1.089

Figure 28: Mortality with regards to race, type of comorbidities >85

4.5 Evaluation of hypothesis 4: race, gender, insurance, socioeconomics, types of comorbidities , hospital region , hospital location in different age groups on CKD

4.5.1 Logistic regression -Age group 0-19 vs CKD

A multivariable logistic regression analysis was conducted to examine independent predictors of CKD of the age group 0-19 years old. Variables included (race, gender, insurance, socioeconomics, comorbidities, hospital region and hospital location). The model was significant (χ^2= 35058.3302, df= 26, p < .0001) and all the predictors were independent predictors of CKD (Figure 29).

Being African American (OR= 1.202, *p* = 0.2800, CI: 1.117, 1.293), Hispanic (OR= 1.286, *p*= 0.0016, CI: 1.201 ,1.378), Native American (OR= 2.463, *p* = 0.2800, CI 1.996 ,3.041) are associated with higher odds of CKD.

Patients with hypertension (OR= 18.887, $p < .0001$, CI: 17.650 ,20.210) , Patients with congestive heart failure (OR= 3.134, $p < .0001$, CI: 2.511, 3.912), patients with uncomplicated diabetes (OR= 1.175, *p*= 0.0839, CI: 0.979 ,1.410). diabetic patient with chronic complications (OR= 3.503 $p < .0001$, CI: 2.377 ,5.164), patients with electrolytes disorder (OR= 4.519, $p < .0001$, CI: 4.255 ,4.800), patients with anemia (OR= 15.165, $p<.0001$, CI: 14.277 ,16.108) are at higher odd of developing CKD.

Urban hospitals (OR= 5.016, $p <.0001$, CI: 4.219, 5.964) are associated with higher risk of CKD than rural hospitals. Patients of the Midwest region (2) (OR= 1.075, *p*= 0.0020, CI: 0.968 ,1.193), South region (3) (OR= 1.197, *p* = 0.5238, CI: 1.099 ,1.304) West region(4) (OR= 1.512, $p <.0001$, CI:1.380,1.657) are associated with high risk of CKD.

Model Fit Statistics		
Criterion	Intercept Only	Intercept and Covariates
AIC	101992.82	66986.491
SC	102005.83	67337.758
-2 Log L	101990.82	66932.491

Testing Global Null Hypothesis: BETA=0			
Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	35058.3302	26	<.0001
Score	299583.975	26	<.0001
Wald	37822.1714	26	<.0001

Analysis of Maximum Likelihood Estimates						
Parameter		DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept		1	-2.4383	0.1470	275.0026	<.0001
RACE	2	1	0.0393	0.0364	1.1673	0.2800
RACE	3	1	0.1073	0.0340	9.9758	0.0016
RACE	4	1	-0.4010	0.0724	30.7135	<.0001
RACE	5	1	0.7570	0.0897	71.1655	<.0001
RACE	6	1	-0.3582	0.0618	33.5952	<.0001
FEMALE	1	1	-0.2021	0.0136	222.3839	<.0001
PAY1	2	1	-1.0065	0.0332	920.7194	<.0001
PAY1	3	1	-0.9170	0.0352	679.5225	<.0001
PAY1	4	1	-1.4492	0.0814	316.9089	<.0001
PAY1	5	1	0.3269	0.1042	9.8410	0.0017
PAY1	6	1	-0.5486	0.0563	94.9991	<.0001
ZIPINC_QRTL	2	1	0.0522	0.0234	4.9707	0.0258
ZIPINC_QRTL	3	1	-0.0329	0.0238	1.9050	0.1675
ZIPINC_QRTL	4	1	-0.1657	0.0277	35.8350	<.0001
CM_HTN_C	1	1	1.4692	0.0173	7230.3476	<.0001
CM_OBESE	1	1	-0.0415	0.0414	1.0052	0.3161
CM_CHF	1	1	0.5712	0.0566	102.0008	<.0001
CM_DM	1	1	0.0805	0.0466	2.9872	0.0839
CM_DMCX	1	1	0.6269	0.0990	40.1281	<.0001
CM_DRUG	1	1	-0.3148	0.0626	25.2789	<.0001
CM_LYTES	1	1	0.7542	0.0153	2414.0593	<.0001
CM_ANEMDEF	1	1	1.3595	0.0154	7807.4564	<.0001
HOSP_LOCATION	1	1	0.8063	0.0441	333.6863	<.0001
HOSP_REGION	2	1	-0.0942	0.0305	9.5250	0.0020
HOSP_REGION	3	1	0.0135	0.0212	0.4065	0.5238
HOSP_REGION	4	1	0.2471	0.0247	100.2246	<.0001

Odds Ratio Estimates			
Effect	Point Estimate	95% Wald Confidence Limits	
RACE 2 vs 1	1.202	1.117	1.293
RACE 3 vs 1	1.286	1.201	1.378
RACE 4 vs 1	0.774	0.655	0.914
RACE 5 vs 1	2.463	1.996	3.041
RACE 6 vs 1	0.808	0.702	0.929
FEMALE 1 vs 0	0.667	0.633	0.704
PAY1 2 vs 1	0.010	0.009	0.011
PAY1 3 vs 1	0.011	0.010	0.012
PAY1 4 vs 1	0.006	0.005	0.008
PAY1 5 vs 1	0.038	0.030	0.049
PAY1 6 vs 1	0.016	0.014	0.018
ZIPINC_QRTL 2 vs 1	0.910	0.848	0.976
ZIPINC_QRTL 3 vs 1	0.836	0.777	0.899
ZIPINC_QRTL 4 vs 1	0.732	0.673	0.796
CM_HTN_C 1 vs 0	18.887	17.650	20.210
CM_OBESE 1 vs 0	0.920	0.783	1.082
CM_CHF 1 vs 0	3.134	2.511	3.912
CM_DM 1 vs 0	1.175	0.979	1.410
CM_DMCX 1 vs 0	3.503	2.377	5.164
CM_DRUG 1 vs 0	0.533	0.417	0.681
CM_LYTES 1 vs 0	4.519	4.255	4.800
CM_ANEMDEF 1 vs 0	15.165	14.277	16.108
HOSP_LOCATION 1 vs 0	5.016	4.219	5.964
HOSP_REGION 2 vs 1	1.075	0.968	1.193
HOSP_REGION 3 vs 1	1.197	1.099	1.304
HOSP_REGION 4 vs 1	1.512	1.380	1.657

Figure 29: CKD with regards to race, type of comorbidities 0-19

4.5.2 Logistic regression -Age group 20-64 vs CKD

A multivariable logistic regression analysis was conducted to examine independent predictors of CKD of the age group 20-64 years old. Variables included (race, gender, insurance, socioeconomics, comorbidities, hospital region and hospital location). The model was significant (χ^2= 1348806.37, df= 26, p < .0001) and all the predictors were independent predictors of CKD (Figure 30)

African American patients (OR= 2.418, p < .0001, CI: 2.400 ,2.436) Hispanic (OR= 1.651, p < .0001, CI: 1.635,1.668), Asian or pacific Islander (OR= 1.750, p < .0001, CI:

1.713 ,1.788) ,Native American(OR= 1.427, $p < .0001$, CI: 1.377 ,1.479) , other races (OR= 1.326, $p < .0001$, CI: 1.300 ,1.351) are associated with higher risk of developing CKD.

Patients with hypertension (OR= 2.801, $p < .0001$, CI: 2.782 2.820) , Patients with congestive heart failure (OR= 3.108, $p < .0001$, CI: 3.077 ,3.139), patients with uncomplicated diabetes(OR= 1.781, $p < .0001$, CI: 1.768 1.794) diabetic patient with chronic complications (OR= 8.605, $p < .0001$, CI: 8.524 ,8.687) , electrolytes disorder (OR= 1.954, $p < .0001$, CI: 1.941 ,1.968) , anemia (OR= 4.131, $p < .0001$, CI: 4.104 ,4.159) are at higher risk of developing CKD.

Urban hospitals (OR= 1.322, $p <.0001$, CI: 1.306 ,1.337) are associated with higher rate of CKD than rural hospitals. Patients of South region (3) (OR= 1.019, $p < .0001$, CI: 1.010 1.028), West region(4) (OR= 1.016, $p < .0001$, CI: 1.006 ,1.026) are associated with higher risk of developing CKD.

Model Fit Statistics		
Criterion	Intercept Only	Intercept and Covariates
AIC	4390882.0	3042127.7
SC	4390896.1	3042506.9
-2 Log L	4390880.0	3042073.7

Testing Global Null Hypothesis: BETA=0			
Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	1348806.37	26	<.0001
Score	1963297.79	26	<.0001
Wald	968059.975	26	<.0001

Analysis of Maximum Likelihood Estimates						
Parameter		DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept		1	-1.0684	0.00728	21510.9381	<.0001
RACE	2	1	0.4526	0.00466	9431.3418	<.0001
RACE	3	1	0.0714	0.00534	178.6611	<.0001
RACE	4	1	0.1293	0.00952	184.4886	<.0001
RACE	5	1	-0.0747	0.0153	23.8777	<.0001
RACE	6	1	-0.1484	0.00875	288.0264	<.0001
FEMALE	1	1	-0.3011	0.00161	35160.9560	<.0001
PAY1	2	1	0.0251	0.00457	30.2069	<.0001
PAY1	3	1	-0.1465	0.00435	1132.0861	<.0001
PAY1	4	1	-0.3725	0.00627	3528.0362	<.0001
PAY1	5	1	-0.2544	0.0150	287.5782	<.0001
PAY1	6	1	-0.3557	0.00794	2005.3235	<.0001
ZIPINC_QRTL	2	1	0.0171	0.00279	37.7453	<.0001
ZIPINC_QRTL	3	1	-0.00157	0.00289	0.2945	0.5874
ZIPINC_QRTL	4	1	-0.0448	0.00336	178.0671	<.0001
CM_HTN_C	1	1	0.5150	0.00172	89476.8205	<.0001
CM_OBESE	1	1	-0.0846	0.00219	1499.4653	<.0001
CM_CHF	1	1	0.5669	0.00252	50696.4162	<.0001
CM_DM	1	1	0.2885	0.00190	23072.3712	<.0001
CM_DMCX	1	1	1.0762	0.00241	199429.459	<.0001
CM_DRUG	1	1	-0.1708	0.00340	2517.2169	<.0001
CM_LYTES	1	1	0.3350	0.00171	38581.7864	<.0001
CM_ANEMDEF	1	1	0.7093	0.00169	176575.915	<.0001
HOSP_LOCATION	1	1	0.1394	0.00297	2208.3969	<.0001
HOSP_REGION	2	1	-0.0573	0.00324	312.9326	<.0001
HOSP_REGION	3	1	0.0263	0.00244	115.8713	<.0001
HOSP_REGION	4	1	0.0235	0.00320	53.7697	<.0001

Odds Ratio Estimates			
Effect	Point Estimate	95% Wald Confidence Limits	
RACE 2 vs 1	2.418	2.400	2.436
RACE 3 vs 1	1.651	1.635	1.668
RACE 4 vs 1	1.750	1.713	1.788
RACE 5 vs 1	1.427	1.377	1.479
RACE 6 vs 1	1.326	1.300	1.351
FEMALE 1 vs 0	0.548	0.544	0.551
PAY1 2 vs 1	0.340	0.337	0.343
PAY1 3 vs 1	0.286	0.284	0.289
PAY1 4 vs 1	0.228	0.225	0.232
PAY1 5 vs 1	0.257	0.248	0.266
PAY1 6 vs 1	0.232	0.228	0.236
ZIPINC_QRTL 2 vs 1	0.988	0.980	0.996
ZIPINC_QRTL 3 vs 1	0.970	0.961	0.978
ZIPINC_QRTL 4 vs 1	0.929	0.919	0.938
CM_HTN_C 1 vs 0	2.801	2.782	2.820
CM_OBESE 1 vs 0	0.844	0.837	0.852
CM_CHF 1 vs 0	3.108	3.077	3.139
CM_DM 1 vs 0	1.781	1.768	1.794
CM_DMCX 1 vs 0	8.605	8.524	8.687
CM_DRUG 1 vs 0	0.711	0.701	0.720
CM_LYTES 1 vs 0	1.954	1.941	1.968
CM_ANEMDEF 1 vs 0	4.131	4.104	4.159
HOSP_LOCATION 1 vs 0	1.322	1.306	1.337
HOSP_REGION 2 vs 1	0.937	0.928	0.947
HOSP_REGION 3 vs 1	1.019	1.010	1.028
HOSP_REGION 4 vs 1	1.016	1.006	1.026

Figure 30: CKD with regards to race, type of comorbidities 20-64

4.5.3 Logistic regression -Age group 65-74 vs CKD

A multivariable logistic regression analysis was conducted to examine independent predictors of CKD of the age group 65-74 years old. Variables included (race, gender, insurance, socioeconomics, comorbidities, hospital region and hospital location). The model was significant (χ^2= 317599.201, df= 26, p < .0001) and all the predictors were independent predictors of CKD (Figure 31).

African American patients (OR= 2.143, p < .0001, CI: 2.121, 2.165), Hispanic (OR= 1.396, p= 0.0135, CI: 1.377 ,1.415), Asian or pacific Islander (OR= 1.514, p < .0001, CI: 1.476, 1.553) ,Native American(OR= 1.262, p < .0001, CI: 1.201 ,1.326) , other races (OR= 1.159, p < .0001, CI: 1.131, 1.187) are associated with higher risk of CKD than White Americans. Patients that had no charges (OR= 1.292, p < .0001, CI: 1.154, 1.447) are associated with higher risk of CKD than Medicare patients.

Patients with hypertension (OR= 1.445, p < .0001, CI: 1.433,1.458) , obesity (OR= 1.081, p < .0001, CI 1.070 ,1.093), congestive heart failure (OR= 2.344, p < .0001, CI: 2.320 ,2.367), uncomplicate diabetes (OR= 1.826, p < .0001, CI: 1.811 ,1.842) diabetes with chronic complications (OR= 6.453, p < .0001, CI: 6.376 ,6.530) ,electrolytes disorder (OR= 1.495 , p < .0001, CI: 1.483 ,1.508) ,anemia (OR= 2.887, p < .0001, CI: 2.863 ,2.911) are at higher risk of CKD.

Urban hospitals (OR= 1.153, p <.0001, CI: 1.139, 1.168) are associated with higher rate of CKD than rural hospitals. Patients of Midwest region (2) (OR= 1.018, p < .0001, CI: 1.006 ,1.031) are associated with higher risk of CKD.

Model Fit Statistics		
Criterion	Intercept Only	Intercept and Covariates
AIC	2096891.0	1779343.8
SC	2096903.7	1779687.1
-2 Log L	2096889.0	1779289.8

Testing Global Null Hypothesis: BETA=0			
Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	317599.201	26	<.0001
Score	366438.213	26	<.0001
Wald	272566.139	26	<.0001

Analysis of Maximum Likelihood Estimates						
Parameter		DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept		1	-0.3941	0.0167	557.3968	<.0001
RACE	2	1	0.4472	0.00654	4679.6392	<.0001
RACE	3	1	0.0184	0.00746	6.1021	0.0135
RACE	4	1	0.0995	0.0116	73.4701	<.0001
RACE	5	1	-0.0824	0.0212	15.1521	<.0001
RACE	6	1	-0.1678	0.0111	228.4360	<.0001
FEMALE	1	1	-0.1929	0.00196	9690.0175	<.0001
PAY1	2	1	0.0291	0.0151	3.7057	0.0542
PAY1	3	1	-0.1545	0.0122	160.3848	<.0001
PAY1	4	1	-0.1408	0.0226	38.8722	<.0001
PAY1	5	1	0.3318	0.0485	46.7436	<.0001
PAY1	6	1	-0.1410	0.0195	52.1520	<.0001
ZIPINC_QRTL	2	1	0.0180	0.00339	28.3315	<.0001
ZIPINC_QRTL	3	1	-0.00751	0.00346	4.7091	0.0300
ZIPINC_QRTL	4	1	-0.0472	0.00380	153.9118	<.0001
CM_HTN_C	1	1	0.1841	0.00223	6789.5871	<.0001
CM_OBESE	1	1	0.0391	0.00277	199.8958	<.0001
CM_CHF	1	1	0.4259	0.00257	27361.6028	<.0001
CM_DM	1	1	0.3011	0.00215	19677.3733	<.0001
CM_DMCX	1	1	0.9323	0.00304	93744.8956	<.0001
CM_DRUG	1	1	-0.1551	0.0107	209.3527	<.0001
CM_LYTES	1	1	0.2012	0.00211	9100.4938	<.0001
CM_ANEMDEF	1	1	0.5301	0.00210	63785.7692	<.0001
HOSP_LOCATION	1	1	0.0713	0.00325	482.4186	<.0001
HOSP_REGION	2	1	0.0342	0.00387	77.7964	<.0001
HOSP_REGION	3	1	-0.0205	0.00302	46.1979	<.0001
HOSP_REGION	4	1	-0.0298	0.00393	57.6533	<.0001

Odds Ratio Estimates			
Effect	Point Estimate	95% Wald Confidence Limits	
RACE 2 vs 1	2.143	2.121	2.165
RACE 3 vs 1	1.396	1.377	1.415
RACE 4 vs 1	1.514	1.476	1.553
RACE 5 vs 1	1.262	1.201	1.326
RACE 6 vs 1	1.159	1.131	1.187
FEMALE 1 vs 0	0.680	0.675	0.685
PAY1 2 vs 1	0.955	0.931	0.979
PAY1 3 vs 1	0.795	0.785	0.804
PAY1 4 vs 1	0.806	0.768	0.845
PAY1 5 vs 1	1.292	1.154	1.447
PAY1 6 vs 1	0.805	0.775	0.837
ZIPINC_QRTL 2 vs 1	0.982	0.971	0.992
ZIPINC_QRTL 3 vs 1	0.957	0.946	0.967
ZIPINC_QRTL 4 vs 1	0.920	0.909	0.930
CM_HTN_C 1 vs 0	1.445	1.433	1.458
CM_OBESE 1 vs 0	1.081	1.070	1.093
CM_CHF 1 vs 0	2.344	2.320	2.367
CM_DM 1 vs 0	1.826	1.811	1.842
CM_DMCX 1 vs 0	6.453	6.376	6.530
CM_DRUG 1 vs 0	0.733	0.703	0.765
CM_LYTES 1 vs 0	1.495	1.483	1.508
CM_ANEMDEF 1 vs 0	2.887	2.863	2.911
HOSP_LOCATION 1 vs 0	1.153	1.139	1.168
HOSP_REGION 2 vs 1	1.018	1.006	1.031
HOSP_REGION 3 vs 1	0.964	0.954	0.974
HOSP_REGION 4 vs 1	0.955	0.943	0.967

Figure 31: CKD with regards to race, type of comorbidities 65-74

4.5.4 Logistic regression -Age group 75-84 vs CKD

A multivariable logistic regression analysis was conducted to examine independent predictors of CKD of the age group 75-84 years old. Variables included (race, gender, insurance, socioeconomics, comorbidities, hospital region and hospital location). The model was significant (χ^2= 233435.076, df= 26, p < .0001) and all the predictors were independent predictors of CKD (Figure 32).

African American patients (OR= 1.770, p < .0001, CI: 1.751,1.789), Hispanic (OR= 1.084, p < .0001, CI: 1.070 1.099), Asian or pacific Islander (OR= 1.318, p < .0001, CI:

1.288, 1.348) ,Native American(OR= 1.096, $p < .0001$, CI: 1.042 ,1.152) , other races (OR= 1.056, $p < .0001$, CI: 1.033 ,1.081) are associated with higher risk of CKD. Patients that had no charges (OR= 1.292, $p < .0001$, CI: 1.154, 1.447) are associated with higher risk of CKD. Patients earning between 40,000 and 49,999 (OR= 1.011, p 0.0006, CI: 1.001, 1.021), between 50,000 and 65,999 (OR= 1.008, $p = 0.0125$, CI: 0.998 1.018), are at higher risk of CKD.

Patients with hypertension (OR= 1.370, $p < .0001$, CI: 1.360, 1.381) , obesity (OR= 1.202, $p < .0001$, CI 1.187, 1.217), congestive heart failure (OR= 1.978, $p < .0001$, CI: 1.961, 1.995), uncomplicated diabetes (OR= 1.565, $p < .0001$, CI: 1.553 ,1.577) diabetes with chronic complications (OR= 4.310, $p < .0001$, CI: 4.257 ,4.363) ,electrolytes disorder (OR= 1.341, $p < .0001$, CI: 1.332, 1.351), anemia (OR= 2.510, $p < .0001$, CI: 2.492 ,2.529) are at higher risk of CKD.

Urban hospitals (OR= 1.139, $p <.0001$, CI: 1.126 1.152) are associated with higher rate of CKD than rural hospitals. Patients of Midwest region (2) (OR= 1.061, $p < .0001$, CI: 1.050 ,1.073) are associated with higher risk of CKD.

Model Fit Statistics		
Criterion	Intercept Only	Intercept and Covariates
AIC	2354371.0	2120988.0
SC	2354383.7	2121330.8
-2 Log L	2354369.0	2120934.0

Testing Global Null Hypothesis: BETA=0			
Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	233435.076	26	<.0001
Score	253534.112	26	<.0001
Wald	211511.749	26	<.0001

Analysis of Maximum Likelihood Estimates						
Parameter		DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept		1	-0.4014	0.0230	305.0298	<.0001
RACE	2	1	0.3920	0.00669	3430.8757	<.0001
RACE	3	1	-0.0982	0.00742	174.9964	<.0001
RACE	4	1	0.0970	0.0106	83.2486	<.0001
RACE	5	1	-0.0876	0.0215	16.6309	<.0001
RACE	6	1	-0.1242	0.0107	135.8954	<.0001
FEMALE	1	1	-0.2451	0.00175	19601.0966	<.0001
PAY1	2	1	0.00494	0.0186	0.0704	0.7907
PAY1	3	1	0.0174	0.0149	1.3532	0.2447
PAY1	4	1	-0.0858	0.0263	10.6497	0.0011
PAY1	5	1	0.00143	0.0616	0.0005	0.9815
PAY1	6	1	-0.0261	0.0216	1.4499	0.2285
ZIPINC_QRTL	2	1	0.0104	0.00304	11.7850	0.0006
ZIPINC_QRTL	3	1	0.00763	0.00306	6.2354	0.0125
ZIPINC_QRTL	4	1	-0.0177	0.00325	29.6925	<.0001
CM_HTN_C	1	1	0.1575	0.00199	6248.2065	<.0001
CM_OBESE	1	1	0.0918	0.00321	817.5254	<.0001
CM_CHF	1	1	0.3411	0.00215	25075.2323	<.0001
CM_DM	1	1	0.2239	0.00194	13370.6070	<.0001
CM_DMCX	1	1	0.7304	0.00312	54789.9033	<.0001
CM_DRUG	1	1	-0.1394	0.0172	65.5185	<.0001
CM_LYTES	1	1	0.1468	0.00187	6185.7118	<.0001
CM_ANEMDEF	1	1	0.4602	0.00186	61033.1916	<.0001
HOSP_LOCATION	1	1	0.0651	0.00283	530.2680	<.0001
HOSP_REGION	2	1	0.0545	0.00339	258.8316	<.0001
HOSP_REGION	3	1	-0.0432	0.00275	246.8743	<.0001
HOSP_REGION	4	1	-0.00643	0.00350	3.3690	0.0664

Odds Ratio Estimates			
Effect	Point Estimate	95% Wald Confidence Limits	
RACE 2 vs 1	1.770	1.751	1.789
RACE 3 vs 1	1.084	1.070	1.099
RACE 4 vs 1	1.318	1.288	1.348
RACE 5 vs 1	1.096	1.042	1.152
RACE 6 vs 1	1.056	1.033	1.081
FEMALE 1 vs 0	0.613	0.608	0.617
PAY1 2 vs 1	0.920	0.893	0.948
PAY1 3 vs 1	0.932	0.919	0.945
PAY1 4 vs 1	0.840	0.796	0.887
PAY1 5 vs 1	0.917	0.794	1.059
PAY1 6 vs 1	0.892	0.857	0.929
ZIPINC_QRTL 2 vs 1	1.011	1.001	1.021
ZIPINC_QRTL 3 vs 1	1.008	0.998	1.018
ZIPINC_QRTL 4 vs 1	0.983	0.973	0.993
CM_HTN_C 1 vs 0	1.370	1.360	1.381
CM_OBESE 1 vs 0	1.202	1.187	1.217
CM_CHF 1 vs 0	1.978	1.961	1.995
CM_DM 1 vs 0	1.565	1.553	1.577
CM_DMCX 1 vs 0	4.310	4.257	4.363
CM_DRUG 1 vs 0	0.757	0.707	0.809
CM_LYTES 1 vs 0	1.341	1.332	1.351
CM_ANEMDEF 1 vs 0	2.510	2.492	2.529
HOSP_LOCATION 1 vs 0	1.139	1.126	1.152
HOSP_REGION 2 vs 1	1.061	1.050	1.073
HOSP_REGION 3 vs 1	0.962	0.953	0.971
HOSP_REGION 4 vs 1	0.998	0.988	1.009

Figure 32: CKD with regards to race, type of comorbidities 75-84

4.5.5 Logistic regression -Age group >85 vs CKD

A multivariable logistic regression analysis was conducted to examine independent predictors of CKD of the age group >85 years old. Variables included (race, gender, insurance, socioeconomics, comorbidities, hospital region and hospital location). The model was significant (χ^2= 112183.905, df= 26, p < .0001) and all the predictors were independent predictors of CKD (Figure 33)

African American patients (OR= 1.458, $p < .0001$, CI: 1.438 ,1.478), Asian or pacific Islander (OR= 1.106, $p < .0001$, CI: 1.076 ,1.137) are associated with higher risk of CKD.

Patients earning between 40,000 and 49,999 (OR= 1.033, $p <.0001$, CI: 1.022, 1.045), between 50,000 and 65,999 (OR= 1.025, $p = 0.0153$, CI: 1.013, 1.038), and patients who earn >66,000 (OR= 1.009, $p= 0.0265$, CI: 0.997 ,1.021) are at higher risk of CKD.

Patients with hypertension (OR= 1.275, $p < .0001$, CI: 1.264 ,1.286), obesity (OR= 1.349, $p < .0001$, CI 1.318 ,1.380), congestive heart failure (OR= 1.684, $p < .0001$, CI: 1.669 ,1.699), uncomplicated diabetes (OR= 1.355, $p < .0001$, CI: 1.342 ,1.368) diabetes with chronic complications (OR= 3.117, $p < .0001$, CI: 3.060 ,3.174) ,electrolytes disorder (OR= 1.251, $p < .0001$, CI: 1.241, 1.261), anemia (OR= 2.240, $p < .0001$, CI: 2.221, 2.258) are at higher risk of CKD.

Urban hospitals (OR= 1.160, $p <.0001$, CI: 1.145, 1.174) are associated with higher rate of CKD than rural hospitals. Patients of Midwest region (2) (OR= 1.107, $p < .0001$, CI: 1.094 ,1.120)), West region(4) (OR= 1.060, $p < .0001$, CI: 1.047 ,1.073) are associated with higher risk of CKD.

Model Fit Statistics		
Criterion	Intercept Only	Intercept and Covariates
AIC	1724084.8	1611952.9
SC	1724097.1	1612285.4
-2 Log L	1724082.8	1611898.9

Testing Global Null Hypothesis: BETA=0			
Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	112183.905	26	<.0001
Score	117381.149	26	<.0001
Wald	105451.787	26	<.0001

Analysis of Maximum Likelihood Estimates						
Parameter		DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept		1	-0.3933	0.0358	120.9725	<.0001
RACE	2	1	0.3491	0.00894	1526.0340	<.0001
RACE	3	1	-0.1434	0.0100	204.8048	<.0001
RACE	4	1	0.0729	0.0133	30.2255	<.0001
RACE	5	1	-0.1881	0.0298	39.8504	<.0001
RACE	6	1	-0.0625	0.0134	21.6969	<.0001
FEMALE	1	1	-0.2897	0.00201	20726.3972	<.0001
PAY1	2	1	-0.0223	0.0253	0.7777	0.3778
PAY1	3	1	0.0238	0.0203	1.3761	0.2408
PAY1	4	1	-0.0294	0.0348	0.7137	0.3982
PAY1	5	1	-0.0470	0.0858	0.2998	0.5840
PAY1	6	1	0.0288	0.0264	1.1908	0.2752
ZIPINC_QRTL	2	1	0.0162	0.00345	22.0196	<.0001
ZIPINC_QRTL	3	1	0.00837	0.00345	5.8760	0.0153
ZIPINC_QRTL	4	1	-0.00785	0.00354	4.9244	0.0265
CM_HTN_C	1	1	0.1214	0.00220	3042.6565	<.0001
CM_OBESE	1	1	0.1496	0.00588	646.8125	<.0001
CM_CHF	1	1	0.2606	0.00227	13181.0195	<.0001
CM_DM	1	1	0.1520	0.00241	3978.6739	<.0001
CM_DMCX	1	1	0.5684	0.00469	14665.2358	<.0001
CM_DRUG	1	1	-0.1243	0.0288	18.5797	<.0001
CM_LYTES	1	1	0.1119	0.00205	2969.5009	<.0001
CM_ANEMDEF	1	1	0.4032	0.00207	37810.1960	<.0001
HOSP_LOCATION	1	1	0.0740	0.00314	557.3510	<.0001
HOSP_REGION	2	1	0.0722	0.00376	368.6271	<.0001
HOSP_REGION	3	1	-0.0707	0.00318	494.2337	<.0001
HOSP_REGION	4	1	0.0283	0.00390	52.7646	<.0001

Odds Ratio Estimates			
Effect	Point Estimate	95% Wald Confidence Limits	
RACE 2 vs 1	1.458	1.438	1.478
RACE 3 vs 1	0.891	0.875	0.907
RACE 4 vs 1	1.106	1.076	1.137
RACE 5 vs 1	0.852	0.795	0.913
RACE 6 vs 1	0.966	0.939	0.993
FEMALE 1 vs 0	0.560	0.556	0.565
PAY1 2 vs 1	0.934	0.897	0.973
PAY1 3 vs 1	0.978	0.960	0.996
PAY1 4 vs 1	0.927	0.864	0.995
PAY1 5 vs 1	0.911	0.745	1.114
PAY1 6 vs 1	0.983	0.940	1.027
ZIPINC_QRTL 2 vs 1	1.033	1.022	1.045
ZIPINC_QRTL 3 vs 1	1.025	1.013	1.038
ZIPINC_QRTL 4 vs 1	1.009	0.997	1.021
CM_HTN_C 1 vs 0	1.275	1.264	1.286
CM_OBESE 1 vs 0	1.349	1.318	1.380
CM_CHF 1 vs 0	1.684	1.669	1.699
CM_DM 1 vs 0	1.355	1.342	1.368
CM_DMCX 1 vs 0	3.117	3.060	3.174
CM_DRUG 1 vs 0	0.780	0.697	0.873
CM_LYTES 1 vs 0	1.251	1.241	1.261
CM_ANEMDEF 1 vs 0	2.240	2.221	2.258
HOSP_LOCATION 1 vs 0	1.160	1.145	1.174
HOSP_REGION 2 vs 1	1.107	1.094	1.120
HOSP_REGION 3 vs 1	0.960	0.950	0.970
HOSP_REGION 4 vs 1	1.060	1.047	1.073

Figure 33: CKD with regards to race, type of comorbidities >85

CHAPTER V

DISCUSSION

5.1 Main Findings

The objective of this research was to identify the risk factors, LOS, mortality and cost related to CKD patients in the United States. The dataset was obtained from the nationwide inpatient's sample(NIS) and was analyzed to find the relationship between chronic kidney disease and its major risk factors and its effect on length of stay, total charges, and mortality. A summary of the descriptive analysis results of the dataset obtained from NIS for CKD patients are the following:

Age is a significant player in determining the impact on CKD; the average age was 63 years old. Children 0-19 totaled 4809 patients and 20 to 64 years old patients 49.05 %. 65 to74 years old 22.43%. 75 to 84 years old 19%. And 85 and older were 8.73 %. Therefore, the older the person is the higher risk of developing CKD considering having other major comorbidities such as heart disease ,diabetes and hypertension.

Gender type increases the risk of developing chronic kidney diseases. According to the CDC, women are at a higher risk of developing CKD than men.[35] In our case, female patients were 51.76% of the total patients in the sample obtained, where male patients were 48.23%. Therefore, female patients are more likely to develop CKD considering having some of the major comorbidities.

The race is a critical factor as some ethnic groups are more prone to develop some diseases more than others. Our analyses showed that the White patients had 43.50% and black patients 30.1% of the total CKD patients from 2009-2012 NIS dataset. The Native Americans patients had the lowest percentage among all race groups which was 0.89%.

Insurance type, Medicare recipients were the highest among all groups, private insurance holders had an 11.8% then Medicare recipients had 8.3%. The overall sample from 2009-2012 was (n=606,663), and the first risk factor that contributes to developing CKD is hypertension with 72.5% diabetes mellitus (complicated 22.09% and uncomplicated 29.41%). Congestive heart disease 19.30%. Anemia 22.09%, obesity 10.50% and as a result of the these comorbidities ,CKD patients develop renal failure which accounts for (534,468) or 88.1%, other major comorbidities are fluid and electrolytes disorder with 29.25%.

For hospital regions, The South region had 44.26% of the total patients. Midwest 22.7% Northeast had 19.42%. West region has the lowest ratio of 13.62%. The mean LOS of CKD patients between 2009 to 2012 was 5.4 days where the median was four days. The average charges of 2009 were $40,695.42 and in 2010 increased to (%0.88). In 2011 it rose to (%1.7) wherein 2012 it increased by (%0.6). For the total discharges, the West region had the highest total discharge when comparing to other regions from 2009 to 2012.

The first objective was to find whether there are any statistical significant associations between types of comorbidities and age groups on total charges. Linear regressing analysis showed that total charges for CKD patients increases with the presence of comorbidities. Table 23 shows the cost of each comorbidities in every age group and we can see that it had an impact on total charges. Manns et al indicated in their study that heart disease, diabetes and hypertension impacts cost which confirms our findings.[36] To add, drug abuse, electrolytes disorder, anemia and obesity also contributes to the increase in cost.

Age Group	Hypertension	Obesity	CHF	Diabetes uncomplicated	Diabetes with Complication	Drugs	Electrolytes Disorder	Anemia
0-19	58,167	2,462	151,783	6,177	29,399	8,902	48,068	22,771
20-64	4,892	4,478	14,804	2,439	4,510	3,972	20,972	12,299
65-74	1,185	5,053	9,397	1,843	1,451	3,752	17,095	9,440
75-84	664	6,745	8,115	1,221	3,103	2,790	13,164	7,519
>85	327	8,117	7,570	842	5,123	772	8,691	6,362

Table 23: comorbidities effect on total charges

The second objective was to find whether there are any statistical significant associations between types of comorbidities and different age groups on length of stay. Linear regressing analysis showed that length of stay for CKD patients increases with the presence of comorbidities. Comorbidities in table 24 affect length of stay due to their complex outcomes. In a study conducted by Mathew et al they found that hypertension, diabetes, heart disease and anemia are associated with readmission and therefore our study also confirm that these comorbidities increase length of stay.[37]

Age Group	Hypertension	Obesity	CHF	Diabetes uncomplicated	Diabetes with Complication	Drugs	Electrolyte Disorder	Anemia
0-19	6.2	0.06	15.82	0.52	4.75	1.96	5.62	1.84
20-64	0.07	0.34	1.95	0.19	1.01	0.68	2.32	1.61
65-74	0.43	0.28	2.03	0.10	0.70	0.75	2.38	1.54
75-84	0.40	0.41	1.82	0.09	0.68	0.71	1.96	1.23
>85	0.25	0.69	1.42	0.04	0.71	0.78	1.31	0.97

Table 24: comorbidities effect on length of stay

The third objective was to find the effect that comorbidities have on mortality of CKD patients. We found that patients with comorbidities such as anemia, congestive heart failure, diabetes, hypertension, fluid and electrolytes disorder and obesity, were at a higher odds of mortality than patients without these comorbidities as shown in table 25. In a cohort study by Fraser et al indicated that hypertension, heart failure, diabetes, and anemia were associated with higher mortality in CKD patients which confirms our study.[38]

Age Group(OR)	Hypertension	Obesity	CHF	Diabetes uncomplicated	Diabetes with Complication	Drugs	Electrolyte Disorder	Anemia
0-19	0.36	2.46	0.07	0.78	0.33	1.75	0.15	1.07
20-64	1.15	1.28	0.37	0.89	1.27	1.44	0.18	0.85
65-74	1.65	1.39	0.46	1.08	1.24	1.53	0.32	0.98
75-84	1.62	1.35	0.48	1.05	1.15	1.76	0.40	1.07
>85	1.49	1.28	0.53	0.99	1.15	2.19	0.53	1.18

Table 25: comorbidities effect on mortality

For group 0-19, patients with obesity (OR= 2.465, $p < .0001$, CI:1. 1.916 ,3.172),drugs abuse (OR= 1.750, $p < .0001$, CI: 1.426 ,2.149), anemia (OR= 1.074, p=0.0033, CI: 0.968 ,1.192) are at higher odds of mortality than those without. Age group 20-64, Patients with hypertension (OR= 1.156, $p < .0001$, CI: 1.140, 1.173) ,obesity (OR= 1.288, $p < .0001$, CI: 1.261, 1.316), diabetes with chronic complications (OR= 1.277, $p < .0001$, CI: 1.238 ,1.317) ,Patients with drug abuse (OR= 1.443, $p < .0001$, CI: 1.402 ,1.485) are at higher odds of mortality than those without.. For the third group 65-74, Patients with hypertension (OR= 1.654, $p < .0001$, CI: 1.627, 1.680) , obesity (OR= 1.390, $p < .0001$, CI: 1.353, 1.429) uncomplicated Diabetes (DM) (OR= 1.088, $p <.0001$, CI: 1.068, 1.108) ,diabetic patients with chronic complications (OR= 1.245, $p < .0001$, CI: 1.205, 1.286) are associated with higher odds of mortality than those without.

Age group 4 (75-84), Patients with hypertension (OR= 1.626, $p < .0001$, CI: 1.604, 1.649) ,obesity (OR= 1.352, $p < .0001$, CI: 1.312, 1.394) ,patients with Diabetes Mellitus

(DM) (OR= 1.059, $p < .0001$, CI: 1.042 ,1.076) diabetic patient with chronic complications (OR= 1.159, $p < .0001$, CI: 1.125, 1.195), drugs abuse (OR= 1.768, $p < .0001$, CI: 1.515 ,2.063) ,Patients with anemia (OR= 1.077, $p < .0001$, CI: 1.060 ,1.094) are at higher risk of mortality than those without. Lastly age group 5 (>85), Patients with hypertension (OR= 1.494, $p < .0001$, CI: 1.474, 1.515),obesity (OR= 1.286, $p < .0001$, CI: 1.225, 1.350), diabetic patient with chronic complications (OR= 1.159, $p < .0001$, CI: 1.114 ,1.206) , drugs abuse (OR= 2.193, $p < .0001$, CI: 1.700 ,2.828) , anemia (OR= 1.187, $p<.0001$, CI: 1.168 ,1.206) are at higher odds of mortality than those without.

Age Group(OR)	Hypertension	Obesity	CHF	uncomplicated Diabetes	Diabetes with Complication	Drugs	Electrolyte Disorder	Anemia
0-19	18.88	0.92	3.13	1.17	3.50	0.53	4.51	15.16
20-64	2.80	0.84	3.10	1.78	8.60	0.71	1.95	4.13
65-74	1.44	1.08	2.34	1.82	6.45	0.73	1.49	2.88
75-84	1.37	1.20	1.97	1.56	4.31	0.75	1.34	2.51
>85	1.27	1.34	1.68	1.35	3.11	0.78	1.25	2.24

Table 26: comorbidities effect on CKD

The forth objective was to find the impact comorbidities has on developing CKD. We found that patients with comorbidities such as anemia, congestive heart failure, diabetes, hypertension, fluid and electrolytes disorder and obesity, were at a higher odds of developing CKD in every group as shown in table 26.

Patients between the age of 0-19 and has hypertension their risk of developing CKD (OR= 18.887, $p < .0001$, CI: 17.650 ,20.210), congestive heart failure (OR= 3.134, $p < .0001$, CI: 2.511, 3.912), uncomplicated diabetes (OR= 1.175, $p= 0.0839$, CI: 0.979 ,1.410), diabetes with chronic complications (OR= 3.503 $p < .0001$, CI: 2.377 ,5.164), electrolytes disorder (OR= 4.519, $p < .0001$, CI: 4.255 ,4.800), anemia (OR= 15.165, $p<.0001$, CI: 14.277 ,16.108) .

Patients between the age of 20-64 and has hypertension their risk of developing CKD increases by (OR= 2.801, $p < .0001$, CI: 2.782 2.820) , congestive heart failure (OR= 3.108, $p < .0001$, CI: 3.077 ,3.139), uncomplicated diabetes(OR= 1.781, $p < .0001$, CI: 1.768 1.794) diabetes with chronic complications (OR= 8.605, $p < .0001$, CI: 8.524 ,8.687) , electrolytes disorder (OR= 1.954, $p < .0001$, CI: 1.941 ,1.968) , anemia (OR= 4.131, $p < .0001$, CI: 4.104 ,4.159).

Patients between the age of 65-74 and has hypertension their risk of developing CKD increases by (OR= 1.445, $p < .0001$, CI: 1.433,1.458) , obesity (OR= 1.081, $p < .0001$, CI 1.070 ,1.093), congestive heart failure (OR= 2.344, $p < .0001$, CI: 2.320 ,2.367), uncomplicate diabetes (OR= 1.826, $p < .0001$, CI: 1.811 ,1.842) diabetes with chronic complications (OR= 6.453, $p < .0001$, CI: 6.376 ,6.530) ,electrolytes disorder (OR= 1.495 , $p < .0001$, CI: 1.483 ,1.508) ,anemia (OR= 2.887, $p < .0001$, CI: 2.863 ,2.911).

Patients between the age of 75-84 and has hypertension their risk of developing CKD increases by (OR= 1.370, $p < .0001$, CI: 1.360, 1.381) , obesity (OR= 1.202, $p < .0001$, CI 1.187, 1.217), congestive heart failure (OR= 1.978, $p < .0001$, CI: 1.961, 1.995), uncomplicated diabetes (OR= 1.565, $p < .0001$, CI: 1.553 ,1.577) diabetes with chronic complications (OR= 4.310, $p < .0001$, CI: 4.257 ,4.363) ,electrolytes disorder (OR= 1.341, $p < .0001$, CI: 1.332, 1.351), anemia (OR= 2.510, $p < .0001$, CI: 2.492 ,2.529) .

Patients >85 and has hypertension their risk of developing CKD increases by (OR= 1.275, $p < .0001$, CI: 1.264 ,1.286), obesity (OR= 1.349, $p < .0001$, CI 1.318 ,1.380), congestive heart failure (OR= 1.684, $p < .0001$, CI: 1.669 ,1.699), uncomplicated diabetes (OR= 1.355, $p < .0001$, CI: 1.342 ,1.368) diabetes with chronic complications (OR= 3.117,

$p < .0001$, CI: 3.060 ,3.174) ,electrolytes disorder (OR= 1.251, $p < .0001$, CI: 1.241, 1.261), anemia (OR= 2.240, $p < .0001$, CI: 2.221, 2.258).

The fifth objective was to look into the impact of mortality, length of stay, and total charges among different races and gender for each group. Asians in group 5 stayed longer than other races across all age group also, they had the highest total charges among other groups. Hispanics were at a higher risk of mortality than the other races across all age group. Female stayed shorter than males across all age groups, and their total charges were less than males as well. Female in group 2 (20-64) were at a high risk of mortality than males across all age groups.

Race &Gender	Length of Stay(days)	Total Charges	Mortality (OR)	CKD (OR)
Age Group 1 (0-19)				
White (reference)				
Black	0.38	2646.44	0.62	1.202
Hispanic	-0.27	1227.12	1.10	1.286
Asian or Pacific Islanders	0.002	-173.66	0.99	0.774
Native Americans	0.27	1890.97	0.75	2.463
Other	0.30	3044.98	0.66	0.808
Female	-0.29	-2409.08	1.34	0.667
Age Group 2 (20-64)				
White (reference)				
Black	0.04	-1661.03	1.11	2.418
Hispanic	-0.29	54.90	1.23	1.651
Asian or Pacific Islanders	0.18	1140.29	0.86	1.750
Native Americans	0.04	-4365.20	1.14	1.427
Other	0.16	1200.91	0.99	1.326
Female	-0.80	-10542.61	1.77	0.548
Age Group 3 (65-74)				
White (reference)				
Black	0.41	229.75	0.93	2.143
Hispanic	0.08	6209.39	1.01	1.396
Asian or Pacific Islanders	0.30	9149.24	0.82	1.514
Native Americans	-0.001	-3962.28	0.90	1.262
Other	0.60	6632.31	0.84	1.159
Female	-0.19	-5610.07	1.28	0.680
Age Group 4 (75-84)				
White (reference)				
Black	0.52	2537.06	0.97	1.770
Hispanic	0.17	8578.02	1.02	1.084
Asian or Pacific Islanders	0.46	11726.25	0.78	1.318
Native Americans	0.03	-3102.42	1.07	1.096
Other	0.74	8288.93	0.86	1.056

Female	-0.22	-5774.27	1.30	0.613
Age Group 5 (>85)				
White (reference)				
Black	0.54	4223.07	0.93	1.458
Hispanic	0.27	10327.39	0.94	0.891
Asian or Pacific Islanders	0.62	14555.45	0.71	1.106
Native Americans	0.16	-1648.60	0.92	0.852
Other	0.60	7401.12	0.83	0.966
Female	-0.20	-4449.64	1.24	0.560

Table 27: LOS, TOTCHG, Mortality on Race

The sixth objective was to look into the impact of mortality, length of stay, and total charges among different insurance types for each group. Group 5 (>85) Medicaid patients stayed 3.07 longer than any other group. The total charges for other forms of payments in group 1(0-19) were higher than other insurance types across all age groups. Uninsured patients in age group 2(20-64) were at a higher risk of mortality than the other groups.

Insurance Type	Length of Stay (days)	Total Charges	Mortality (OR)	CKD(OR)
Age Group 1 (0-19)				
Medicare (reference)				
Medicaid	1.05	9553.10	1.06	0.010
Private insurance	0.70	8146.30	1.19	0.011
Self-pay	0.02	3694.30	0.52	0.006
No charge	0.53	9978.55	0.71	0.038
other	1.51	16408.80	0.67	0.016
Age Group 2 (20-64)				
Medicare (reference)				
Medicaid	-0.54	-3966.45	1.18	0.340
Private insurance	-1.17	-359.18	1.34	0.286
Self-pay	-1.32	-6686.59	1.15	0.228
No charge	-0.81	-5273.20	1.62	0.257
other	-0.91	335.44	1.15	0.232
Age Group 3 (65-74)				
Medicare (reference)				
Medicaid	1.01	-639.68	0.89	0.955
Private insurance	-0.17	824.09	0.88	0.795
Self-pay	0.01	-5766.14	0.57	0.806
No charge	0.45	-7171.99	0.49	1.292
other	-0.08	-171.11	0.39	0.805
Age Group 4 (75-84)				
Medicare (reference)				
Medicaid	1.33	2237.89	0.87	0.920
Private insurance	-0.02	434.83	0.66	0.932

Self-pay	0.65	-3707.21	0.43	0.840
No charge	0.58	-5235.29	0.36	0.917
other	-0.21	-4604.75	0.27	0.892
Age Group 5 (>85)				
Medicare (reference)				
Medicaid	3.07	4436.53	0.76	0.934
Private insurance	-0.04	-1294.52	0.54	0.978
Self-pay	1.59	-3816.84	0.33	0.927
No charge	0.38	-1734.87	0.26	0.911
other	-0.37	-6931.40	0.21	0.983

Table 28: LOS, TOTCHG, Mortality on Insurance

The seventh objective was to look into the impact of mortality, length of stay, and total charges among different socioeconomics for each group. We found that across all age groups ,patient with income <39,999 stayed longer than the others. Where patients with income >63,000 were charged more than the others in group (3-5). Also, patients in (1-3) with income >63,000 were at a higher risk of mortality than the others.

Socioeconomic Status	**Length of Stay(days)**	**Total Charges**	**Mortality (OR)**	**CKD(OR)**
Age Group 1 (0-19)				
<$39,999(reference)				
$39,000 - $47,999	-0.11	-815.89	1.07	0.910
$48,000 - 62,999	-0.14	-984.55	1.12	0.836
> $63,000	-0.19	-1392.33	1.33	0.732
Age Group 2 (20-64)				
<$39,999(reference)				
$39,000 - $47,999	-0.13	-720.16	1.095	0.988
$48,000 - 62,999	-0.17	-445.94	1.172	0.970
> $63,000	-0.16	-624.20	1.238	0.929
Age Group 3 (65-74)				
<$39,999(reference)				
$39,000 - $47,999	-0.24	-801.24	1.059	0.982
$48,000 - 62,999	-0.34	-297.90	1.104	0.957
> $63,000	-0.40	806.69	1.148	0.920
Age Group 4 (75-84)				
<$39,999(reference)				
$39,000 - $47,999	-0.20	-952.61	1.079	1.011
$48,000 - 62,999	-0.28	-348.99	1.112	1.008
> $63,000	-0.30	698.33	1.097	0.983
Age Group 5 (>85)				
<$39,999(reference)				
$39,000 - $47,999	-0.25	-779.12	1.048	1.033
$48,000 - 62,999	-0.28	79.19	1.052	1.025
> $63,000	-0.23	1523.76	1.013	1.009

Table 29: LOS, TOTCHG, Mortality on Socioeconomic Status

The eighth objective was to look into US regions and its effect on mortality, length of stay and total charges. Across all age groups the northeast region showed a longer LOS for CKD patients. West region group 2(65-74) had the most total charges with $14,424.21. Where Midwest region had the a higher odds of mortality across all age groups with Age group 5 (>85) (OR1.21).

Hospitals Region	**Length of Stay(days)**	**Total Charges**	**Mortality (OR)**	**CKD(OR)**
Age Group 1 (0-19)				
Northeast (Reference)				
Midwest	-0.31	-5225.45	0.95	1.075
South	-0.20	-4556.63	0.94	1.197
West	-0.32	1540.76	0.87	1.512
Age Group 2 (20-64)				
Northeast (Reference)				
Midwest	-0.72	-8523.02	1.17	0.937
South	-0.50	-4941.90	0.99	1.019
West	-0.63	7493.80	0.97	1.016
Age Group 3 (65-74)				
Northeast (Reference)				
Midwest	-0.77	-9296.60	1.18	1.018
South	-0.46	-3611.96	1.06	0.964
West	-0.80	14424.21	1.04	0.955
Age Group 4 (75-84)				
Northeast (Reference)				
Midwest	-0.78	-9444.83	1.17	1.061
South	-0.43	-3686.40	1.06	0.962
West	-0.91	13813.49	1.06	0.998
Age Group 5 (>85)				
Northeast (Reference)				
Midwest	-0.71	-8530.64	1.21	1.107
South	-0.40	-3418.86	1.08	0.960
West	-0.74	12134.96	1.06	1.060

Table 30: LOS, TOTCHG, Mortality on various hospital regions

The ninth objective was to look into the impact of mortality, length of stay, and total charges among different types of hospitals locations such as rural, or urban for each group. We found that across all age groups ,urban hospitals patients stayed longer than rural hospital patients . Also urban patients total charges were more than those in rural hospitals. Lastly, mortality were higher at urban hospitals than rural.

Hospital Location	Length of Stay(days)	Total Charges	Mortality (OR)	CKD(OR)
Age Group 1 (0-19)				
Rural reference				
Urban	1.52	11824.73	0.34	5.016
Age Group 2 (20-64)				
Rural reference				
Urban	0.86	14960.19	0.74	1.322
Age Group 3 (65-74)				
Rural reference				
Urban	0.94	21322.96	0.87	1.153
Age Group 4 (75-84)				
Rural reference				
Urban	0.77	19139.88	0.91	1.139
Age Group 5 (>85)				
Rural reference				
Urban	0.36	14264.57	1.05	1.160

Table 31: LOS, TOTCHG, Mortality on various hospitals settings

CHAPTER VI

Conclusion, Study Limitation And Future Research

6. Conclusion

Chronic kidney disease is a major disease that effect other part of the body as well as partake in worsening of other conditions such heart failure. In this study , comorbidities across all age groups such as diabetes, hypertension, obesity, anemia, and congestive heart disease increases the likelihood of developing CKD. Patients with these risk factors should follow guidelines to control their condition to avoid developing CKD.

6.1 Study Limitation

In this study, data obtained from the NIS database for 2009-2012 were analyzed to find the relationship between CKD and LOS, cost, mortality. It uses ICD-9-CM which is primarily used by insurers for billing purposes. Though, the data were rich in data related in LOS, total charges, and comorbidities but it lacked to identify CKD stages as well as if CKD was developed due to an adverse reaction to medications.

6.2 Future research

Progress has been made into identifying comorbidities and risk factors related to CKD. Future research should consider the potential effects of medications, drugs and infection of the kidneys. Also, a more comprehensive research is needed to include at least ten years of data and figure out the affect and changes in health care on cost as well as mortality. In 2015 NIS data has changed from ICD-9 to ICD-10 which will impact any applicable research if merged with data prior to 2014.

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